Essays on International Trade and Globalisation

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A thesis submitted for the degree of

Doctor of Philosophy in Economics

September 2022

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Abstract

This thesis contains three papers on globalisation and its effects. The first two chapters study the labour market impacts of international trade in contrasting contexts. Chapter One uses the recent surge in Chinese export growth to study the effects of a manufacturing trade shock on workers and firms in the UK. Using micro data on both workers and firms, it shows how the trade shocks effects materialise at worker, firm, and industry dimensions, as well as how the impacts vary across types of workers and firms. The second chapter focuses on international trade in services. Services trade has grown rapidly in the past few decades and differs from manufacturing in terms of the nature of trade and the types of workers more affected by trade. I use detailed UK micro data to estimate the impact of the growth in imports of services on labour market outcomes, including the heterogeneity of the effects across the wage distribution. The final chapter is more distinct and documents the huge extent to which international tax loopholes influence flows of foreign direct investments. Using administrative data on foreign investments received by Indian firms, it estimates the impact of a reform to a bilateral tax treaty between India and its largest foreign investor Mauritius.

Supervisor This thesis was supervised by Steve Bond.

Total words This thesis contains approximately 67,405 words.

Statement of authorship Chapter 1 is joint work with João Paulo Pessoa. Chapter 3 is joint work with Swati Dhingra and Mathieu Parenti.

Acknowledgement of funding I am grateful for funding from the Wolf Studentship through Corpus Christi College and the Department of Economics at University of Oxford. I received additional support from the Centre for Economic Performance at the London School of Economics, the Department of Economics and Tuck Business School at Dartmouth College, and the Trade and Investment in Services Associates.

Data disclaimer Data from the Annual Survey of Hours and Earnings, Business Structure Database and International Trade in Services Survey are collected by the Office for National Statistics and supplied by the Secure Data Service at the UK Data Service. The work contains statistical data from ONS which is Crown Copyright. The use of data in this work does not imply the endorsement of ONS or the Secure Data Service in relation to the interpretation or analysis of the data. This work uses research datasets which may not exactly reproduce National Statistics Aggregates.

Acknowledgements

I am very grateful to my supervisor, Steve Bond, for his excellent guidance and feedback throughout my DPhil, and for committing a great deal of time to our meetings. Gabriel Ulyssea also offered a huge amount of helpful advice and suggestions both during his time at Oxford and at UCL, despite not officially being my supervisor.

I am incredibly grateful to Swati Dhingra for first convincing me that international trade is interesting - motivating my DPhil topics - and then continuing to be a great mentor during my DPhil. I have learnt a huge amount from Swati. It has been a great experience to work alongside my co-authors – João, Swati, and Mathieu - and I became a better researcher having worked with them.

I thank Corpus Christi College for support during my studies. I am particularly grateful to Jonathan and Martin Wolf for the funding provided by the Wolf Studentship, which I am proud to have been the recipient of. James Duffy was a very helpful college advisor. The Department of Economics was a vibrant research community. I am grateful to Ferdinand Rauch for helpful comments in my Confirmation of Status and to Brian Bell for supervising my MPhil thesis and being supportive ever since.

I am pleased to have been a research assistant at the Centre for Economic Performance both before and during my DPhil. I made great friends through CEP – Elsa, Jack, Jan, Nikhil, Rui, and Shania. I am lucky to have benefitted from their companionship, as well as learning from them academically.

Visiting Dartmouth College was an informative and stimulating experience and I am

grateful to the faculty for their suggestions and for welcoming me to the research community.

During my time in Oxford, I was incredibly lucky to meet many amazing friends. To Lynn, Harry, Sammy, Lauren, Mark, and Dat, I am so thankful for your continued silliness to complement the struggles of academic life. And it is thanks to Oxford that I met my partner and best friend, Esra, who has been the best possible companion - always encouraging, motivating, and supportive.

I am hugely thankful to my parents for giving me every opportunity and always giving the best advice, particularly when it comes to prioritising the most important aspects of life. I thank my brother Alex for first warning me about the difficulties of a PhD and then being a great person to exchange experiences with. I am grateful to Hilary and Martin for always supporting me, giving advice, and allowing me to retreat to the Coach House – where most of this DPhil was written - when Covid hit.

I could not and would not have been able to do the DPhil without the support of my family, friends, and mentors, and I really appreciate for the opportunities that I have had.

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Introduction

This thesis contains three papers on globalisation and its effects. The first two chapters study the labour market impacts of international trade in contrasting contexts. Chapter One uses the recent surge in Chinese export growth to study the effects of a manufacturing trade shock on workers and firms in the UK. Using micro data on both workers and firms, it shows how the effects of trade shocks materialise at the worker, firm, and industry levels, as well as how the impacts vary across types of workers and firms. The second chapter focuses on international trade in services. Services trade has grown rapidly in the past few decades and differs from manufacturing in terms of the nature of trade and the types of workers more affected by trade. I use detailed UK micro data to estimate the impact of the growth in imports of services on labour market outcomes, including the heterogeneity of the effects across the wage distribution. The final chapter is more distinct and documents the huge extent to which international tax loopholes determine flows of foreign investments. Using administrative data on foreign direct investments received by Indian firms, it estimates the impact of a reform to a bilateral tax treaty between India and its largest foreign investor Mauritius.

Openness to international trade generally increases aggregate real incomes (Melitz, 2003; Eaton and Kortum, 2002). One mechanism through which these gains accrue is a reallocation of resources across industries, regions, and firms, typically to those that are more productive. Trade therefore has implications for labour markets through changes in overall and relative demands for domestic workers' skills. Adjustments to changes in trade patterns can be costly and take time, for example where workers are required to

transition across firms and sectors. So while international trade increases welfare on average, it also generates winners and losers.

There are many aspects of international trade that can affect labour markets. Exporting typically raises wages (Hummels et al., 2014) and employment (Bernard and Jensen, 1999). Import competition negatively affects employment and wages in more exposed sectors (Autor et al., 2013a; De Lyon and Pessoa, 2021; Utar, 2018), with jobs flowing to less exposed sectors (Feenstra and Sasahara, 2017; Asquith et al., 2019), but has also been shown to promote innovation (Bloom et al., 2016), boost the productivity of managers (Chen and Steinwender, 2021), and promote exports through lower input costs (Breinlich et al., 2022). Offshoring - the import of goods or services used in the production process - typically has an asymmetric effect on labour, with workers whose tasks are substituted for foreign labour more likely to suffer while those whose tasks are complementary to offshored labour likely to benefit. There may also be an aggregate productivity effect due to the efficiency gain from offshoring, which can benefit all workers (Grossman and Rossi-Hansberg, 2008). For goods offshoring in developed countries, the evidence suggests that offshoring puts downward pressure on wages (Ebenstein et al., 2014), with less-educated workers experiencing more severe wage losses and more educated workers gaining (Hummels et al., 2014) through shifts in the demand for different tasks (Becker et al., 2013). The evidence is more mixed for trade in intermediate services. Services offshoring increases firms' employment (Eppinger, 2019), especially for managers (Ariu et al., 2019) and is generally skill-biased (Crinò, 2010). However, looking at trade between US states, there is evidence that importing business services reduces high skill relative to low skill wages (Eckert, 2019) and, for UK imports of services, this thesis presents additional evidence that higher wage workers experience downward pressure on wages.

Up to the global financial crisis of 2008, world trade grew rapidly as a share of GDP. Waves of unilateral liberalisation were followed by an era of new bilateral and multilateral trade agreements which reduced tariff and non-tariff barriers to trade, while technological change reduced the costs of international trade. In many developed countries, the correlation between the decline in manufacturing employment and the increase in import competition - particularly from China - and the growth of trade in intermediate inputs to production, which now make up around two thirds of all trade (Johnson and Noguera, 2012; Datt et al., 2011), spurred renewed academic interest in the labour market effects of trade. Since the financial crisis, global trade has stagnated, and there has been a recent surge of protectionist policies which have impacted trade flows and affected labour markets: the sharp depreciation of the pound that followed the Brexit vote caused a relative fall in wages and training for workers in exposed industries in the UK (Costa et al., 2019). The trade war between the USA and China that began in 2018 has resulted in a fall in employment (Waugh, 2021) and real wages (Fajgelbaum et al., 2020) in exposed regions of the USA. There is a high level of interest from policymakers to understand the links between trade and labour markets. In the UK, for example, the Department for International Trade has commissioned at least three research reports on the topic in the past three years (Costa et al., Forthcoming; Lassmann and Spinelli, 2020; Black et al., 2021).

In the first two chapters of this thesis, I use detailed UK micro data to provide evidence on the impact of two quite different trade shocks on labour market outcomes. The first chapter studies the labour market effects of the growth of Chinese exports, which were concentrated in the manufacturing sector, on the outcomes of firms and workers over a seven year adjustment period. The second chapter studies the rapid growth of international trade in services. It focuses on the impacts of services imports typically used as inputs to production and estimates the impact on overall and distributional

labour market outcomes. I show that these two shocks had different implications for labour market outcomes and inequality.

In recent decades, Chinese exports have grown rapidly in absolute terms and as a share of global trade, especially since its accession to the WTO in 2001. Meanwhile, in many developed countries, the share of employment in the manufacturing sector has fallen dramatically. For example, in the United Kingdom, manufacturing employment has fallen from 16.7 percent at the beginning of 1997 to 9.1 percent in 2017. The rapid growth of China has spurred an extensive literature examining the impacts of international trade, particularly the impacts of import competition on labour markets in developed countries (Autor et al., 2016).

The first chapter of this thesis - a joint paper with João Paulo Pessoa - investigates the impacts of the Chinese import competition shock on the UK. We use panel data on both workers and firms to identify the margins of adjustment. For workers, we examine their cumulative earnings, entry and exit from employment, and average wages conditional on employment. We also look at firm-level employment growth and probability of exit. We allow for heterogeneous effects across worker and firm types, and decompose adjustments according to worker switching patterns across firms and industries.

We focus on changes over the period 2000 to 2007, allowing for medium-term adjustment effects. To identify the effects of the rise of China, we rely on the observation that exposure to the China shock varied across narrowly-defined industries. We define workers' and firms' exposure to the shock based on their initial industry. One concern for identification is that the growth of Chinese exports to a sector could be correlated with labour demand shocks in the UK. Therefore, to identify the causal effect of Chinese export growth on the UK market, we adopt an instrumental variable strategy that isolates the part of trade flows that is driven by the China-specific effect, following Costa

et al. (2016).

We find that workers initially employed in industries exposed to high Chinese import growth experienced lower average weekly and hourly earnings growth compared to individuals in less exposed industries. For example, the growth of average weekly earnings of workers in highly affected sectors was 3.9% lower than that of workers in industries facing low levels of Chinese import competition. We also find some evidence of negative effects on workers' total earnings growth, defined as total cumulative earnings in the period 2001-2007 divided by the worker's pre-period average annual earnings, and on the number of years employed.

At the plant-level, we find evidence that plants in manufacturing industries which were more exposed to Chinese import competition displayed lower employment growth relative to plants in less exposed manufacturing sectors. In the period considered, plants in highly affected sectors experienced an employment growth rate that was approximately 13 percentage points smaller than that of plants in less affected industries. We also find more limited evidence that more exposed plants had a higher probability of going out of business.

To study workers' margins of reallocation in response to the shock, we decompose their employment and earnings outcomes into mutually exclusive channels of adjustment between 2001 and 2007 based on whether the worker remains at their initial employer and/or sector, as well as potentially counterbalancing movements across employers and distinct types of sectors. The results suggest that when workers did not move out of their original firm and/or sector, the effects of the China shock on total earnings growth were more severe. On the other hand, when workers moved into other manufacturing sectors and into the services sector, the negative impact of the China shock was somewhat mitigated. These offsetting effects occur primarily through relatively more years of

employment when workers were outside their original two-digit sector.

The effects are heterogeneous across types of workers and firms. We find that women suffered more from the shock than men in terms of their total earnings. This was driven by a sharp fall in working years for women more exposed to the shock, with no significant relative fall in average wages of women. Younger workers suffered considerably more from the China shock than older workers in both earnings and employment. Individuals with lower initial pay experienced greater negative effects than individuals with higher initial pay in regards to employment, total earnings and average hours worked. In our firm heterogeneity analysis, we show that older and larger plants are more heavily affected by the China shock than younger and smaller ones, respectively, especially in terms of employment growth.

The second chapter of this paper focuses on the labour market impacts of international trade in services. Services trade has grown rapidly in recent decades, driven by technological developments and efforts to liberalise trade policy both through deep preferential trade agreements and unilateral liberalisation, most notably the General Agreement on Trade in Services (GATS). "Tradable" services, such as legal, engineering, and advertising, comprise around 43% of UK employment, compared with just 11% in manufacturing in 2016.

Yet the literature on the effects of services trade is small relative to that of goods trade, while it is likely that the effects will be contrasting. Tradable services industries tend to be high-skill intensive and the skills of foreign services providers are becoming increasingly important to service-importing businesses. It is well documented that workers of different skill types experience different outcomes in response to goods trade shocks, and goods offshoring - the process of importing inputs to production - typically substitutes for low skill labour while augmenting high skill labour. Given that production

of services is more skill intensive, as are traded services, it is not clear that the same responses would hold for imports of services. In particular, it may be that some domestic high skill labour is substituted by foreign high skill labour.

I investigate the effects of the growth of services imports on local labour market (LLM) outcomes in the UK. Using detailed micro data at the employer-employee level, I examine distributional and adjustment effects that are associated with a plausibly exogenous rise in services imports. LLM exposure to services trade is highly likely to be endogenously determined with respect to local labour market outcomes due to, for example, demand or productivity shocks that shift both importing and wages. To overcome this endogeneity, I construct an instrument that is correlated with changes in LLM imports but uncorrelated with unobserved shocks to labour outcomes. The instrument relies on the empirical observation that much of the growth of services imports is growth within existing service-country trade. The instrument is a shift-share which uses a LLM's pre-period import shares for each service-country pair as exposure weights to changes in the world export supply (excluding the UK and deflating by service-specific prices) of a service-country pair over a period.

The results suggest that a plausibly exogenous increase in LLM exposure to services imports is associated with an increase in total employment. This is evidence of a productivity benefit from offshoring services, whereby LLMs that offshore benefit from efficiency gains of importing foreign services, generating increased total demand for labour overall. The average wage in a LLM, however, falls with a rise in import exposure. This result can be explained by the distributional analysis. Employment at importing firms, who pay higher wages, falls, with the rise in employment driven by non-importing firms. The rise in employment is also driven by industries outside of tradable services and manufacturing.

Looking at the distributional effects on wages, I find that a rise in imports of services is associated with falls in wages at the 75th and 90th percentiles within a LLM, but not at other percentiles below and above this. The average wage of occupations involving non-routine cognitive tasks also falls with a rise in services imports. A rise in imports is also associated with a fall in the average wage of workers in managerial occupations, which appears to be driven by an increasing quantity of workers classed as managers.

The third chapter of the thesis is written jointly with Swati Dhingra and Mathieu Parenti. It concerns foreign direct investment (FDI) and the role that tax policy plays in distorting its flows. Multinational enterprises exploit gaps in international taxation rules to shift their tax liability to low-tax countries. This means they reduce the total amount of tax that they pay, eroding the tax base of many economies and leads to an international redistribution of incomes. The share of global investments that goes to empty corporate shell companies to be routed on to another firm in another country - "Phantom FDI" - has risen in recent years and now accounts for 40% of global flows (Damgaard et al., 2019).

Historic multilateral policy cooperation has recently advanced to address this growing problem of tax avoidance by global firms. But there are already discussions that this may not succeed in plugging tax loopholes and boosting government revenues, especially in developing countries (Stiglitz, 2021). Unilateral measures can alleviate some of the inadequacies of international rules, as was argued in the case of digital services taxes. There is however active debate on the appropriateness of unilateral measures, which some expect will create a double taxation burden on firms and complex international legal disputes arising from a plethora of unilateral measures from governments across the world.

Understanding tax loopholes and the impacts of plugging them are crucial for designing

appropriate international tax policy. But there are still huge empirical challenges in doing so. First, data is often limited by self-reporting and adequate coverage of tax haven countries in available data sources. Second, there have been few episodes of plugging important tax loopholes internationally as yet. The bulk of our knowledge about the effects of plugging tax loopholes therefore comes from tax differences within a single country, rather than international tax policies. The chapter contributes on both these aspects by examining international tax loopholes in India, which is one of the largest recipients of foreign investments, including phantom FDI, in the world. The paper builds a database for the universe of foreign direct investment transactions from administrative sources. The unit of observation is a foreign direct investment transaction into a receiving Indian firm from a sending firm in a foreign country.

A first key finding is that 65.4% of India's inward FDI came directly from countries classified as tax havens between 2010 and 2015. The single largest investor in India was Mauritius, which accounted for 0.016% of world GDP in 2015 but 29% of all FDI coming to India between 2010 and 2015. We estimate a cross-country regression of FDI flows into India on a rich set of typical gravity variables and show that Mauritius is a huge outlier for its investments into India during this period, even after adding a rich set of controls.

The second contribution of our analysis is to link foreign investments directly to international tax loopholes. India and Mauritius have a bilateral tax treaty (BTT) which, until 2017, enabled profits from sales of Indian companies to be reported in Mauritius if the transaction came from a Mauritius-based firm. There were no strict requirements to establishing a presence in Mauritius. This meant that profits on sales of Indian assets acquired through Mauritius would be taxed at the rate of capital gains tax in Mauritius – 0% thereby completely avoiding the 10 to 40% capital gains tax that would otherwise

be charged in India. This generated incentives for "treaty shopping" - whereby foreign investors in a third country like the US would invest in India through a Mauritian subsidiary - and for "round tripping" - whereby Indian firms would set up a Mauritian subsidiary to avoid capital gains taxes.

In 2016, India and Mauritius agreed to an amendment to the treaty which would remove this loophole. It specified that any sales of Indian assets that had been purchased after April 2017 would be subject to capital gains taxation in India, reducing the incentive for treaty shopping and round tripping. The paper exploits this plugging of an international tax loophole to examine the impacts on the volume and source of foreign investments coming into India using event study and difference-in-differences estimation strategies. It finds that there is a robust and large relative fall in the volume of FDI sent to India through Mauritius following the policy amendment. FDI inflows through Mauritius fell by 47.4% relative to investments from other countries, noting that we do not assume that investments from other countries were unaffected by the amendment for this interpretation.

Finally, we set up the data as a panel at the level of the Indian receiving firm. We show that Indian firms that had previously received investments through Mauritius (before the treaty amendment) subsequently experienced no relative fall in FDI compared with firms who had not received any investments from Mauritius before the policy change. In other words, the amendment did not seem to reduce the amount of FDI received by Indian firms, at least for the intensive margin of firms that had received FDI before the amendment.

Contributions The first chapter contributes to a rapidly growing literature on the effects of the growth of Chinese manufacturing exports. By combining data on both workers and firms in the same setting, we present detailed evidence on where the

adjustments to import competition shocks take place, therefore providing information about the frictions to labour market adjustments and firm dynamics. For example, the plant-level analysis suggests that the China shock caused plants in more heavily-affected sectors to downsize and exit the market, and that this effect is present across different types of firms. In line with this, our worker-level decomposition shows that workers who remained at their initial firm and/or sector were hit the hardest, while those who switched across broadly-defined industries were able to partially offset those negative effects. Overall, by taking into account the possibility that new firms may enter the market and that firms may hire new employees (who may or may not be in our worker-level analysis sample), our results indicate that the impacts of China on employment and earnings reflect a contraction of some sectors and not simply labour market churn whereby firms adjusted their labour force by releasing their existing employees and hiring new ones.

The second chapter contributes to the growing literature on the effects of international trade in services on labour market outcomes and to the wage effects of offshoring. I contribute to this literature by estimating the distributional impacts of importing services in a local labour market using detailed worker and firm level datasets and modern techniques for shift-share instrumental variables estimation. Most notably, it shows that services importing can cause a relative contraction in wages for workers in the top half of the wage distribution. This is in contrast to the distributional effects of import competition - estimated in Chapter One of this thesis - and to goods offshoring and skill-biased or routine-biased technological change, which tend to augment high skill or high wage labour.

The paper also contributes to a broader literature on services trade by presenting new facts on services trade. First, it estimates the cross-sectional firm and local labour

market services trade premiums at the worker level. Second, it presents a decomposition of the margins of growth of services trade within service-countries, within firms, and across firms.

The third chapter makes three contributions to the fields of international economics, public economics, and macroeconomics. First, it uses detailed administrative firm-level data on all FDI received by Indian firms, including information on the investor firm and its country, to document the importance of tax havens in FDI flows. Pioneering work in public economics and macroeconomics has typically estimated the scale of profit shifting by cross-examining various data sources, such as mirror flows across sending and receiving countries, due to a lack of high quality data on economic activity in tax haven countries. We show that 65.4% of India's inward FDI came from countries classified as tax havens between 2010 and 2015. The single largest investor in India was Mauritius, which accounted for 0.016% of world GDP in 2015 but an astonishing 29% of all FDI coming to India between 2010 and 2015. Mauritius remains a huge outlier even after controlling for a rich set of gravity variables.

The second contribution shows the role that the India-Mauritius bilateral tax treaty (BTT) played in redirecting FDI flows through Mauritius. There are very few cases where BTTs have been amended to plug important tax loopholes. We study the amendment to the India-Mauritius BTT to show that it had a large and robust effect on the relative volume of FDI flows to India through Mauritius. The third contribution is to show that Indian firms did not receive any less FDI as a result of the amendment, which has important policy implications for developing countries amending unilateral and bilateral tax policies.

Chapter 1

Worker and Firm Responses to Trade Shocks: The UK-China Case

with João Paulo Pessoa

Abstract

We exploit the recent surge in Chinese export growth to study the effects of a trade shock on workers and firms in a foreign market, the UK, in the period 2000-2007. We find that individuals initially employed in sectors highly exposed to growth in imports from China experienced lower income growth and remained out of employment longer than workers in sectors that were less exposed to import competition. The effects are heterogeneous, with initially lower-paid workers suffering more in terms of employment and earnings than those initially better-paid, and female workers experiencing a greater relative fall in total earnings than males, mostly through reduced years of employment. Plants in industries more exposed to Chinese products displayed lower employment growth and higher probability of going out of business than plants in sectors more insulated from competition with China, with stronger effects for larger plants.

This paper is published in the European Economic Review (Volume 133, April 2021, 103678).

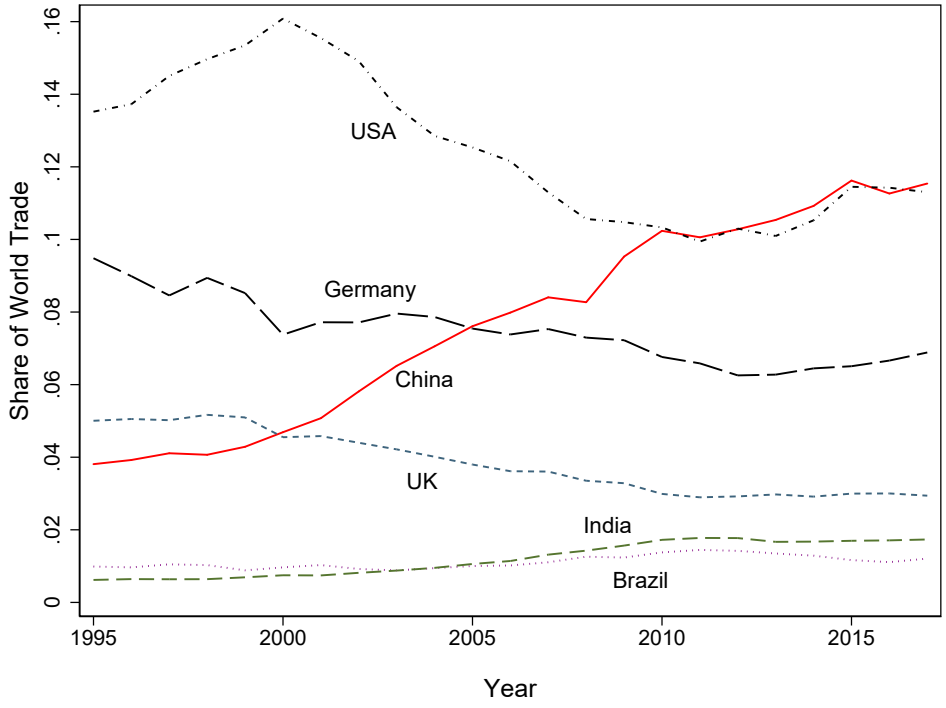
1.1 Introduction

One of the main consequences of trade openness is the reallocation of resources towards more productive regions, sectors and firms. This reallocation generally benefits the economies as a whole by raising productivity, reducing prices and ultimately increasing aggregate welfare (Melitz, 2003; Eaton and Kortum, 2002). However, this reallocation has important implications on labor markets, with not all groups of firms and workers benefiting from the process.

In recent decades, China has emerged as a dominant player in international trade. Its growth has been extremely rapid since its accession to the World Trade Organisation (WTO) in 2001, leading the country to surpass the United States in its share of world goods trade in 2011, as shown in Figure 1.1. Meanwhile, in many developed countries, the share of employment in the manufacturing sector has fallen dramatically. For example, in the United Kingdom, manufacturing employment has fallen from 16.7 percent at the beginning of 1997 to 9.1 percent in 2017. The remarkable integration of China into the global economy and the context of its growth has spurred renewed interest into the effects of international trade, especially on labor markets (Autor et al., 2016).

In this paper, we investigate how both workers and firms in a developed mid-sized economy, the UK, were affected by rising import competition from China. The UK provides an interesting environment for the study of trade shocks. There has been a sharp decline in employment in the manufacturing sector but the productive services sector has grown rapidly, with exports of services nearly doubling between 2001 and 2007 (Office for National Statistics, 2013). Furthermore, the country persistently ranks as one of the most flexible labor markets in the world (Scwab, 2018). These possibilities could potentially offset the frictional adjustments of workers affected by the China

Figure 1.1: Share of World Trade by Country



Notes: The figure shows the yearly share of world trade in goods (value of imports and exports) by country between 1995 and 2017.
Source: World Integrated Trade Solution (WITS) Database.

shock.

We investigate the effects of the growth of imports from China on both workers and firms, drawing on a rich set of UK administrative datasets. Exploiting the worker and firm panel datasets, we are able to analyze several margins of adjustment, including workers' cumulative earnings, employment status, average hourly and weekly wages (conditional on being employed), as well as firms' exits and employment growth. We also analyze numerous dimensions of heterogeneity for both workers and firms, and investigate how workers adjusted to the shock when switching their firm or industry.

To identify the effects of Chinese import competition on UK workers and firms between 2000 (the year before China entered the WTO) and 2007 (the year before the "Great

Recession"), we rely on the fact that industries faced differential changes in exposure to Chinese import competition and exploit this variation across narrowly defined industries. A major concern in the identification of these effects is the potential endogeneity of the import exposure measure. For instance, the UK's imports from China may be correlated with contemporaneous labor demand shocks in the UK, which could lead to biased estimates. To identify the causal effect of Chinese export growth on the UK market, we adopt an instrumental variable strategy that isolates the part of trade flows that is driven by the China-specific effect, following Costa et al. (2016).[1]

We find strong and statistically significant evidence that workers initially employed in industries exposed to high levels of Chinese import growth experienced lower average weekly and hourly earnings growth compared to individuals in industries less exposed to imports from China. For example, the growth of average weekly earnings of workers in highly affected sectors was 3.9% lower than that of workers in industries facing low levels of Chinese import competition. Furthermore, we find some evidence of negative effects on workers' total earnings, defined as total cumulative earnings in the period 2001-2007 divided by the worker's pre-period average annual earnings, and on the number of years employed.

The impact of the shock on the demand side of the UK labor market also entails important insights about how the country adjusted to the rise in import competition. Were firms in sectors hit harder by Chinese imports not able to survive the increased foreign competition? Did firms downsize? Or were firms simultaneously firing and hiring workers in response to the shock, leaving overall employment relatively unaffected at the sector level and implying that the results at the worker-level simply reflect firms reorganising their employment composition? To better understand these issues, we

[1]We also show that our results are robust to using an instrument more closely related to that of Autor et al. (2014), which uses Chinese exports to a subset of developed countries excluding the UK.

study how Chinese import exposure affected firm outcomes over the same period.

We find evidence that plants in manufacturing industries more exposed to Chinese import competition displayed lower employment growth relative to plants in less exposed manufacturing sectors. In the period considered, plants in highly affected sectors experienced an employment growth rate that was approximately 13 percentage points smaller than that of plants in less affected industries. We find that the negative employment effects hold whether we include new entrant firms or not, or when restricting our sample only to firms that survived up to 2007. We also find more limited evidence that more exposed plants had a higher probability of going out of business. Therefore, there is evidence that firms in more exposed industries also suffered relatively more from the increase in import competition from China, both on the intensive and extensive margins.

We also study the reallocation margins by which workers adjust to the import competition shock. We do this by decomposing the employment and earnings effects into mutually exclusive channels of adjustment between 2001 and 2007 based on whether the worker remains at their initial employer and/or sector, as well as potentially counterbalancing movements across employers and distinct types of sectors. The results suggest that when workers did not move out of their original firm and/or sector, the effects of the China shock on total earnings growth were more severe. On the other hand, when workers moved into other tradable sectors and into the services sector, the negative impact of the China shock was somewhat mitigated. These offsetting effects occur primarily through relatively more years of employment when workers were outside their original two-digit sector.

We show that the effects are heterogeneous across distinct groups of workers and firms. We find that women suffered more from the shock than men in terms of their total

earnings. This was driven by a significant relative fall in both working years and average earnings for women more exposed to the shock, while men experienced only a relative decline in average earnings. Younger workers suffered considerably more from the China shock than older workers in both earnings and employment. Individuals with lower initial pay experienced greater negative effects than individuals with higher initial pay in regards to employment, total earnings and average hours worked. In our firm heterogeneity analysis, we show that older and larger plants are more heavily affected by the China shock than younger and smaller ones, respectively, especially in terms of employment growth.[2]

Our paper mainly contributes to the literature analyzing the effects of import competition from China on labor markets.[3] This literature has developed quickly since the work of Autor et al. (2013a), who showed that US regions more exposed to Chinese imports displayed lower employment and earnings growth when compared to less exposed regions. Our paper is closely related to those of Autor et al. (2014) and Utar (2018) who use worker-level data to study the impacts of the Chinese shock on individuals in the US and

[2]One possible explanation for this effect is that age and firm size are positively correlated (Hsieh and Klenow, 2014) and, within industries, larger plants typically produce more standardized goods than smaller ones, therefore being more subject to competition with standardized imported products Holmes and Stevens (2014).

[3]More broadly, we contribute to the strand of the literature that investigates the effects of trade on labor markets. In particular, our worker-level analysis contributes to the literature on short-run worker adjustment to import competition. For example, Egger et al. (2007) use Austrian data to estimate how trade and outsourcing affected transition probabilities between sectors and/or being employed, finding that international factors are important for worker adjustment. For instance, increases in outsourcing negatively affect the probability of staying in or changing into the manufacturing sector. Other papers that analyze the impact of trade shocks on workers, firms and regions include Revenga (1992), Bernard et al. (2006), Topalova (2007), Menezes-Filho and Muendler (2007), Kovak (2013), Hakobyan and McLaren (2016), Dix-Carneiro and Kovak (2017), and Dix-Carneiro and Kovak (2019), to cite just a few.

Denmark, respectively.[4] Similar to our results for the UK case, the papers show that Chinese import competition had negative (relative) effects on earnings and employment of American and Danish workers, with the earnings effects being more prominent than the employment effect. The magnitudes of the effects on UK workers' earnings are similar to those in the US, but smaller than the ones found in Denmark, although the latter comparison should be interpreted with caution due to differences with our empirical specification and sample.

Dauth et al. (2014) use worker-level data to study the impact of rising import exposure from the East (China and Eastern Europe) on employment outcomes in Germany between 1988 and 2008, finding that higher import competition diminishes workers' expected employment durations and job tenure (in their original employer or industry). However, they find that exports to the East helped to offset the negative employment effects and, interestingly, the rise of Eastern Europe affected German workers more heavily than trade with China.[5]

Building on the existing literature, we are, to the best of our knowledge, the first paper to simultaneously study the impacts of Chinese import competition on labor market outcomes for both workers and firms, deriving useful insights on the process of

[4]Ashournia et al. (2014) study the impact of the China shock on the wage gap between high and low skilled Danish workers, finding that the shock increased the gap as only low skilled workers' wage (and employment) growth were negatively affected by the shock. To better understand the mechanisms behind the changes in the wage gap, Ashournia et al. use firm-level regressions to analyze the impact of Chinese import competition on firms' sales by product type, finding that the China shock is biased towards low-skill intensive products. Our firm-level analysis looks at firms' employment and activity status, which are outcomes directly related to the impact of China on the labor market. Keller and Utar (2019) also study the impact of import competition from China on the Danish labor market, but focus on the effect on job polarization, showing that import competition from China has led to a rise in job polarization in Denmark.

[5]Dauth et al. (2014) also study the impact of the rise of the East on German regions, finding that more import competition lowered employment growth in regions specialized in import-competing industries, while regions focused on export-oriented sectors experienced stronger employment gains. In a developing country regional level study, Costa et al. (2016) present evidence that the surge in imports from China negatively affected workers in terms of employment and earnings across Brazilian microregions, while the rise in Chinese commodity demand had the opposite effects.

adjustment to the shock. For instance, the firm-level analysis suggests that the China shock caused firms in more heavily-affected sectors to downsize and exit the market, and that this effect is present across different types of firms. In line with this, our worker-level decomposition shows that workers who remained at their initial firm and/or sector were hit the hardest, while those who switched across broadly-defined industries were able to partially offset those negative effects. Overall, by taking into account the possibility that new firms may enter the market and that firms may hire new employees (who may or may not be in our worker-level analysis sample), our results indicate that the impacts of China on employment and earnings reflect a contraction of some sectors and not simply labor market churn whereby firms adjusted their labor force by releasing their employees and hiring new ones.[6]

By studying the demand side of the labor market of a mid-size economy such as the UK, we additionally contribute to the strand of literature that analyzes the impact of trade shocks on firms' behavior, including those that focus on competition with China. Bernard et al. (2006) analyze the effects of import competition from low-wage countries, which is mainly due to China over the period considered (1977 to 1997). In line with our results, they find that industries facing greater import exposure experience higher rates of plant exit and, among surviving plants, those in more exposed sectors experience more sizeable reductions in employment. Iacovone et al. (2013) find that competition with China led to plant (and product) exit and sales contraction of Mexican producers, with stronger effects for smaller plants. Utar and Ruiz (2013) show that the inflow of Chinese goods had a significant negative (relative) impact on employment and plant growth in Mexico. Mion and Zhu (2013) find evidence that Chinese import competition reduces employment growth of Belgian firms. They find, however, that imports from China have

[6]We also find mild evidence that more exposed firms experienced lower sales growth relative to less-exposed firms, suggesting that affected firms were not just offshoring jobs and maintaining the overall scale of their operations.

no effect on firm survival. Bloom et al. (2016) focus the impact of Chinese imports on innovation in European countries, but also find evidence that competition with China had a negative effect on firms employment growth and survival probability.[7]

The paper is organized as follows. In Section 1.2, we describe the data used in the analysis and additional information about the China shock. In Section 1.3, we present our empirical strategy and show the results of the analysis using worker and firm panel data from the UK. We offer concluding comments in Section 1.4.

1.2 Data and the China Shock

We use a combination of rich administrative and survey data sources for the analysis. At the worker level, the main dataset is the Annual Survey of Hours and Earnings (ASHE) (Office for National Statistics, 2019a). It is an administrative dataset covering one percent of all workers, with the sample based on the last 2 digits of the National Insurance Number (equivalent to the social security number in the US).[8] The ASHE is a panel dataset with data collected annually, and provides information on individuals' earnings and employment history.[9]

[7]Medina (2020) studies the effect of China's WTO accession on Peruvian firms' quality upgrade decisions following an increase in competition with Chinese products, finding that profitability losses due to competition in low quality segments induce firms to shift production toward high-quality varieties.

[8]The sample is broadly representative of the UK workforce, except for those on low pay (particularly those below the National Minimum Wage) and in self employment. Weights are provided to account for non-respondents and to match stratum in the Labour Force Survey (Office for National Statistics, Social Survey Division, Northern Ireland Statistics and Research Agency, Central Survey Unit, 2020) - a survey of employment in the UK. In our baseline analysis, we present unweighted results and show in the Appendix that the moments in the raw data as well as the baseline results are very similar when using the weights.

[9]The data are collected for a particular reference period in April, and include weekly and hourly earnings, hours worked, and the main industry of activity of the workplace. While the ASHE data has limited information on personal characteristics compared to some other data sources, the responses in the ASHE are considered to be highly accurate because they are provided by employers rather than employees themselves. The ASHE covers neither the self-employed nor individuals without payment in the reference period.

The main firm-level dataset is the Business Structure Database (BSD) (Office for National Statistics, 2019b). It contains plant-level information on employment, activity status, and main industry for almost all business organizations in the UK, as well as some further information at the enterprise level such as sales and foreign ownership. The BSD is derived mainly from the Inter-Departmental Business Register (IDBR), which is a live register of plants collected by HM Revenue and Customs via VAT and Pay As You Earn (PAYE) records.[10] If a business is liable for VAT and/or has at least one member of staff registered for the PAYE tax collection system, then the business will appear in the IDBR (and hence in the BSD). Businesses listed in the IDBR account for almost 99 percent of economic activity in the UK. Only very small businesses (such as those of self-employed individuals) are not included in the register.

The main drawback of the BSD is that it provides limited information for each firm. We therefore supplement it with data from the Annual Respondent Database (ARD) (Office for National Statistics, 2020) in order to obtain some key technology-related control variables *at the sector-level* used in our analysis. The ARD is a survey distributed to all businesses with employment of 250 or more and a sample of smaller businesses drawn using stratified sampling from the IDBR sampling frame. The data is collected at the "reporting unit" level, which may be a plant, collection of plants or the enterprise level. In each year, there are over 70,000 business contributors. The ARD provides detailed information and can be used to calculate, for example, R&D and capital intensity.[11] The ARD is representative at the industry level, which is the dimension on which we construct these controls for our regressions.

[10]PAYE is the system that HM Revenue and Customs uses to collect Income Tax and National Insurance contributions from employees.

[11]There are some missing industries in ARD, restricting the sample of analysis. The missing industries are ISIC 2 digit: 1 (agriculture and hunting); 45 (construction); 65, 66 and 67 (financial intermediation); 75 (Public Administration and Defence); 8512 (Medical and dental practice activities) and 99 (Extra-territorial organization and bodies).

Data on exports and imports are obtained from the CEPII BACI database. This database contains information on all bilateral trade flows between any given pair of countries; such flows are described using the Harmonized System (HS) classification, at the 6-digit level.[12] To create a mapping between this trade classification and the industry classification in the ASHE, BSD and ARD that use the 5-digit UK standard industrial classification (UK SIC), we use a third intermediate classification: the 4-digit international Standard Industrial Classification revision 3 (ISIC3). Both HS and UK SIC can be easily aggregated to ISIC3, providing a consistent classification for our analysis.

Throughout our analysis, we use 2001 as the reference point for worker outcomes because China joined the WTO at the end of that year. China had begun to liberalize trade prior to 2001 but to gain access to the WTO it had to commit to several measures to further liberalize trade such as the reduction of import duties. China's entry into the WTO also meant that restrictive import quotas imposed by the European Union (mainly in textiles and apparel) would be lifted. Finally, the entry of China into the WTO also implied a considerable reduction in uncertainty for Chinese exporters. Handley and Limão (2017) show that this reduction in uncertainty in the US indeed contributed to a boom in China's exports to the US after its WTO accession.[13]

To measure the UK exposure to China, we use the import penetration measure matching that derived in Autor et al. (2014), i.e., the change in value of imports from China (the exporter) between 2000 and 2007 divided by the UK's (the importer) total expenditure

[12]Original data are provided by the United Nations Statistical Division (Comtrade database). BACI is constructed using an original procedure that reconciles the declarations of the exporter and the importer. This harmonization procedure enables the number of countries for which trade data are available to be extended considerably, as compared to the original Comtrade data.

[13]Even though tariffs were largely unchanged after 2001, China's joining the WTO led the US to implement the permanent most favored nation (MFN) status in the following year, which ended the annual threat of imposing high tariffs on Chinese goods. China was not subject to such annual reviews in Europe. On the other hand, China's negotiations with the EU were completed later than those with the US and much closer (in 2000-2001) to its accession.

on all goods (per sector) in the year 2000:

$$Chinese\ Import\ Exposure \equiv \frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}},$$

where expenditure equals the sum of total imports and the total UK sales (shipments), minus exports. We construct this measure by combining the Business Structure Database (sales per industry) and the BACI database (imports and exports). We consider only mainland China, i.e., we do not include Hong Kong and Macao in the import exposure measure.[14] Data on sales, exports and imports are at the 4-digit industry classification level (ISIC3) and are expressed in real terms (in thousands of GBP, using 2005 as the base year).

Table 1.1 shows the industries that were directly affected by China between 2000 and 2007 and the size of each industry as a share of employment in 2000.[15] The table presents 2-digit industries, while for our analysis we will use variation at the 4-digit level. The greatest increase in import penetration occurred in low-tech manufacturing sectors. Several industries that faced more Chinese competition had sizable shares of the labor force in tradable sectors in 2000. The heavily affected industries are generally linked to textiles, furniture and machinery production. The sectors that experienced lower increases in import penetration are within agriculture and mining.

Figure 1.2 suggests that industries more exposed to Chinese products suffered greater employment declines. It shows a negative relationship between changes in log employment and changes in Chinese import exposure in tradable industries at the 4-digit level.

[14] Our results in the next section do not change substantially if we include these two Special Administrative Regions.

[15] We carry out our analysis for samples considering only manufacturing industries, only tradable industries, and for both tradable and non-tradable industries, assuming a Chinese Import Exposure value of zero for the later.

Table 1.1: Industry Employment and Import Exposure.

Sector	$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	$(\frac{Imports_{chi}}{Expenditure})_{00}$	(Employment Share)$_{00}$
Tanning and Dressing of Leather	0.130	0.142	0.55%
Wearing Apparel	0.101	0.079	2.93%
Furniture and Manufacturing n.e.c.	0.090	0.056	4.53%
Office, Accounting and Computing Machinery	0.054	0.061	1.01%
Radio, Television and Communication Equipment	0.050	0.031	2.77%
Textiles	0.048	0.029	3.45%
Machinery and Equipment	0.031	0.017	8.39%
Wood and Cork (except furniture)	0.029	0.010	1.69%
Other Non-Metallic Mineral Products	0.025	0.008	3.06%
Fabricated Metal Products $*^A$	0.022	0.012	8.27%
Electrical Machinery	0.022	0.038	4.2%
Basic Metals	0.016	0.003	2.89%
Rubber and Plastic	0.013	0.020	5.17%
Medical, Optical and Other Instruments $*^B$	0.008	0.021	3.29%
Paper	0.008	0.003	2.31%
Chemicals	0.007	0.006	5.99%
Forestry and Logging	0.005	0.006	0.23%
Publishing and Printing $*^C$	0.004	0.004	7.67%
Coke, Refined Petroleum and Nuclear Fuel	0.003	0.001	0.60%
Other Transport Equipment	0.003	0.005	3.47%
Motor Vehicles, Trailers and Semi-Trailers	0.003	0.000	4.72%
Fishing	0.002	0.001	0.26%
Other Mining and Quarrying	0.002	0.003	0.79%
Food and Beverages	0.002	0.001	10.58%
Mining of Coal and Lignite	0.001	0.003	0.30%
Agriculture and Hunting	0.000	0.003	10.07%
Tobacco	0.000	0.000	0.20%
Crude Petroleum and Natural Gas	0.000	0.000	0.63%
Total			*100%*

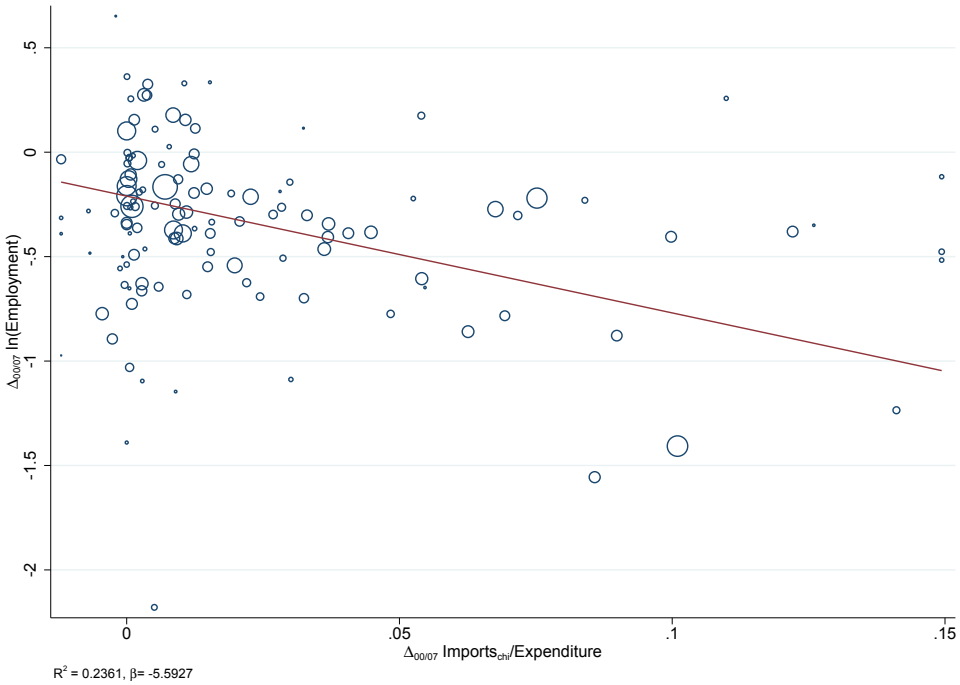
NOTES: The table considers only tradable goods industries (agriculture, manufacturing and mining). The table shows changes in Chinese import penetration from 2000 to 2007, the Chinese import penetration measure in 2000 and employment shares in 2000 by industry (ISIC3 2-digit). The denominator of this last measure considers only tradable goods industries. $*^A$ Excludes machinery and equipment. $*^B$ Includes watches and clocks. $*^C$ Includes reproduction of recorded media. Mining of ores are excluded from the table above due to the small number of observations.

1.3 Empirical Strategy and the Effects of China

1.3.1 Worker-level Evidence

Our model specification is motivated by Autor et al. (2014). We observe each worker's industry of business in 2000 and for each industry we compute the change in import exposure up to 2007. So long as worker mobility across sectors is not perfectly frictionless, import shocks to a worker's initial industry should affect his/her employment and earnings from 2001 onwards, as the import penetration shock represents a potential fall

Figure 1.2: Changes in the Logarithm of Industry Employment vs Chinese Import Exposure



NOTES: The figure plots changes in employment between 2000 and 2007 against changes in exposure to Chinese imports in the UK at the 4-digit ISIC3 industry level. The size of the markers represent industry employment in 2000 and the fitted line uses these as weights. β represents the slope coefficient of the fitted line (the standard error is 0.9).

in domestic labor demand in that industry.

Our baseline estimating equation is:

$$y_{ik,01/07} = \beta_1 \frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}} + \beta_2 Z_{ik} + \varepsilon_{ik}$$

The main outcomes we analyze are represented by $y_{ik,01/07}$, which will be one of five possible variables for employee i working in industry k (in 2000) in the period from 2001 to 2007: (i) Normalized total earnings, defined as total earnings between 2001 and 2007 - which accounts for both time worked and earnings conditional on working - divided by average annual earnings between 1997 and 2000; (ii) total working years is

the total number of working years between 2001 and 2007[16]; (iii) normalized average weekly earnings is equal to average weekly earnings between 2001 and 2007, divided by average weekly earnings between 1997 and 2000; (iv) normalized average hourly earnings is equal to average hourly earnings between 2001 and 2007, divided by average hourly earnings between 1997 and 2000; and (v) normalized average hours worked is equal to the average numbers of hours worked per week between 2001 and 2007, divided by the average numbers of hours worked per week between 1997 and 2000.[17] All earnings measures are in real terms (using 2005 as the base year) and are winsorized at the top 99% and at the bottom 1%; all regressions consider only workers aged between 17 and 59 years in the initial period. Importantly, by normalizing variables by the worker's pre-period level, we are accounting for worker-specific, time-invariant unobservables that may affect outcomes.

As detailed previously, the change in import exposure from China between 2000 and 2007 in the worker's industry of activity in 2000 is defined as $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$. This is the change in Chinese imports between 2000 and 2007 divided by expenditure in a sector in the UK and is defined specifically for each industry.

The vector Z_{ik} contains individual and industry controls, which vary depending on each regression specification. All of the regressions include controls for pre-period levels of: log of average hourly earnings; log of average weekly earnings; average time employed between 1997 and 2000;[18] and average hours worked per week. Controlling for these lagged variables mitigates the concern that the results are only picking up worker-level

[16]For the robustness checks where we use the expanded sample of workers with low labor force attachment, we normalize total working years by dividing by the worker's average years employed between 1997 and 2000.

[17]For more details about the construction of all the dependent variables, see the Appendix 1.A.1. In particular, the annual earnings equal the Average Weekly Earnings multiplied by 52, the number of weeks in a year.

[18]The average time employed is constant in the baseline sample which is restricted to workers with high labor force attachment in the pre-period, defined as being employed in all four years from 1997-2000.

heterogeneity associated with exposure to changes in Chinese imports. By including these controls, we are estimating how the earnings and employment of individuals with comparable pre-period characteristics, including previous earnings and labor force attachment, were affected by the differential performance of China across industries in the period 2001 to 2007.

Additionally, we control for worker characteristics, in particular, age, age-squared, gender and an interaction between age and pre-period (log of) weekly earnings, (log of) hourly earnings and (levels of) years and hours worked. The ASHE data does not provide information on individuals' education. To compare individuals with similar educational backgrounds and similar jobs, we control for occupation fixed effects at the 4-digit classification level. We also control for whether the individual was working full-time or part-time in 2000.

The identifying variation comes from differences in Chinese import penetration across industries. It is therefore necessary to control for characteristics of each industry. We use (log of) real industry sales, (level of) industry employment, and (the log of) real industry exports to China in 2000 as controls. To rule out the possibility that Chinese imports simply capture a pre-existing general increase in the trend of UK imports, we also control for the change in import exposure to China and the rest of the world between 1997 and 1999 and for both industry import exposure to China and to the rest of the world in 2000, all at the 4-digit industry classification level. We include a very broad measure of outsourcing in 2000, given by the share of input costs in the output value at the 2-digit industry classification level. This value is obtained from the UK input-output tables supplied by the Office for National Statistics. We also control for previous trends in employment by including pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry classification) and from 1994 to

1996 (4-digit industry classification).[19] To compare industries with similar levels of technologies, we also include R&D intensity (investment in R&D normalized by the value added), real purchases of computer services and real investment in machinery at the 4-digit industry classification level in 2000. These variables are available at the firm level in the ARD, which we then aggregate into averages for each 4-digit industry classification using sample weights to ensure that they are representative at the industry level.

The error term ε_{ik} represents unobserved components that affect workers' outcomes of interest. This term might be correlated with contemporaneous labor demand shocks in the UK. That is, imports from China in a given industry may be endogenously determined with respect to labor market conditions in that industry. To identify the causal impact of imports on labor market outcomes, we isolate the component of trade flows driven by Chinese productivity gains (or declining trade barriers). We do this by adopting an instrumental variable (IV) strategy similar to that of Costa et al. (2016).

To capture the supply-driven Chinese effect, we use the interaction between two components. The first component is the estimated China fixed effect obtained from an auxiliary regression of world trade flows. To obtain the fixed effect, we first define X_{ck} to be total exports of country c in sector k. We exclude the UK from the data and then run the following regression for all other countries in the BACI dataset:

$$\Delta X_{ck} = \gamma_k + \delta_{China,k} + \varepsilon_{ck}.$$

[19]These additional controls use data from the Labour Force Survey (LFS) from the ONS (Office for National Statistics, Social Survey Division, Northern Ireland Statistics and Research Agency, Central Survey Unit, 2020). The LFS is an individual level survey and, with sampling weights, is representative at the industry level.

The left-hand side of the regression is the change in exports of a country in a given sector between years 2000 and 2007. The sector fixed effect, γ_k, is the mean change in exports for each sector k across countries (excluding the UK), capturing, for example, effects of shocks in world prices that are common to all countries.[20] This implies that the China fixed effect $\delta_{China,k}$ captures the deviation in export changes of China in sector k (excluding trade with the UK), relative to the weighted cross-country average. In other words, we are isolating the part of trade flows that is driven by the China-specific effect and not common to all countries. We normalize this measure by the total expenditure in a sector in the UK in 1997, $Expenditure_{k,97}$. The instrument is then given by

$$IV_{chi} = \frac{\hat{\delta}_{China,k}}{Expenditure_{k,97}},$$

where $\hat{\delta}_{China,k}$ is the estimate of $\delta_{China,k}$. The modelling assumption here is that changes in Chinese exports in each industry after 2000 to the world (excluding the UK) were not affected by UK industries. This instrument will suffer from reverse causality if the component $\hat{\delta}_{China,k}$ and/or the UK production in 1997 are affected by any type of anticipation of post-2000 labor demand shocks in the UK. To account for this, we add a series of additional controls in the regressions as discussed above. The advantage of our instrument is that it partials out industry shocks that are common to the world to isolate the China-specific component of trade. For robustness, we also construct an instrument more closely related to Autor et al. (2014), which uses Chinese exports in industry k to other developed economies, excluding the UK (in our case).

Table 1.2 shows the mean and standard deviation (in parentheses) for the main worker-level variables used in our analysis.[21] The top panel shows the outcome variables while

[20]The regression is weighted by export volumes in 2000.

[21]The table shows unweighted values, as in our preferred specifications. Table 1.B.1 in the Appendix presents the equivalent table with the ASHE calibration weights. The values are extremely similar.

the bottom panel shows variables that are used as controls. The columns present each of the four main samples used in the analysis. The main sample in column 1 includes all workers in all sectors with high labor force attachment - defined as being employed in all four years between 1997 and 2000 - while column 2 restricts this sample to manufacturing workers. Column 3 considers workers in all sectors with low and high labor force attachment, i.e. it includes workers who were employed and had positive earnings in at least one year between 1997 and 2000. The last column shows the summary statistics for the workers in manufacturing in the expanded sample.[22]

The first five rows show the main dependent variables. For the main sample in column 1, workers earned 6.41 times their initial annual earnings over the period 2001 to 2007 and had 5.13 years of employment (remembering that the working measure is normalized by the average number of years worked in the pre-period, i.e. it will be equal to the number of working years only in the first two columns where we restrict to workers with high labor force attachment in the pre period). Conditional on workers being employed, they earned 1.25 and 1.19 times their initial average earnings in terms of weekly and hourly payments, respectively, and worked 1.04 times their initial average hours worked.

We also analyze four other outcomes, shown in the next four rows. The probability of switching occupation at any point across the seven-year period is 0.45, while the probability of switching working area, defined at NUTS 3 level, equals 0.35.[23] The probability of switching industry is 0.46 while the probability of working in the services sector at any point between 2001 and 2007 is 0.81. To be clear, this last variable does not imply that the workers switched to the service sector. It simply considers if a worker worked in the service sector between 2001 and 2007, independently of their initial

[22]All samples include only workers who appear for at least one year in the period 2001-2007, as some variable are not well defined for individuals with zero years of employment and earnings.

[23]This is the nomenclature of territorial units for statistics (NUTS) level 3 for an individual working area.

Table 1.2: Descriptive Statistics: Workers

	Main	Main: Manufacturing	Expanded	Expanded: Manufacturing
Normalized Total Earnings	6.413	5.907	6.900	5.834
	(4.015)	(2.868)	(44.632)	(4.994)
Normalized Average Weekly Earnings	1.250	1.173	1.452	1.207
	(0.973)	(0.358)	(11.096)	(0.762)
Normalized Average Hourly Earnings	1.187	1.132	1.246	1.167
	(0.349)	(0.265)	(0.923)	(0.687)
Total Working Years	5.128	5.003	5.189	5.108
	(1.812)	(1.815)	(2.179)	(2.127)
Normalized Average Hours Worked	1.035	0.996	1.109	1.004
	(0.451)	(0.193)	(0.902)	(0.283)
Occupation Switch	0.454	0.506	0.512	0.549
	(0.498)	(0.500)	(0.500)	(0.498)
Work Area Switch	0.350	0.323	0.390	0.353
	(0.477)	(0.468)	(0.488)	(0.478)
Industry Switch	0.456	0.501	0.504	0.544
	(0.498)	(0.500)	(0.500)	(0.498)
Worked in Services	0.806	0.328	0.837	0.370
	(0.395)	(0.469)	(0.369)	(0.483)
Log (Average Hourly Earnings) 97-00	2.264	2.273	2.182	2.218
	(0.482)	(0.425)	(0.508)	(0.449)
Average Hourly Earnings 97-00	10.888	10.705	10.170	10.242
	(6.101)	(5.588)	(6.118)	(5.615)
Log (Average Weekly Earnings) 97-00	5.764	5.897	5.638	5.842
	(0.628)	(0.467)	(0.720)	(0.504)
Average Weekly Earnings 97-00	379.5	405.4	350.3	389.5
	(226.8)	(207.0)	(233.5)	(210.1)
Average Working Years 97-00	1.000	1.000	0.954	0.958
	(0.000)	(0.000)	(0.115)	(0.109)
Average Hours Worked (per week) 97-00	35.793	39.968	34.693	39.684
	(9.665)	(7.141)	(10.632)	(7.539)
Manufacturing	0.280	1.000	0.248	1.000
	(0.449)	(0.000)	(0.432)	(0.000)
Age	41.444	40.962	38.878	39.190
	(9.749)	(9.833)	(10.785)	(10.544)
Young	0.431	0.459	0.520	0.521
	(0.495)	(0.498)	(0.500)	(0.500)
Female	0.471	0.240	0.493	0.264
	(0.499)	(0.427)	(0.500)	(0.441)
Part Time	0.188	0.048	0.230	0.058
	(0.391)	(0.213)	(0.421)	(0.235)
High Earnings Capacity	0.340	0.342	0.340	0.341
	(0.474)	(0.474)	(0.474)	(0.474)
Mid Earnings Capacity	0.330	0.330	0.330	0.330
	(0.470)	(0.470)	(0.470)	(0.470)
High Skilled Occupation	0.398	0.282	0.374	0.279
	(0.490)	(0.450)	(0.484)	(0.448)
Mid Skilled Occupation	0.363	0.602	0.346	0.589
	(0.481)	(0.490)	(0.476)	(0.492)
N	48,529	13,566	88,955	22,094

Notes: The table shows the mean and standard deviation (in parentheses) of the variables at the worker-level. The main sample includes only workers with high labor force attachment in the pre period. The expanded samples include any worker with at least one year of employment in the pre period.

sector.

The table also shows the mean and standard deviations of the worker-level control variables. Workers in the main sample had, on average, log(average hourly earnings) and log(average weekly earnings) of 2.26 and 5.76, respectively (variables are in GBP in 2005 before the logs), and worked 35.8 hours per week in the pre period. The mean of (the level of) average hourly earnings is 10.9 and for average weekly earnings it is 380. A share of 0.28 of the workers were employed in manufacturing. Workers were 41.4 years old on average, and a share of 0.43 were younger than 40 years. The share of workers that were female was 0.47 and 0.19 percent were in part-time positions. The Earnings Capacity variables divide workers according to their tercile of hourly earnings within the distribution of their age cohort in the pre-period. As expected, workers are roughly evenly distributed into the three categories. In terms of occupational skill, a share of 0.40 and 0.36 of the individuals worked in high and mid skilled occupations, where we rank occupations (at the one digit SOC 2000 code) according to average hourly earnings in the sample.[24]

Table 1.B.2 in the Appendix shows the mean of the trade shocks in the sample for each of the four samples considered above. The table shows the mean and standard deviation (in parentheses) for the variables: Chinese Import Exposure; levels of imports from China in 2000 (adjusted by expenditure in the same year); and Chinese import exposure at the commuting zone (CZ) level. The last variable is the weighted average of the sector shocks in a commuting zone, again defined at the NUTS 3 classification level and using industry employment shares as weights. Following an approach similar to that of Costa et al. (2016), we divide the shock by the size of the labor force in the CZ from ASHE (in thousands of individuals and using the fact that ASHE is just a 1% sample). The table also shows different percentiles of Chinese Import Exposure (both

[24]For more information, see Table 1.B.3 in the Appendix and the surrounding discussion.

at the sector and at the CZ level).[25]

1.3.1.1 Average Impact on Employment and Earnings

We start by estimating the impact of greater Chinese imports on earnings and time spent in employment. Table 1.3 presents the main results. Column 1 shows results of a simple OLS regression, and the remaining columns are estimated by two stage least squares (2SLS) using the instrumental variables strategy outlined above. In all specifications, we control for lagged (log) earnings, employment and hours worked (excluding them does not qualitatively change the results). In columns 2-5 we introduce various sets of controls. The variables included in "Worker Controls" in columns 3 and 5 represent all the individual-level characteristics described previously, while the variables in "Industry Controls" in columns 4 and 5 encompass the industry-level characteristics.

Table 1.3 indicates that individuals initially working in industries more exposed to Chinese import growth experienced more negative effects on employment and earnings than those who were in industries with lower exposure, all else equal. Each of the five panels A, B, C, D and E represents a different dependent variable: normalized total earnings; normalized average weekly earnings; normalized average hourly earnings; normalized number of years worked; and normalized average of hours worked per week. In the first column, which presents the OLS results, the coefficients are negative and statistically significant, except in the last panel for normalized average hours worked. The 2SLS estimates in column 2 are larger in magnitude than those in the OLS regressions, indicating that the OLS estimates in column 1 are biased toward zero, possibly because labor demand shocks in the UK are positively correlated with imports from China in this

[25]For confidentiality reasons, we are unable to present percentiles of the distribution. Therefore, to obtain percentile X we average the variable across individuals within percentiles X + 5 and X-5 of the variable. For example, "percentile 10 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$" is the mean of Chinese Import Exposure between the percentiles 5 and 15 of the variable.

simple specification without other controls. The first stages are strong, as indicated by the Kleibergen-Paap (KP) F statistics in the lower part of the table. When we control for worker characteristics in column 3, the coefficients generally decline in magnitude but remain significant, except for hours worked once more. This is mainly due to the addition of the 4-digit occupation fixed effects. Controlling for industry characteristics in column 4 also reduces the coefficients relative to column 2. In column 5, the most demanding specification that includes the full set of controls, the coefficients are all negative.

The effects on earnings growth are strong (Panels A, B and C). In column 5, our preferred specification, we can see a negative effect of imports from China on normalized total earnings, normalized Weekly Earnings, and normalized average hourly earnings, with the last two being statistically significant at the 5 percent level. With the help of column 2 of Table 1.B.2 in the Appendix, which shows the percentiles of the import penetration variable for the manufacturing sector, the estimates imply that comparing a worker initially employed in a manufacturing sector at the 75^{th} percentile of Chinese import exposure (0.03) with a worker initially employed in an industry at the 25^{th} percentile of Chinese exposure (0.001) in the manufacturing sample, column 5 shows that an employee at the 75^{th} percentile observed his or her normalized average weekly earnings decline by 3.87% = 100 * (-1.333) * (0.03 - 0.001) more than an employee at the 25^{th} percentile of the shock. The effect on normalized average hourly earnings (Panel C) corresponds to a reduction of 3.45% at the 75^{th} percentile of the shock relative to the 25^{th} percentile.

Table 1.3 also provides some tentative evidence that workers in more exposed sectors were more likely to be out of employment than those in less exposed sectors, although this result is not statistically significant in columns 4 and 5 when more stringent controls

Table 1.3: Employment and Earnings

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A	**Normalized Total Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-7.839***	-10.680***	-9.544***	-5.194	-7.525
	(1.873)	(2.201)	(2.020)	(5.944)	(5.663)
Panel B	**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.659**	-0.709**	-1.305***	-0.721	-1.333**
	(0.264)	(0.271)	(0.303)	(0.631)	(0.634)
Panel C	**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.182***	-1.526***	-1.054***	-0.883	-1.188**
	(0.180)	(0.294)	(0.244)	(0.603)	(0.527)
Panel D	**Total Working Years**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-4.086***	-6.499***	-3.669**	-2.355	-2.290
	(1.093)	(1.622)	(1.469)	(3.788)	(3.467)
Panel E	**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.363*	0.548**	-0.194	-0.276	-0.505
	(0.199)	(0.275)	(0.143)	(0.377)	(0.387)
1^{st} Stage(s) Statistics					
IV_{chi}		.023***	.021***	.012***	.012***
		(.004)	(.003)	(.003)	(.003)
KP F Stat		35.662	36.273	13.160	14.485
N	48,529	48,529	48,529	48,529	48,529
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (4SIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

are added. There is no convincing evidence that hours of work was an active margin of adjustment for workers, as the the coefficients switch sign and lose significance in specifications with more stringent controls.

In the Appendix, we show that the results are qualitatively robust to an alternative IV similar to the one used in Autor et al. (2014) (see Table 1.B.4), to restricting the sample to workers employed in manufacturing in 2000 (see Table 1.B.5) and to expanding the sample to include workers with lower labor force attachment (see Table 1.B.6).[26]

We can also perform a back-of-the-envelope counterfactual exercise for the change in normalized average weekly earnings for workers initially in the manufacturing sector as a result of the China shock. Table 1.2 shows that the mean worker in the manufacturing sample experienced average weekly earnings growth of 17.3% relative to their pre-period average weekly earnings and the mean exposure to the shock across these same workers was 0.021, as shown in Table 1.B.2 of the Appendix. The estimated coefficient for the marginal effect of the trade shock in the manufacturing sample is -0.982, as seen in column 5 of Table 1.B.5. Therefore, the mean exposed worker experienced a 2% fall in average wages (-0.982 x 0.021 = -0.021) because of Chinese exports to the UK. Had China not increased its exports to the UK, their average weekly earnings growth would have been approximately 19% instead of 17% in the sample period. If we look at the the worker at the 90th percentile of exposure among those initially in manufacturing (0.074), the estimated fall in average wages was 7.3%, an even more substantial drop relative to the mean value of the outcome variable.

We next conduct a falsification exercise by using the sample of workers employed in

[26]In the Appendix, we also show that the results are robust to the use of ASHE weights (Table 1.B.7) and to expanding the sample to include those who do not work at all between 2001 and 2007 (Table 1.B.8). Note that panels B and C are not affected by the latter robustness check, as average earnings are calculated conditional on being employed. Results are also robust to removing the control for the variable which we use to normalize the outcome variable (Table 1.B.9).

1997, calculating the same earnings and employment measures from 1998 to 2000 and running a regression considering future Chinese import penetration on the right-hand side and the same controls for workers relative to the pre-period (1997) and for industries. Results are shown in Table 1.B.10 of the Appendix, with no coefficient being statistically significant in the most stringent specification. Moreover, almost all the coefficients are relatively smaller in magnitude (the exception being panel B) and have smaller t-stats when compared to Table 1.3. We note that the results are not exactly zero, possibly because China's liberalization had already begun at a gradual rate in this pre period. This is why we control for pre-trends in wages and employment at the industry level.[27]

In summary, Table 1.3 indicates that greater import exposure to China in a sector significantly reduces real average earnings growth relative to less exposed sectors. We also find mild evidence that Chinese import competition affected years of employment and cumulative earnings.

We can also compare our results in Table 1.3 to those in Autor et al. (2014). In column 5, the coefficient of -7.525 (not statistically significant at usual levels) implies that comparing an individual initially employed in an industry at the 75^{th} percentile of the Chinese import exposure measure to one at the 25^{th} percentile, the implied differential in earnings is $21.82\% = 100 * (-7.525) * (0.03 - 0.001)$ of the worker's initial earnings. Comparing the same two groups of workers in the US, Autor et al. obtain the value of 45.8% for a 16-year period (between 1992 and 2007). When we divide both coefficients by the number of years used in each analysis (7 and 16), the effects in the UK and in the US are 3.11% and 2.86%, respectively. In contrast, Utar (2018) finds a more sizable

[27]We would ideally run the falsification exercise with another sample going further back in time, but we are limited by the data which starts in 1997. For the placebo exercise, the sample includes workers in some industries which do not appear in the main analysis. In Table 1.B.11 of the Appendix, we repeat the placebo analysis without these additional sectors and show that the results all remain insignificant.

effect in Denmark when examining the removal of textile quotas. Utar estimates an 89% fall of a pre-period year of annual earnings over a 9 year period, equating to 9.9% per year. Note though that our empirical specification and sample differs more compared with Utar (2018) than with Autor et al. (2014), so the comparison with the results of Utar (2018) should be interpreted with caution.

As in both Autor et al. (2014) and Utar (2018), we observe weak evidence of employment effects. In Panel B of Table 1.3, column 5, comparing the same two groups of workers (75^{th} vs. 25^{th} percentiles), the implied differential in the number of years without a job is $0.06 = (-2.290) * (0.03 - 0.001)$, i.e., 0.8 more months of unemployment (or out of the labor force).

Overall then, the comparisons between the UK and US are similar for both cumulative earnings and employment. The effect for the US is slightly less negative, which is likely to reflect that US labor markets are more flexible than those in the UK (Scwab, 2018).[28]

1.3.1.2 Movements across Jobs

We next study workers' reallocation margins of adjustment to the rise in Chinese import exposure. We do this by decomposing the effects seen in the previous sub-section into

[28]The estimated effect for Denmark is much larger. We expect that part of the difference between Utar's results and ours to be due to distinct specifications. However, one possible economic reason for the larger effects observed in Denmark is that the country is economically smaller and more open (in terms of imports relative to GDP) than the UK so economic shocks would generate more output (and potentially employment) volatility in Denmark compared to the UK (di Giovanni and Levchenko, 2012).

mutually exclusive channels.[29] The specification we use for each decomposition is that of column 5 of Table 1.3. We therefore show the baseline results of this column again in the first column of each decomposition table. The other columns show the mutually exclusive channels of adjustment. Given that the categories are mutually exclusive and the explanatory variables are consistent across specifications, the coefficients in all columns other than column (1) will sum to the coefficient in column (1) when we consider total earnings or total working years in our regressions, where the dependent variables are totals.[30] For the other dependent variables this property no longer holds, as they are averages computed conditionally on employment in a particular category, and hence, the sample differs across columns.

Our main decomposition is according to firm and sector mobility, with the results presented in Table 1.4.[31] Our analysis takes into account the direct impacts experienced by workers at their initial employer compared with the effects arising when workers move across firms and sectors. The mutually exclusive sector outcomes are: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors outside their initial 2-digit sector

[29] In the Online Appendix, we analyze four other outcomes linked to worker mobility across regions, occupations, and industries. We re-estimate our baseline model (without any decomposition) on dummy variables for whether the worker switched region, occupation, or industry between 2001 and 2007. The results are presented in Table 1.B.12, along with more detailed discussion. The results show that there is some mild evidence to suggest that workers more exposed to the China shock were more likely to switch industry. There is no convincing evidence to suggest that workers more exposed to the shock were more likely to switch occupation or region. This finding, however, does not rule out the possibility that workers were affected differently by the China shock after moving across jobs, as we show in the present section.

[30] In the decompositions, total earnings in each column is the total earnings in that mutually exclusive category and is therefore equal to 0 if the worker never falls in that category. Total working years is defined accordingly.

[31] Throughout the decomposition analysis in this Section, we do not present first stage F statistics in the tables to save space but in almost all cases they are above 10. There are two cases where the F stat is 9.6 for the Residual Sector in Table 1.4.

(column 6); and a residual category (column 7).[32]

A rich pattern of adjustment emerges from the analysis. Panel A shows that individuals who remained in their original employer (column 2) or in the same sector (either at the most disaggregated level, in column 3, or the two-digit level, in column 4) suffered considerably from the China shock in terms of normalized total earnings, with all the coefficients being negative and large in columns 2-4 (and statistically significant in columns 3 and 4). We observe that when workers switch to other tradable sectors or to the services sector (columns 5 and 6), the coefficients on normalized total earnings are positive, meaning that workers more affected by the China shock were able to offset their negative earnings effects when switching to these sectors. But this compensation occurs only through more years of employment in those other sectors, not through higher wages. To see this, note that we have negative coefficients in almost all columns of panels B and C (that show average earnings conditional on the individual being employed) and positive coefficients in columns 5 and 6 of Panel D. The first result shows that average earnings were generally negatively affected by imports from China regardless of the final industry of employment, while the second shows a positive effect on employment for workers who moved outside their initial 2-digit industry. Finally, we can see that working years were negatively affected for individuals who remained in their 2-digit initial industry (columns 2-4, panel D).[33]

We next analyze how workers were affected in terms of their adjustment within or

[32]Note that columns 2 and 3 require that the worker is assigned to an enterprise code, a small number of which are not present in the data. Each of the other columns do not require this. So, in columns 4, 5 and 6 the individual could be at the initial firm or not (or have a missing enterprise code) as long as the individual is in a different sector. It is likely that the residual category will include mostly individuals that remained in the same sector but with a missing enterprise category, as well as individuals that moved to jobs that were not associated with a valid industry code.

[33]In the Online Appendix, we conduct the same decomposition analysis for the sample of manufacturing workers (Table 1.B.13) and the expanded sample including low labor force attachment workers (Table 1.B.14). The results are qualitatively similar, but the significance of the results varies across samples. The decomposition results are quantitatively very similar when using the ASHE sampling weights, and hence, we omit the results for the sake of space.

Table 1.4: Firm and Sector Decomposition

	(1) 2SLS All	(2) 2SLS Same Firm and Sector	(3) 2SLS Same Sector	(4) 2SLS Same 2-dig Sector	(5) 2SLS Tradable Sector	(6) 2SLS Non-Tradable Sector	(7) 2SLS Residual Sector
Panel A			**Normalized Total Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-7.525	-15.211	-6.383**	-6.036*	6.179**	5.227	8.700*
	(5.663)	(10.406)	(2.661)	(3.271)	(2.734)	(6.428)	(5.043)
N	48,529	48,529	48,529	48,529	48,529	48,529	48,529
Panel B			**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.333**	0.205	-3.175	-2.568	-1.507*	-0.969	-3.971
	(0.634)	(0.449)	(2.211)	(1.658)	(0.866)	(1.183)	(3.687)
N	48,529	33,432	3,980	5,670	3,727	15,030	6,089
Panel C			**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.188**	-0.192	-3.385	-1.880	-0.932	-1.160	-1.937
	(0.527)	(0.396)	(2.202)	(1.288)	(0.644)	(0.941)	(1.238)
N	48,529	33,417	3,979	5,664	3,725	15,024	6,084
Panel D			**Total Working Years**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.290	-13.405	-5.167**	-4.258	6.030**	7.139	7.371*
	(3.467)	(8.279)	(2.148)	(2.615)	(2.329)	(5.189)	(4.408)
N	48,529	48,529	48,529	48,529	48,529	48,529	48,529
Panel E			**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.505	-0.246	-1.077	0.319	-0.731	0.349	-1.448
	(0.387)	(0.224)	(1.195)	(0.651)	(0.582)	(0.596)	(0.980)
N	48,529	33,465	3,995	5,679	3,733	15,067	6,097
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

across commuting zones. We run a decomposition analysis with two mutually exclusive categories: remaining in the initial commuting zone, and switching commuting zone. The results are shown in Table 1.B.15, where column 1 is again the baseline results. The estimates suggest that jobs at workers' initial commuting zones and in new commuting zones are both affected by the China shock. It seems, however, that jobs in different commuting zones are more affected in terms of hourly earnings and employment, even though only the former effect is statistically significant.[34] Hence, we find no evidence that workers were able to mitigate their negative earnings effects through geographical mobility.[35]

1.3.1.3 Heterogeneous Effects

We now study the effect of Chinese import penetration on distinct groups of workers defined in terms of age, gender, and relative earnings (within age cohort) in the pre-period (1997-2000).[36] A rise in import penetration may have differential impacts on distinct groups of workers. For example, workers' mobility across sectors, occupations and regions may vary with their age, gender and earnings capacity (Artuç et al., 2010; Brussevich, 2018; Keller and Utar, 2018).

Following Utar (2018) and Autor et al. (2014), our approach to estimating heterogeneous effects consists of splitting our previous analysis into different samples. More precisely, we split the sector decomposition analysis from Table 1.4 into different samples according

[34]The results of the commuting zone decomposition for the manufacturing and low labor force attachment samples are similar and are therefore not included in the paper.

[35]In the Appendix, we also decompose the baseline result by three mutually exclusive groups of occupational classifications: low, middle, and high skill. The results in Table 1.B.16 suggest that earnings growth was lower for all categories of jobs. Average earnings growth fell most for workers employed in high skill occupations. On the other hand, total working years relatively fell most for workers in mid skill occupations, and actually relatively increased for workers in high skill positions, but these effects are not statistically significant. Hence, our results do not show clear evidence of import penetration from China leading to job or wage polarization at the worker level in the UK.

[36]We also run a heterogeneity analysis based on occupational skill levels and present the results in Tables 1.B.18-1.B.20 of the Appendix.

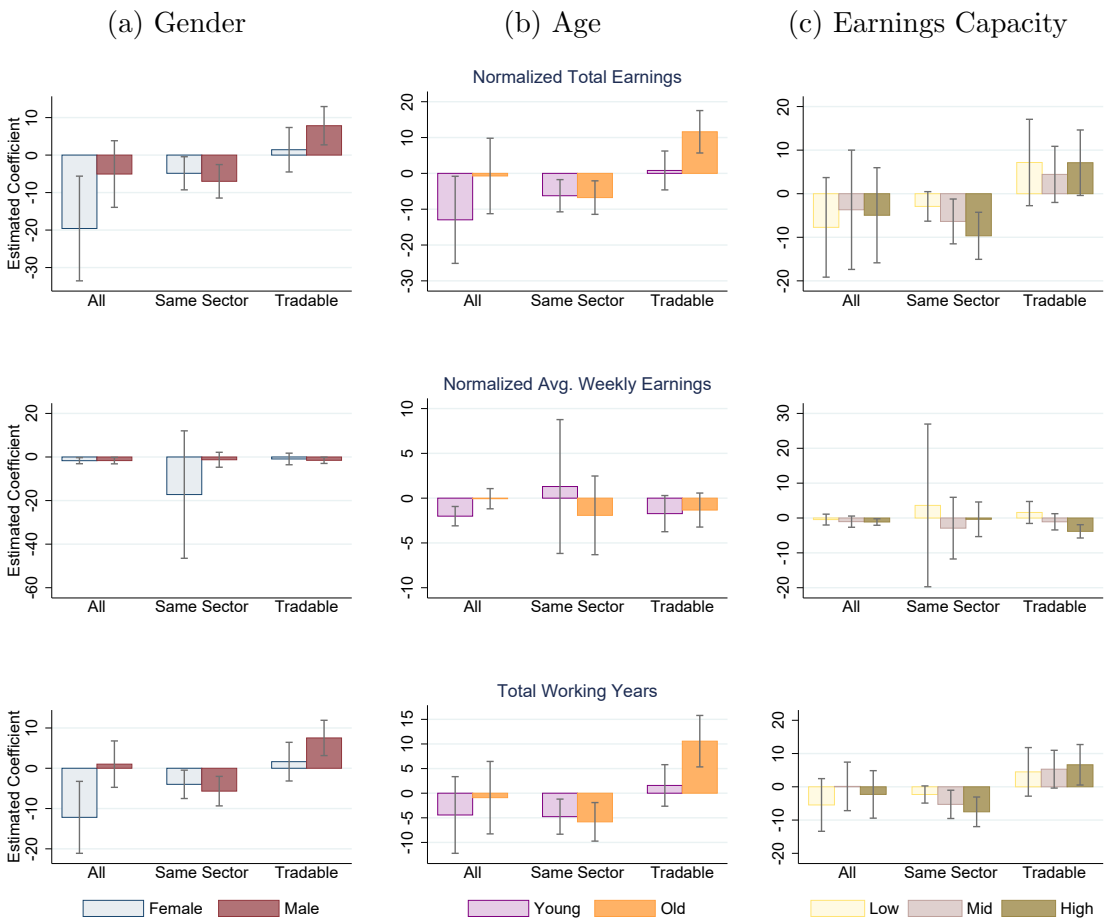
to gender (male/female), age (below 40/above or equal to 40) and relative earnings capacity within age cohort (low, mid, high).[37].

The results are shown in Figure 1.3.[38] Column (a) shows the results of our gender heterogeneity exercise. The first row shows the results for total earnings, the second row for average weekly earnings and the last row for total working years. Each bar corresponds to the coefficient of Chinese import penetration from a different regression, together with the respective 90% confidence interval. The horizontal axis corresponds to different categories based on our decomposition analysis. They consider our baseline model ("All" - equivalent of column 1 of Table 1.4). We also consider two other coefficients that entail important insights about workers movements across sectors. "Same Sector" corresponds to the case of employment at a different firm but within the same initial sector (equivalent of column 3 of Table 1.4), while "Tradable" corresponds to employment in tradable industries but not the same 2-digit sector (equivalent of column 5 of Table 1.4). The first row of column (a) shows that women suffered more than men in terms of their total earnings as a result of import penetration from China, a result also found in Keller and Utar (2018) for Denmark. This was driven by a sharp relative fall in working years and no significant relative fall in average earnings of women. Men experienced a relative decline in average earnings, from the China shock but did not have lower total working years. We can also see that men were able to gain in terms

[37]In Appendix Table 1.B.22, we also study the heterogeneous effects by interacting the change in Chinese import exposure with age in 2000, with a female dummy variable, or with log average hourly earnings between 1997 and 2000 ($\bar{HE}_{97/00}$). The results are qualitatively similar to those presented in the main part of the paper.

[38]Throughout the heterogeneous effects section, we do not present the first stage F statistics for each regression to present the results in a more organized way (in the vast majority of cases they are above 10). For the same reason, we show only results for total earnings, average weekly earnings and total working years in the figure, and just a sub-set of the coefficients. All the plotted coefficients can be found in Tables 1.B.23, 1.B.24 and 1.B.25 of the Appendix (all regressions are estimated by 2SLS with all controls at the worker- and industry-levels). The results for average hourly earnings and for average hours worked, which are not qualitatively different from the ones presented in the main part of the paper, can be seen in the Appendix.

Figure 1.3: Heterogeneous Effects



NOTES: Each bar represents the coefficient of a different regression and their respective 90% confidence intervals. Rows 1, 2 and 3 represent different outcome variables - see the notes of Table 1.3 for their definitions. Each column presents a different heterogeneity analysis, which is conducted by splitting the sample based on different workers' characteristics. Each columns consider a different sample split: (a) male and female workers; (b) young and old workers; (c) workers with low, mid and high earnings capacity. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The horizontal axis corresponds to different categories based on our decomposition analysis. "All" corresponds to the baseline model - equivalent of column 1 of Table 1.4. "Same Sector" corresponds to employment at a different firm but within the same initial sector - equivalent of column 3 of Table 1.4. "Tradable" corresponds to employment in tradable industries but not the same 2-digit sector - equivalent of column 5 of Table 1.4. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit). All the plotted coefficients can be found in Tables 1.B.23, 1.B.24 and 1.B.25 in the Appendix.

of their relative total earnings growth if they switched to other 2-digit sectors whereas the same effect for women is considerably smaller and not statistically significan.[39]

[39]Note that the average exposure to the China shock of males is larger than that of females - see Table 1.B.21 for the average China shock across different sub-samples.

Column (b) of the figure shows the effects for workers below 40 in the initial period (labelled young) and those above or equal to 40 in the initial period (labelled old). Looking first at the "All" category coefficients, we see that younger workers were hit harder than older workers in terms of their total earnings. For young workers, there is a statistically significant negative coefficient for total and average earnings, while the corresponding coefficients for older workers are very close to 0 and not statistically significant. Analogously to the female/male case, it seems that older workers partially compensate their relative employment declines in their initial 2-digit industry with lower declines (or even increases) when they transition to other industries, while younger workers are not able to mitigate the losses from employment linked to their initial sectors.

We also investigate whether workers with different earnings capacity were affected differently by the shock. We split workers into terciles of average (hourly) earnings in the pre-period within their age cohort. By assigning earnings terciles within cohorts of workers with similar age, our sample division should capture differences in earnings capacity arising from workers' characteristics other than experience, such as intrinsic ability and education. Our baseline results in column (c) of Figure 1.3 show evidence that workers with low earnings capacity suffered the most from the shock in terms of total earnings, although the standard errors are large so the results are statistically insignificant. We can also see that workers of all earnings capacity levels that switched out of their two-digit sector were able to offset their relative total earnings losses (mostly not statistically significant results). However, the second row shows that conditional on being employed, the average wages of mid and high earnings capacity workers were more affected than those of low earnings capacity. This suggests that low earnings capacity workers were mostly affected in terms of employment, which is what we see in the last row of column (c). As in the other heterogeneity exercises, moving out from

their original industry seems to offset the negative effects from import competition on employment for all categories of workers.[40]

1.3.1.4 Local Labor Market Analysis

So far, our analysis has measured workers' exposure to an import shock through their initial industry. This channel captures the *direct* impact of Chinese import penetration on worker outcomes but may miss important *indirect*, or general equilibrium, effects. First, the extent to which workers are affected by the import shock will depend on the their ability to relocate to other sectors. This, in turn, depends on employment opportunities within their local labor market, assuming that workers are relatively immobile across regions, and therefore on the extent to which the China shock impacted other important industries in their commuting zone. Second, there will be an aggregate demand effect of the shock, multiplying the positive and negative shocks through the economy. Part of this aggregate demand effect will be captured at the local level through expenditure on non-traded local goods and services (Acemoglu et al., 2016).

To encompass these general equilibrium effects, we redefine the Chinese import penetration shock at the local labor market level.[41] Specifically, the commuting zone shock is defined as the weighted average of the industry-level import shock in each commuting zone, where the weights are the initial share of the industry employment in the commuting zone labor force. Analogously, our commuting zone IV is constructed as a weighted average of the industry-level IV. The dependent variable is defined at the individual

[40]We show how the results vary with the skill ranking of each worker's initial occupation, defined based on the relative hourly wage of the occupation in 2000. We present the results in Tables 1.B.29 and 1.B.30 of the Appendix. Workers of all occupational types were negatively affected by the China shock but there is some heterogeneity driven by sharper falls in total working years for workers in low and mid skill occupations.

[41]One indirect channel that we do not consider here is exposure to the shock through upstream and downstream industry linkages, which may either positively or negatively affect labor demand at the industry level.

level as before, and for comparability we keep the same sample of workers.

Table 1.5: Local Labor Market Shock

	(1) 2SLS	(2) 2SLS	(3) 2SLS
	Normalized Total Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-7.525		-7.498
	(5.663)		(5.674)
CZ_{chi}		-1.075	-0.958
		(1.286)	(1.289)
	Normalized Average Weekly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.333**		-1.308**
	(0.634)		(0.632)
CZ_{chi}		-0.925***	-0.904***
		(0.250)	(0.251)
	Normalized Average Hourly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.188**		-1.163**
	(0.527)		(0.528)
CZ_{chi}		-0.890***	-0.872***
		(0.177)	(0.178)
	Total Working Years		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.290		-2.373
	(3.467)		(3.417)
CZ_{chi}		2.930***	2.967***
		(0.798)	(0.794)
	Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.505		-0.502
	(0.387)		(0.385)
CZ_{chi}		-0.132	-0.124
		(0.090)	(0.090)
1^{st} Stage(s) Statistics			
IV_{chi}	.012***		.012***
	(.003)		(.003)
F Stat IV_{chi}	14.485		7.737
$IVCZ_{chi}$		.017***	.017***
		(.001)	(.001)
F Stat $IVCZ_{chi}$		166.21	83.168
N	48,529	48,529	48,529
All Controls	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E, respectively, represent different outcome variables - see notes of Table 1.3 for their definitions. The sample is restricted to workers with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The commuting zone shock (Imports China in CZ) is a weighted (by the share of the labor force) average of the sector import shock in each CZ adjusted by total employment in the CZ from ASHE (in thousands of individuals). All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. The instrument for change in imports in CZ, $IVCZ_{chi}$ is just a weighted (by the share of the labor force) average of the industry-level instrument. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ =110). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We present the results in Table 1.5. Column 1 presents the baseline results from the industry level shock, column 2 shows results for the commuting zone shock, and column 3 includes both shocks as explanatory variables. All of the regressions are estimated by 2SLS and include all of our previous controls. The results suggest that workers in commuting zones more affected by the shock suffer from significantly lower average earnings growth. Surprisingly, we find a positive coefficient for total years worked - a result that is also found in the US data by Autor et al. (2014) who propose that this phenomenon may be explained by an income effect.

In column 3, we see that the estimated coefficients for the industry and commuting zone shocks are very similar to the cases where they are estimated separately, implying that the two shocks are uncorrelated.[42] In particular, note that the industry effect is not capturing regional variation in exposure to the shock and that the main result holds conditional on the exposure of a worker's local labor market to the shock. Column 3 suggests that workers in both industries and local labor markets hit by the shock experienced lower total and average earnings growth, although the effects on total working years went in opposite directions. The fact that the negative coefficient on the commuting zone shock on average earnings remains when the direct industry shock is included suggests that the general equilibrium effects are important.[43]

1.3.2 Firm-level Evidence

We now study how firms responded to the import shock in terms of employment and activity. More precisely, we turn to the analysis of plant-level responses to Chinese import penetration using data from the BSD described above. Our empirical approach

[42]The correlation between the sector shock and the CZ shock in the data is relatively low (0.127 in the main sample and 0.114 in the expanded sample with low attachment labor force workers).

[43]In Tables 1.B.31 and 1.B.32 of the Appendix, we show that the results are qualitatively similar for workers initially in the manufacturing sector and for the sample of workers with low labor force attachment.

is similar to that presented in sub-section 1.3.1. Our initial time period is still defined as the year 2000; however, in contrast to the worker analysis, we now include new entrants in some parts of the analysis. That is, we also consider plants that commenced operations in any year after (and including) 2001 in some specifications. We focus on ONS "local units", which are generally equivalent to plants. Groups of local units can be aggregated to the enterprise (firm) level. We observe the main industry of each plant, meaning that using plant-level data for our analysis is far more accurate than using data at the firm level, as firms may own many plants in different sectors. We use some additional firm-level information for our control variables.

We run a regression at the plant-level, where plants are indexed by j. The shock, which is still defined as the change in import penetration from China, is assigned at the industry level and therefore allocated to all plants in an ISIC3 4-digit industry. We cluster standard errors at the 3 digit industry level. Our main specification is:

$$y_{jk} = \beta_1 \frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}} + \beta_2 Z_{jk} + \varepsilon_{jk}$$

Our dependent variables are: i) Employment Growth, defined as the change in log(employment) between 2000 and 2007; and ii) Activity Status, a dummy variable equal to 1 if a plant was in business in 2007 and 0 otherwise.[44]

As in the worker level analysis, we are interested in comparing similar units so we control for a set of firm and industry level characteristics. The firm controls include an enterprise start-of-business-year fixed effect, a dummy for whether the enterprise is foreign owned

[44]For more details about the construction of the variables, see Section 1.A.2 of the Appendix. In particular, we assume that employment equals 1 for inactive plants (in the final period) and for young plants (in the initial period) that appear later than 2000 in the sample. Also note that all firms in our sample start active in 2000 (or in the year they enter). Hence, activity status equals 1 in 2007 if the firm did not changed its status throughout the period we analyze, while activity status equals zero otherwise.

and (log) employment at the enterprise level in the starting period. "Industry Controls" include the same variables as described in the worker-level analysis.

Table 1.6 shows the mean and standard deviation (in parentheses) for the main variables used in the analysis at the plant level (note that some variables are defined at the enterprise level as described above). We consider nine different sub-samples. Columns 1, 4 and 7 consider plants in tradable goods sectors (ISIC3 industry code lower than 3700), while columns 2, 5 and 8 consider only plants in manufacturing sectors (ISIC3 industry code lower than 3700 and greater than 1499). Columns 3, 6, and 9 include plants in all sectors. The samples then further restrict by activity status. For columns 1, 2 and 3, we include all plants in the sample, i.e. we include all plants that were alive in 2000, plants that enter after 2000 and survived up to 2007, and plants that died before 2007 that were active in 2000. In columns 4, 5 and 6 we exclude new entrants from this sample, i.e. plants that were not active in 2000. Columns 7-9 include only plants that were alive in 2000 and survived up to 2007. Similarly to previous studies that analyze the impact of Chinese imports on firms (Utar and Ruiz, 2013), in our main analysis we will focus on plants in the manufacturing sector.

The first two rows show the main dependent variables - employment growth and activity status. For our baseline sample in column 2, employment growth was on average -18.7% and a share of 0.52 of the plants were alive in 2007. Comparing plants in the manufacturing sector to all sectors of the economy (in column 3), the obvious difference is that employment at plants initially in manufacturing declined significantly over the period while for all plants mean employment growth was positive at 5.2%. Our analysis will shed light on the role of Chinese import penetration in explaining these trends.

The other rows show other plant and enterprise characteristics relevant for our analysis. A share of 0.10 of the plant are owned by foreign enterprises, the average number of

Table 1.6: Descriptive Statistics - Firms

	All Plants			No Entrants			Surviving Plants		
	Trad.	Manuf.	All	Trad.	Manuf.	All	Trad.	Manuf.	All
Employment Growth	-0.179	-0.187	0.052	-0.850	-0.857	0.078	0.031	0.032	0.078
	(1.547)	(1.560)	(1.490)	(1.319)	(1.331)	(0.620)	(0.651)	(0.653)	(0.620)
Activity Status	0.518	0.518	0.503	0.497	0.499	1.000	1.000	1.000	1.000
	(0.500)	(0.500)	(0.500)	(0.500)	(0.500)	(0.000)	(0.000)	(0.000)	(0.000)
Foreign Ownership	0.104	0.104	0.140	0.121	0.121	0.187	0.134	0.134	0.224
	(0.305)	(0.305)	(0.347)	(0.326)	(0.326)	(0.390)	(0.341)	(0.340)	(0.417)
Employment_{T_0} (enterprise)	362	193	5,552	255	191	3,635	184	178	1,884
	(5,125)	(1,679)	(26,080)	(3,354)	(1,772)	(17,639)	(1,180)	(1,189)	(8,602)
Local Units_{T_0} (enterprise)	10.1	6.8	186.4	6.6	5.1	145.9	4.5	3.8	86.1
	(103.5)	(64.4)	(654.3)	(64.3)	(48.8)	(521.6)	(24.0)	(20.6)	(333.6)
Employment_{T_0} (local unit)	21.455	22.143	13.963	27.334	28.190	16.475	35.722	36.852	21.331
	(93.432)	(95.559)	(77.196)	(110.418)	(112.708)	(84.165)	(140.155)	(142.942)	(108.827)
Small	0.424	0.416	0.478	0.437	0.493	0.414	0.489	0.481	0.440
	(0.494)	(0.493)	(0.499)	(0.496)	(0.500)	(0.493)	(0.500)	(0.500)	(0.496)
Young	0.499	0.499	0.444	0.333	0.331	0.434	0.226	0.223	0.324
	(0.500)	(0.500)	(0.497)	(0.471)	(0.471)	(0.496)	(0.418)	(0.416)	(0.468)
N	212,676	202,566	1,799,189	135,378	129,513	930,975	67,337	64,565	416,388

NOTES: The table shows mean and standard deviation (in parentheses) for different sub-samples of the firm-level data. Columns 1-3 include all plants, columns 4-6 restricts to the sample without new entrants, columns 7-9 restricts to firms alive at the start and end of the sample period. We consider plants in tradable (columns 1, 4 and 7), manufacturing (columns 2, 5 and 8) and all (columns 3, 6 and 9) sectors.

workers at the local unit is approximately 22. The plant belongs to enterprises that have, on average, 193 workers and 6.7 plants.

Similar to the worker-level case, Table 1.B.33 in the Appendix shows the mean of the shocks in the sample by column, as well as the (pseudo) percentiles of Chinese import exposure at the plant level.

1.3.2.1 Average Impact on Employment and Activity

Table 1.7 shows the regression results for the main sample of interest: plants initially in the manufacturing sector. The dependent variable is employment growth of the plant. Panel A includes all manufacturing plants, Panel B restricts to the sample without plants that enter after 2000, and panel C restricts to only firms that are observed in 2001 and survive up to 2007. Column (1) is estimated by OLS while columns (2) to (5) are estimated by 2SLS using the IV strategy outlined in Section 1.3.1. Column (2) does not include controls. Column (3) includes firm controls and column (4) includes

industry controls. Column (5) includes both firm and industry controls.

The estimated coefficients are negative in all cases. Examining the 5th column of panels A, a 1-percentage-point increase in Chinese import penetration leads to a decrease of 2.57 percentage points in the employment growth rate in the period. The coefficient is marginally insignificant at the 10% level, with a p-value of 0.100 to 3 decimal places.

To investigate the possibility that the results in Panel A are driven by the entry of new plants - which may be more likely to enter into industries less affected by Chinese imports - we present results excluding new entrants from the sample in Panel B. The estimated coefficient is -2.76, which is very similar to the sample of all manufacturing firms, suggesting that it is not new entrants that are driving the results.

To investigate only the intensive margin of employment adjustment, in Panel C, we restrict the sample to only include plants that were alive in 2000 and survived up to 2007. The coefficient is smaller in magnitude because, as we show in the following analysis, plants more exposed to China were more likely to close. The estimated coefficient is -1.438 and is statistically significant at the 10% level. Therefore, there is adjustment in employment on the intensive margin for surviving plants.

In Table 1.8, we repeat the specifications above for a dummy dependent variable of the plant's activity status. Panel A shows that plants more exposed to China were more likely to be inactive by 2007 relative to less exposed plants, although in the most stringent specification in column 5, the coefficient is not statistically significant at the 10 percent level. The negative coefficient holds in Panel B when restricting the sample to exclude firms that entered after 2000. This provides evidence that adjustment occurred on the extensive margin, as well as on the intensive margin.

Tables 1.B.34 to 1.B.37 show the equivalent analysis but considering a sample of plants in tradable sectors and in all sectors. The sample of tradable plants presents similar

Table 1.7: Plant Employment Growth - Manufacturing Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
			Employment Growth		
Panel A			*Manufacturing - All Firms*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.210	-2.417**	-2.950***	-2.165	-2.571
	(1.104)	(1.105)	(1.035)	(1.787)	(1.536)
1st Stage(s) Statistics					
IV_{chi}		.023***	.023***	.018***	.018***
		(.006)	(.006)	(.006)	(.006)
KP F Stat		17.700	17.663	11.028	11.060
N	202,566	202,566	202,566	202,566	202,566
Panel B			*Manufacturing - No Entrants*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.667	-3.006**	-3.219***	-2.164	-2.763
	(1.186)	(1.180)	(1.185)	(1.758)	(1.833)
1st Stage(s) Statistics					
IV_{chi}		.024***	.023***	.018***	.018***
		(.006)	(.006)	(.006)	(.006)
KP F Stat		17.714	17.744	10.055	10.162
N	129,513	129,513	129,513	129,513	129,513
Panel C			*Manufacturing - Surviving*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.706*	-1.469***	-1.648***	-1.330*	-1.438*
	(0.419)	(0.529)	(0.595)	(0.747)	(0.804)
1st Stage(s) Statistics					
IV_{chi}		.023***	.023***	.017***	.017***
		(.005)	(.005)	(.006)	(.006)
KP F Stat		18.235	18.217	8.855	9.001
N	64,565	64,565	64,565	64,565	64,565
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes all manufacturing plants, Panel B restricts to the sample without new entrants, and Panel C restricts to firms alive at the start and end of the sample period. Employment Growth is defined as change in log(employment) between 2000 and 2007. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.8: Plant Activity Status - Manufacturing Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
			Activity Status		
Panel A			*Manufacturing - All Firms*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.830**	-0.947**	-0.854**	-0.649	-0.750
	(0.328)	(0.389)	(0.342)	(0.483)	(0.468)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.023***	.023***	.018***	.018***
		(.006)	(.006)	(.006)	(.006)
KP F Stat		17.700	17.663	11.028	11.060
N	202,566	202,566	202,566	202,566	202,566
Panel B			*Manufacturing - No Entrants*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.002***	-0.995**	-0.868**	-0.600	-0.819
	(0.353)	(0.416)	(0.365)	(0.581)	(0.551)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.024***	.023***	.018***	.018***
		(.006)	(.006)	(.006)	(.006)
KP F Stat		17.714	17.744	10.055	10.162
N	129,513	129,513	129,513	129,513	129,513
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes all manufacturing plants, Panel B restricts to the sample without new entrants. Activity Status is a dummy variable equals to 1 if a plant was alive in 2007 and 0 otherwise. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

but statistically stronger results, with some of the coefficients gaining significance. On the other hand, results appear weaker when we include plants in all sectors. In sum, it seems that plants have suffered from greater import competition from China, with stronger relative effects in the tradable and manufacturing sectors.

Overall, the analysis indicates that firms more exposed to import competition from

China experienced relatively lower employment growth than those less exposed. The adjustment occurs at the intensive margin - with surviving firms having relatively lower employment growth - and at the extensive margin, with more exposed plants being more likely to cease operation. The results are not driven by selection of new entrants into less exposed industries and, together, the regressions suggest that there was a decline in employment at both the industry and firm levels.[45]

This plant-level analysis complements the worker analysis, showing that both workers and firms suffered more if they were more exposed to the China shock. For example, the worker and firm analysis together suggest that it was not simply the case that firms readjusted their employment composition in response to the shock but instead they were negatively affected in terms of their total employment. Similarly, workers at more exposed plants also suffered more, as shown in the worker analysis above.[46]

1.3.2.2 Heterogeneous Effects

We also examine whether Chinese imports affected plants in a heterogeneous way. To do this, we analyze different samples based on plants' characteristics. We decompose our main results based on plants' age and size in 2000.

[45]This plant-level analysis was not suitable to study the entry of new plants, a dimension that has an impact on employment. With this in mind, we aggregate the data and calculate entry at the sector-year level. In the Appendix, we run a similar analysis, but considering regressions at the sector-level for manufacturing, tradable and all sectors (Tables 1.B.39, 1.B.40 and 1.B.41, respectively). We find evidence that Chinese import exposure negatively affected the change in the number of entrant plants and the change in the entry rate (number of entrant plants divided by the total number of active plants) between 2000 and 2007. It also negatively affected average entry and and average entry rate between 2000 and 2007 (across all years). The t-stats of the regressions, however, are low and the coefficients are generally not statistically significant at standard levels.

[46]In Table 1.B.38 of the Appendix, we present results with the growth of firm sales as the dependent variable. We only observe sales at the firm and not the plant level, so we compute plant level sales using the plant's share of total firm employment as weights, or by simply having firm-level sales as the outcome variable. The results are typically negative but insignificant. There is therefore no evidence to suggest that firms may have lost in terms of employment and gained in terms of total sales by offshoring in response to the shock. We include results for only the intensive margin of sales adjustment - the coefficients for the other samples are qualitatively similar and slightly larger in magnitude.

Table 1.9: Plant Heterogeneous Effects - Manufacturing

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Old	Young	Small	Large	Old	Young	Small	Large
	Employment Growth				**Activity Status**			
Panel A	*Manufacturing - All Firms*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-3.377	-2.111*	-0.498	-3.735	-0.785	-0.682*	-0.384	-0.971
	(2.344)	(1.127)	(0.499)	(2.456)	(0.658)	(0.380)	(0.391)	(0.664)
N	95,867	106,699	84,252	118,304	95,867	106,699	84,252	118,304
Panel B	*Manufacturing - No Entrants*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-5.047	-1.781	-0.261	-4.898	-0.829	-0.810*	-0.394	-1.218
	(3.694)	(1.176)	(0.490)	(3.086)	(0.840)	(0.463)	(0.419)	(0.861)
N	45,134	84,379	63,796	65,710	45,134	84,379	63,796	65,710
Panel C	*Manufacturing - Surviving*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-2.574*	-0.715	-0.209	-2.442				
	(1.422)	(0.544)	(0.454)	(1.461)				
N	25,810	38,755	31,041	33,517				
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes the full sample of plants initially in manufacturing, Panel B excludes entrants from this sample, and Panel C restricts to plants that survive the full estimation period. The dependent variable is either employment growth (columns 1-4), defined as change in ln(employment) between 2000 and 2007, or activity status (columns 5-8), defined as a dummy variable equals to 1 if a plant was alive in 2007 and 0 otherwise. Each column represents a different sample: old and young plants (columns 1, 2, 5 and 6); Small and large plants in terms of employment (columns 3, 4, 7 and 8). All columns are estimated by 2SLS. The explanatory variable of interest is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. All columns are estimated by 2SLS - see notes of Table 1.7 for details on the IV. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.9 shows the employment growth (columns 1-4) and activity status (columns 5-8) results for plants in the manufacturing sector. Panel A considers the sample of all manufacturing plants, Panel B excludes plants that enter after 2000, and Panel C restricts to plants that survive between 2001 and 2007. Columns 1 and 5 show the results for old plants (all plants with birth date before the median birth date in *their*

respective sample) and columns 2 and 6 present the results for young plants (all plants with birth date after or equal to the median birth date in *their respective sample*). Columns 3 and 7 focus on small plants (with employment in their initial year below the median in *their respective sample*), whereas columns 4 and 8 show results for large plants (with employment in their initial year equal or above the median *their respective sample*).[47]

There is some evidence to suggest that larger plants were more strongly affected by the shock than smaller ones in terms of employment growth and activity, with the estimated coefficients for small plants generally being close to zero in all cases and the coefficients for large plants being more sizeable, although generally they are marginally statistically insignificant. There is also some tentative evidence to suggest that older plants were more affected than younger ones in terms of employment, although the differences between the point estimates are smaller than those for large and small plants.[48] Similar results hold when we restrict the sample to plants that were alive in 2000 or to surviving firms (Panels B and C).

We also find similar results when we restrict the sample to plants initially in tradable industries and when we include plants in all industries. In the first case, many of the coefficients become statistically significant (see Tables 1.B.42 and 1.B.43 in the Appendix).

Hsieh and Klenow (2014) find that larger (US) firms are generally older, which may explain why the effects for the two groups of plants go in the same direction. The fact that the two groups of plants are more affected by Chinese competition (than young

[47]The thresholds are calculated within each sample. This implies that the age and size thresholds in Panel A are different from those of Panel B and Panel C. We omit the first stage statistics. Most of the KP F stats are above 10.

[48]The size of the China shock is similar across the different samples: the average of Chinese import exposure is approximately equal to 0.03 in the four groups of plants.

and small plants) is perhaps surprising and we offer three possible explanations for this result. First, Holmes and Stevens (2014) show that, within industries, larger plants typically produce more standardized goods than smaller plants. Therefore, larger plants may be more subject to international competition. Second, it is more costly for larger firms to innovate (Akcigit and Kerr, 2018) and therefore they may be less manoeuvrable in response to the China shock. Third, we measure plant size in terms of employment, so larger plants may be more labor intensive than smaller plants; given that China's comparative advantage is in labor-intensive sectors, larger plants may then be more heavily affected.

1.4 Conclusion

In this paper, we examine the effect of the recent rise of China as a trade shock on the labor market of a foreign market - the UK. We find evidence that an increase in Chinese import penetration significantly decreases individuals' earnings growth and employment, with the effects being heterogeneous across different groups of workers. We also show that plants in industries more affected by Chinese import penetration exhibited lower employment growth and lower probability of survival, the effect being stronger for larger plants. Together, the analysis shows that the effects on employment and earnings were, at least in part, driven by a contraction of labor demand at both the firm and industry level.

Our paper corroborates the idea that trade integration creates both winners and losers around the globe. Our results, however, do not necessarily bolster the argument that the losses of workers and firms from competition with Chinese products outweighed the gains to others from the concurrent increase in exports to China and the decline in consumer and input prices. In fact, several studies have shown that the emergence of

China in global trade generated positive welfare gains (di Giovanni et al., 2014; Caliendo et al., 2019) and increased innovation rates in developed economies (Bloom et al., 2016), while others have shown that the recent boom in commodities-for- manufactures trade between China and other developing countries benefited Brazilian local labor markets (Costa et al., 2016). Furthermore, the exit (or downsizing) of less productive firms due to trade tends to increase countries' average productivities (Melitz, 2003).

Our results also show that labor reallocation is costly in the short to medium term. This suggests that policies targeted to alleviate labor market frictions in general may help countries to cope better not only with trade competition shocks but, potentially, with other types of shocks that generate reshuffling of workers across firms, sectors and regions in the economy.

Appendix

1.A Data Appendix

1.A.1 Worker-level Variables Details

We consider a panel of workers. Hence, we restrict our sample to one observation per worker per year. In cases where workers have more than one job in the same year, we choose the worker's main job when indicated in ASHE. If the main job variable is missing and the worker has a full-time job and a part-time job, we choose the worker's full time job.[49]

As stated previously, ASHE covers neither the self-employed nor individuals without payment in the reference period. We assume that workers are out of employment if they are not in the sample, even though they could be working as self-employed or employed in different periods of time within the same year. We are implicitly assuming that individuals either work or do not work throughout all the year. Notice that seasonality may play a role here. If individuals in a particular occupation, sector or region have a higher probability of being employed in the reference period, this measure will be overestimated, and underestimated in the opposite case. As long as the seasonality component is not changing over time (or the component is changing but the change is uncorrelated with import penetration from China at the industry level), this

[49]For all the other cases of workers with more than one job, which correspond to approximately 0.04 % of the sample, we pick a job at random for the workers).

measurement error should not be a major source of concern for identification.

Our measure of total hours worked includes basic plus overtime hours in the reference period. The earnings variables extracted from ASHE are defined as follows. Weekly Earnings is the sum of basic weekly earnings, overtime pay, incentive pays, shift and premium payments, relative to the pay period considered in ASHE. The hourly earnings variable from ASHE corresponds approximately to weekly earnings divided by total hours worked in the pay period.[50]

We compute our yearly earnings variable by multiplying weekly earnings by 52, the number of weeks in a year. We are assuming that individuals that appear in the sample in a particular year worked and received the same payment in all 52 weeks of the year. Additionally, we are assuming that individuals who did not receive any payment in the reference period did not receive any amount in all other weeks. Again, seasonality may play a role here. We may be overestimating yearly earnings for individuals who work more hours (or have a higher probability of being employed) during the reference period and fewer hours in other weeks of the year. On the other hand, we may be underestimating yearly earnings in the opposite case. Again, as long as (potential) changes over time of the seasonality component are not correlated with import penetration from China at the industry level, this measurement error should not be a major source of concern for identification.

1.A.2 Firm-level Variables Details

To construct our activity status dummy variable, which is equal to 1 if a firm was in business in 2007 and 0 otherwise, we deal with firm deaths and inactivity as follows. Starting from a panel of firms, we define the final year for each firm (T_j for firm j),

[50]The hourly earnings variable from ASHE also includes "pay received in period for other reasons".

which is 2007 for surviving firms and a year before 2007 for firms that died along the way. For firms that died and remained in the sample as inactive, T_j is the first year with a "death date" record in BSD. For firms that disappeared from the sample (between 2001 and 2007) and were active in their last year in the sample (name this period $\hat{T}_j$ for firm j), we assume that the firm died, and hence, the last year of the firm will be the immediately subsequent year ($T_j = \hat{T}_j + 1$). So in the final year we consider for each firm, they could be active or inactive. No firm that was born after 2001 and died before 2007 was considered in the firm-level analysis (although they are included the aggregated analysis for entry).

To build our employment growth dependent variable, defined as the change in log(employment) between 2000 and 2007, we assume that employment equals 1 for inactive firms and for young firms that appear later than 2000 in the sample. So a firm that was alive in 2000 and died before 2007 has a change in log(employment) equal to 0 – log($employment_{00}$), where $employment_{00}$ represents employment in 2000. For a firm that was born after 2000, the variation in log(employment) equals log($employment_{07}$) – 0, where $employment_{07}$ represents employment in 2007.

1.A.3 Trade Variables and Concordances Details

Data on exports and imports come from the CEPII BACI database. Bilateral trade flows are categorized according to the Harmonized System (HS) classification (HS 92 version), at the 6-digit level. Trade flows are in USD and, whenever suitable, are converted to 2005 GBP using official exchange rates and GDP deflators from the World Development Indicators database from the World Bank. To account for outliers, all import penetration measures (considering changes or levels) as well as the IV's are winsorized at the top and bottom two percentiles.

To create a mapping between the HS 92 and the 5-digit UK standard industrial classification (UK SIC) in the ASHE, BSD and ARD datasets, we use a third intermediate classification: the 4-digit international Standard Industrial Classification revision 3 (ISIC3). To convert the HS 92 classification to ISIC3, we use a conversion table from the World Bank - see `https://wits.worldbank.org/product_concordance.html` and table "H0 to ISIC Rev 3".

To convert the UK SIC to ISIC3, we use that the UK SIC (4-digit) code is almost identical to the *Nomenclature statistique des activités économiques dans la Communauté européenne* (NACE) – more details available in the documentation provided by ONS `https://www.ons.gov.uk/methodology/classificationsandstandards/`. We then convert the UK SIC 1992 (NACE rev. 1) and 2003 (NACE rev. 1.1) to a common classification by using information provided by ONS - see "Table of changes between the UK SIC(92) and the UK SIC(2003)" on the same ONS link provided above. Finally, we convert NACE rev. 1 to ISIC3 by using a conversion table from Eurostat - `https://ec.europa.eu/eurostat/ramon/relations/index.cfm?TargetUrl=LST_REL&StrLanguageCode=EN&IntCurrentPage=12` and table " NACE REV. 1 - ISIC REV. 3". More details on the classification procedures and conversion tables are available upon request.

1.B Additional Results

Table 1.B.1: Descriptive Statistics: Workers (Weighted)

	Main	Main: Manufacturing	Expanded	Expanded: Manufacturing
Normalized Total Earnings	6.462	5.947	7.059	5.903
	(4.080)	(2.903)	(43.319)	(5.012)
Normalized Average Weekly Earnings	1.260	1.180	1.503	1.223
	(0.957)	(0.377)	(10.772)	(0.797)
Normalized Average Hourly Earnings	1.192	1.138	1.262	1.180
	(0.352)	(0.274)	(0.913)	(0.688)
Total Working Years	5.128	5.010	5.169	5.109
	(1.810)	(1.813)	(2.182)	(2.131)
Normalized Average Hours Worked	1.040	0.996	1.129	1.007
	(0.469)	(0.192)	(0.980)	(0.292)
Occupation Switch	0.453	0.506	0.516	0.551
	(0.498)	(0.500)	(0.500)	(0.497)
Work Area Switch	0.355	0.329	0.398	0.359
	(0.478)	(0.470)	(0.489)	(0.480)
Industry Switch	0.457	0.500	0.510	0.545
	(0.498)	(0.500)	(0.500)	(0.498)
P(Switch to Services)	0.809	0.327	0.843	0.372
	(0.393)	(0.469)	(0.364)	(0.483)
Log (Average Hourly Earnings) 97-00	2.279	2.288	2.181	2.225
	(0.488)	(0.431)	(0.521)	(0.460)
Average Hourly Earnings 97-00	11.078	10.892	10.219	10.353
	(6.213)	(5.705)	(6.229)	(5.743)
Log (Average Weekly Earnings) 97-00	5.776	5.913	5.627	5.848
	(0.635)	(0.470)	(0.742)	(0.513)
Average Weekly Earnings 97-00	385.3	412.4	350.5	393.5
	(231.0)	(210.7)	(238.1)	(214.3)
Average Working Years 97-00	1.000	1.000	0.954	0.958
	(0.000)	(0.000)	(0.115)	(0.110)
Average Hours Worked (per week) 97-00	35.662	39.954	34.410	39.648
	(9.624)	(7.083)	(10.709)	(7.492)
Manufacturing	0.275	1.000	0.241	1.000
	(0.446)	(0.000)	(0.428)	(0.000)
Age	41.205	40.730	38.190	38.698
	(9.764)	(9.828)	(11.033)	(10.694)
Young	0.438	0.466	0.538	0.534
	(0.496)	(0.499)	(0.499)	(0.499)
Female	0.472	0.233	0.495	0.256
	(0.499)	(0.422)	(0.500)	(0.437)
Part Time	0.189	0.046	0.236	0.057
	(0.392)	(0.210)	(0.425)	(0.232)
High Skilled (by cohort)	0.359	0.360	0.356	0.358
	(0.480)	(0.480)	(0.479)	(0.480)
Mid Skilled (by cohort)	0.324	0.326	0.323	0.326
	(0.468)	(0.469)	(0.468)	(0.469)
High Skilled Occupation	0.429	0.311	0.397	0.307
	(0.495)	(0.463)	(0.489)	(0.461)
Mid Skilled Occupation	0.337	0.582	0.315	0.568
	(0.473)	(0.493)	(0.465)	(0.495)
N	48,529	13,566	88,955	22,094

Notes: Table shows mean and standard deviation (in parentheses) of the variables at the worker-level. The main sample includes only workers with high labor force attachment in the pre period. The expanded samples include any worker with at least one year of employment in the pre period. Observations are weighted using the ASHE calibration weights.

Skill by occupation is defined with the help of Table 1.B.3. Specifically, we rank occupations (at the one digit SOC 2000 code) according to average hourly earnings in the sample. High-skilled occupations are then defined as the top 3, managers

Table 1.B.2: Descriptive Statistics: Trade Shocks at the Worker-level

	Main	Main: Manufacturing	Expanded	Expanded: Manufacturing
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.006	0.021	0.006	0.022
	(0.019)	(0.030)	(0.018)	(0.031)
Percentile 10 of $\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.000	0.000	0.000	0.000
Percentile 25 of $\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.000	0.001	0.000	0.001
Percentile 50 of $\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.000	0.010	0.000	0.010
Percentile 75 of $\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.001	0.030	0.000	0.030
Percentile 90 of $\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.019	0.074	0.017	0.074
$\frac{Imports_{chi,00}}{Expenditure_{00}}$	0.004	0.016	0.004	0.016
	(0.017)	(0.028)	(0.016)	(0.029)
CZ_{chi}	0.021	0.024	0.021	0.024
	(0.018)	(0.020)	(0.018)	(0.020)
Percentile 10 of CZ_{chi}	0.007	0.009	0.007	0.009
Percentile 25 of CZ_{chi}	0.011	0.013	0.011	0.013
Percentile 50 of CZ_{chi}	0.017	0.020	0.017	0.020
Percentile 75 of CZ_{chi}	0.025	0.030	0.025	0.030
Percentile 90 of CZ_{chi}	0.039	0.045	0.039	0.045

Notes: Each column of the table represents a different sample. The table shows the mean and standard deviation (in parentheses) for the variables $\Delta_{00/07}Imports_{chi}/Expenditure_{00}$, $Imports_{chi}/Expenditure_{00}$ and CZ_{chi}. The table also shows percentiles of $\Delta_{00/07}Imports_{chi}/Expenditure_{00}$ and of CZ_{chi}. The UK Data Secure Data Service does not release percentiles of the distribution. Hence, to obtain percentile X we average the variable across individuals within percentiles X + 5 and X-5 of the variable. For example, percentile 10 of "$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$" is the mean of Chinese Import Exposure between the percentiles 5 and 15 of the variable.

and senior officials, professional occupations and associate professional and technical occupations. Mid skilled are in administrative and secretarial occupations, skilled trades occupations and process, plant and machine operatives. Low skilled work in the bottom 3, personal service occupations, sales and customer service occupations and elementary occupations.

Table 1.B.3: Occupation by Skill

	Occupation Code	Hourly Earnings	Employment	Employment Share
Professional Occupations	2	0.017	12,516	0.141
Managers and Senior Officials	1	0.017	10,088	0.113
Associate Professional and Technical Occupations	3	0.013	10,702	0.120
Skilled Trades Occupations	5	0.010	8,328	0.094
Administrative and Secretarial Occupations	4	0.008	12,749	0.143
Process, Plant and Machine Operatives	8	0.008	9,659	0.109
Personal Service Occupations	6	0.007	7,357	0.083
Sales and Customer Service Occupations	7	0.006	5,409	0.061
Elementary Occupations	9	0.006	12,147	0.137

NOTES: We rank occupations (at the one digit SOC 2000 code) according to average hourly earnings (Hourly Earnings in the year 2000, in thousand of GBP 2005) in the expanded sample (including workers with low labor force attachment). Employment is the total number of individuals in each occupation. Employment Share is the share of each occupation in total employment. High-skilled occupations are then defined as the top 3, managers and senior officials, professional occupations and associate professional and technical occupations. Mid skilled are in administrative and secretarial occupations, skilled trades occupations and process, plant and machine operatives. Low skilled work in the bottom 3, personal service occupations, sales and customer service occupations and elementary occupations. Employment in 2000 equals 88,955.

Table 1.B.4: Employment and Earnings – Alternative IV

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A	**Normalized Total Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-7.839***	-9.336***	-7.803***	-0.571	-2.551
	(1.873)	(2.092)	(1.821)	(4.733)	(4.408)
Panel B	**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.659**	-0.532**	-1.097***	-0.246	-0.703
	(0.264)	(0.263)	(0.253)	(0.457)	(0.474)
Panel C	**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.182***	-1.459***	-0.918***	-0.475	-0.732*
	(0.180)	(0.275)	(0.208)	(0.434)	(0.380)
Panel D	**Total Working Years**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-4.086***	-5.958***	-2.831*	-0.015	-0.028
	(1.093)	(1.563)	(1.445)	(3.136)	(2.807)
Panel E	**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.363*	0.612**	-0.178	-0.169	-0.342
	(0.199)	(0.292)	(0.150)	(0.328)	(0.354)
1^{st} Stage(s) Statistics					
IV_{chi}		.033***	.03***	.02***	.02***
		(.005)	(.005)	(.004)	(.004)
KP F Stat		39.749	39.137	19.624	21.344
N	48,529	48,529	48,529	48,529	48,529
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi} is equal to the change in exports from China to other developed economies (excluding the UK) divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.5: Employment and Earnings – Manufacturing

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A	**Normalized Total Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-3.826*	-6.640**	-7.784***	-6.386	-6.705
	(2.007)	(2.554)	(2.610)	(6.168)	(5.757)
Panel B	**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.471**	-0.612**	-0.765***	-0.753	-0.982**
	(0.234)	(0.265)	(0.248)	(0.525)	(0.468)
Panel C	**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.293	-0.326	-0.511**	-0.507	-0.689
	(0.178)	(0.300)	(0.238)	(0.559)	(0.440)
Panel D	**Total Working Years**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.403	-3.730**	-4.076**	-3.771	-3.405
	(0.976)	(1.653)	(1.832)	(3.799)	(3.718)
Panel E	**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.165*	-0.337**	-0.256**	-0.325	-0.341
	(0.088)	(0.149)	(0.125)	(0.239)	(0.210)
1st Stage(s) Statistics					
IV_{chi}		.019***	.018***	.012***	.012***
		(.004)	(.003)	(.004)	(.004)
KP F Stat		25.516	26.904	9.643	9.537
N	13,566	13,566	13,532	13,566	13,532
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers initially employed in the manufacturing sector with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.6: Employment and Earnings – Low Labor force Attachment

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A	**Normalized Total Earnings**				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-13.949**	-10.382	-14.636	-5.342	-17.799
	(6.685)	(7.185)	(9.831)	(10.314)	(17.323)
Panel B	**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-2.416	-1.355	-2.921	-1.474	-4.808
	(1.623)	(1.579)	(2.257)	(2.121)	(4.105)
Panel C	**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.517***	-1.442*	-0.579	0.157	-0.451
	(0.318)	(0.731)	(0.830)	(1.036)	(0.869)
Panel D	**Total Working Years**				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-3.397***	-5.041***	-4.001***	-3.117	-2.722
	(1.128)	(1.627)	(1.241)	(3.356)	(2.924)
Panel E	**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.515**	0.821***	-0.193	-0.391	-0.717
	(0.224)	(0.296)	(0.214)	(0.570)	(0.593)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.023***	.021***	.012***	.012***
		(.004)	(.004)	(.003)	(.003)
KP F Stat		33.351	34.724	13.297	14.749
N	88,955	88,955	88,955	88,955	88,955
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is extended to workers with low labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (SIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.7: Employment and Earnings (Weighted)

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
	Normalized Total Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-7.961***	-10.608***	-9.908***	-5.723	-8.108
	(1.907)	(2.199)	(2.046)	(5.940)	(5.586)
	Normalized Average Weekly Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.684**	-0.702**	-1.331***	-0.784	-1.415**
	(0.278)	(0.287)	(0.302)	(0.659)	(0.652)
	Normalized Average Hourly Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.202***	-1.537***	-1.094***	-0.965	-1.284**
	(0.183)	(0.298)	(0.254)	(0.622)	(0.538)
	Total Working Years				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.094***	-6.465***	-3.832**	-2.545	-2.454
	(1.085)	(1.616)	(1.474)	(3.780)	(3.411)
	Normalized Average Hours Worked				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.378*	0.588**	-0.183	-0.237	-0.506
	(0.212)	(0.291)	(0.153)	(0.393)	(0.410)
1st Stage(s) Statistics					
IV_{chi}		.023***	.021***	.012***	.012***
		(.004)	(.003)	(.003)	(.003)
KP F Stat		36.04	36.761	13.483	14.958
F Stat		36.04	36.761	13.483	14.958
N	7,157,438	7,157,438	7,157,438	7,157,438	7,157,438
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes
$N_{clusters}$	110	110	110	110	110

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. The regressions are weighted using the ASHE calibration weights so the observation counts are approximately 100 times larger to account for ASHE being a 1% sample. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.8: Employment and Earnings - Sample Including Workers with 0 Years of Employment

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
	Normalized Total Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-8.779***	-11.478***	-9.576***	-3.759	-5.843
	(2.101)	(2.309)	(1.987)	(5.668)	(5.468)
	Total Working Years				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.914***	-7.174***	-3.867**	-1.382	-1.243
	(1.337)	(1.706)	(1.486)	(3.673)	(3.497)
	Normalized Average Hours Worked				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.128	0.297	-0.293**	-0.106	-0.274
	(0.203)	(0.250)	(0.147)	(0.396)	(0.409)
1st Stage(s) Statistics					
IV_{chi}		.023***	.021***	.012***	.012***
		(.004)	(.003)	(.003)	(.003)
KP F Stat		36.248	36.861	13.072	14.319
F Stat		36.248	36.861	13.072	14.319
N	50,560	50,560	50,560	50,560	50,560
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes
$N_{clusters}$	110	110	110	110	110

NOTES: Panels A, B, and C respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000; Panel B) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel C) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000, including individuals with zero years of employment between 2001 and 2007. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.9: Employment and Earnings (Exclusion of Control Used in Normalization)

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
	Normalized Total Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-7.839***	-10.680***	-9.544***	-5.194	-7.525
	(1.873)	(2.201)	(2.020)	(5.944)	(5.663)
	Normalized Average Weekly Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.615*	-0.661*	-1.301***	-0.706	-0.869
	(0.325)	(0.390)	(0.304)	(0.677)	(0.600)
	Normalized Average Hourly Earnings				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.127***	-1.480***	-1.039***	-0.833	-1.169**
	(0.187)	(0.307)	(0.241)	(0.640)	(0.541)
	Total Working Years				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.086***	-6.499***	-3.669**	-2.355	-2.290
	(1.093)	(1.622)	(1.469)	(3.788)	(3.467)
	Normalized Average Hours Worked				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.380*	0.571*	-0.194	-0.280	-0.532
	(0.228)	(0.317)	(0.144)	(0.375)	(0.400)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.023***	.021***	.012***	.012***
		(.004)	(.003)	(.003)	(.003)
KP F Stat		35.863	36.275	13.162	14.49
F Stat		35.863	36.275	13.162	14.49
N	48,529	48,529	48,529	48,529	48,529
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes
$N_{clusters}$	110	110	110	110	110

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. The regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls, except for where the (level of) the variable is used to scale the outcome variable. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings (1997-2000) and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 differences from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.10: Placebo Exercise

	(1) 2SLS
Panel A $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	**Normalized Total Earnings**
	-6.183
	(5.711)
Panel B $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	**Normalized Average Weekly Earnings**
	-2.167
	(1.987)
Panel C $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	**Normalized Average Hourly Earnings**
	-0.278
	(0.369)
Panel D $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	**Total Working Years**
	0.379
	(0.889)
Panel E $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	**Normalized Average Hours Worked**
	0.011
	(0.374)
1st Stage(s) Statistics	
IV_{chi}	.012***
	(.002)
KP F Stat	22.009
N	17,474
Basic Controls	Yes
Worker Controls	Yes
Industry Controls	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 1997) in the period that goes from 1998 to 2000. Panel A) Normalized Total Earnings - total earnings between 1998 and 2000 divided by average annual earnings in 1997). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 1998 and 2000 divided by average weekly earnings in 1997; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 1998 and 2000 divided by average hourly earnings in 1997; Panel D) Total Working Years - the number of years employed between 1998 and 2000 divided by the number of years employed in 1997; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 1998 and 2000 divided by the average number of hours worked per week in 1997. The sample excludes individuals that are not in employment in 1997. Column 1 estimated by 2SLS. Change in import penetration (2000-2007) relative to workers' industry of employment in 1997. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings in 1997. "Worker Controls" include sex, age, age-squared, interaction of age with average hourly and weekly earnings, and with average hours worked (1997), occupation fixed effects (4-digit) and a part-time job dummy, all in 1997. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 126$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.11: Placebo Exercise with Sector Restriction

	(1)
	2SLS
	Normalized Total Earnings
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-6.213
	(5.753)
	Normalized Average Weekly Earnings
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-2.145
	(2.002)
	Normalized Average Hourly Earnings
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.251
	(0.367)
	Total Working Years
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.472
	(0.893)
	Normalized Average Hours Worked
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.022
	(0.379)
1st Stage(s) Statistics	
IV_{chi}	.012***
	(.003)
KP F Stat	21.425
F Stat	21.425
N	16,726
Worker Basic Controls	Yes
Worker Controls	Yes
Industry Controls	Yes
$N_{clusters}$	105

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 1997) in the period that goes from 1998 to 2000. Panel A) Normalized Total Earnings - total earnings between 1998 and 2000 divided by average annual earnings in 1997). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 1998 and 2000 divided by average weekly earnings in 1997; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 1998 and 2000 divided by average hourly earnings in 1997; Panel D) Total Working Years - the number of years employed between 1998 and 2000 divided by the number of years employed in 1997; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 1998 and 2000 divided by the average number of hours worked per week in 1997. The sample excludes individuals that are not in employment in 1997. We restrict the sample to only workers in industries that appear in the baseline regressions. Column 1 estimated by 2SLS. Change in import penetration (2000-2007) relative to workers' industry of employment in 1997. All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings in 1997. "Worker Controls" include sex, age, age-squared, interaction of age with average hourly and weekly earnings, and with average hours worked (1997), occupation fixed effects (4-digit) and a part-time job dummy, all in 1997. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 126$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We study four other outcomes linked to worker mobility across regions, occupations, and industries. We re-estimate our baseline model (without any decomposition) on these new dependent variables. Table 1.B.12 presents the results. Panel A shows the effect of Chinese import competition on the probability of workers moving from their initial commuting zone, Panel B shows the effect on the probability of workers moving from their initial occupation and Panel C shows the probability of a worker switch to a different industry because of Chinese import competition. Panel D shows the probability of working in services for at least one period between 2001 and 2007.

Even though the results in our preferred specification (column 5) are not statistically significant, we can see some mild evidence that more Chinese import competition increased the probability of workers switching their main industry of activity at some point during the period (Panel C). For the other outcomes, results have low t-stats and/or switch signs across different specifications (restricting the sample to manufacturing workers in year 2000 and to expand the sample to include workers with lower labor force attachment do not change substantially the results and we do not include them in the paper). Hence, it seems that Chinese import competition did not strongly affect worker mobility across occupations and commuting zones. This fact, however, does not rule out the possibility that workers were affected differently by the China shock after moving across jobs, for whatever reason, as we saw in the previous decomposition analysis in the main part of the paper (see Tables 1.4 and 1.B.15, for example).

Table 1.B.12: Other Outcomes

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A			**Work Area Switch**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.673*	-0.701	-0.823*	-0.119	-0.403
	(0.384)	(0.611)	(0.445)	(0.719)	(0.597)
Panel B			**Occupation Switch**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	1.331***	1.992***	0.737*	1.031	0.975
	(0.283)	(0.458)	(0.378)	(0.965)	(0.927)
Panel C			**Industry Switch**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	2.136***	3.565***	2.734***	1.930	2.029
	(0.577)	(0.961)	(0.876)	(1.744)	(1.567)
Panel D			**Work in Services**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-6.734***	-9.709***	-5.439***	2.564	2.332
	(1.057)	(1.962)	(1.476)	(1.803)	(1.592)
1st Stage(s) Statistics					
IV_{chi}		.023***	.021***	.012***	.012***
		(.004)	(.003)	(.003)	(.003)
KP F Stat		35.662	36.273	13.16	14.485
N	48,529	48,529	48,529	48,529	48,529
Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: Panels A, B, C and D respectively represent the following dependent variables for employee i working in industry j (in 2000) in the period 2001 to 2007. Panel A) Work Area Switch - dummy for switching commuting zone. Panel B) Occupation Switch - dummy for switching occupation; Panel C) Industry Switch - dummy for switching industry; Panel D) Work in Services – dummy for working in services for at least one period. The sample is restricted to workers with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All regressions include average years of employment and hours worked, and average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.13: Firm and Sector Decomposition - Manufacturing

	(1) 2SLS All	(2) 2SLS Same Firm and Sector	(3) 2SLS Same Sector	(4) 2SLS Same 2-dig Sector	(5) 2SLS Tradable Sector	(6) 2SLS Non-Tradable Sector	(7) 2SLS NA
Panel A			**Normalized Total Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-6.705	-9.867	-5.761**	-6.621*	5.331*	7.584	2.630
	(5.757)	(10.008)	(2.243)	(3.845)	(2.936)	(5.915)	(2.788)
N	13,532	13,532	13,532	13,532	13,532	13,532	13,532
Panel B			**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.982**	-0.191	-5.768*	-1.853	-1.425	-0.512	-1.385
	(0.468)	(0.405)	(3.387)	(1.843)	(0.902)	(0.919)	(2.158)
N	13,532	9,411	881	941	2,429	4,388	1,524
Panel C			**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.689	-0.264	-5.427	-1.163	-1.009	-0.525	-0.380
	(0.440)	(0.387)	(3.553)	(1.503)	(0.745)	(0.765)	(1.379)
N	13,532	9,413	881	941	2,427	4,384	1,524
Panel D			**Total Working Years**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-3.405	-8.483	-4.587**	-5.210	5.505**	7.314	2.056
	(3.718)	(7.700)	(1.864)	(3.121)	(2.446)	(4.635)	(2.198)
N	13,532	13,532	13,532	13,532	13,532	13,532	13,532
Panel E			**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.341	-0.111	-0.201	-0.136	-0.469	-0.016	-1.087
	(0.210)	(0.224)	(1.308)	(0.706)	(0.375)	(0.469)	(1.089)
N	13,532	9,425	882	943	2,433	4,403	1,525
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers initially in the manufacturing sector and with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.14: Firm and Sector Decomposition - Low Labor Force Attachment

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS	(6) 2SLS	(7) 2SLS
	All	Same Firm and Sector	Same Sector	Same 2-dig Sector	Tradable Sector	Non-Tradable Sector	NA
Panel A			**Normalized Total Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-17.799	-12.309	-5.618**	-4.629	4.997**	-5.931	5.691
	(17.323)	(9.318)	(2.451)	(3.010)	(2.280)	(14.739)	(4.313)
N	88,955	88,955	88,955	88,955	88,955	88,955	88,955
Panel B			**Normalized Average Weekly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-4.808	-3.548	-3.937	-0.196	-1.156	-12.001	-2.612
	(4.105)	(3.790)	(2.868)	(2.449)	(2.270)	(13.533)	(2.125)
N	88,955	56,961	7,352	10,630	7,094	32,114	12,881
Panel C			**Normalized Average Hourly Earnings**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.451	-0.639	-2.459	0.156	-0.746	0.555	-1.538
	(0.869)	(0.500)	(2.142)	(1.339)	(0.523)	(1.814)	(0.975)
N	88,955	56,919	7,345	10,610	7,089	32,099	12,871
Panel D			**Total Working Years**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.722	-8.554	-4.749**	-3.359	5.846***	2.881	5.212
	(2.924)	(6.988)	(2.125)	(2.471)	(2.223)	(4.434)	(3.836)
N	88,955	88,955	88,955	88,955	88,955	88,955	88,955
Panel E			**Normalized Average Hours Worked**				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.717	-0.187	-1.242	0.813	-0.533	-0.906	-0.934
	(0.593)	(0.270)	(1.472)	(0.932)	(0.904)	(0.755)	(0.735)
N	88,955	57,048	7,385	10,661	7,111	32,221	12,914
Basic Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is expanded to include workers with low labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.15: Commuting Zone Decomposition

	(1) 2SLS	(2) 2SLS	(3) 2SLS
	All	Same CZ	Switch CZ
Panel A	**Normalized Total Earnings**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-7.525	-2.567	-4.949
	(5.663)	(5.974)	(4.682)
N	48,529	48,529	48,529
Panel B	**Normalized Average Weekly Earnings**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.333**	-0.930*	-0.816
	(0.634)	(0.555)	(1.153)
N	48,529	40,991	16,957
Panel C	**Normalized Average Hourly Earnings**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.188**	-0.649	-1.568*
	(0.527)	(0.411)	(0.805)
N	48,529	40,982	16,941
Panel D	**Total Working Years**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.290	-0.010	-2.269
	(3.467)	(4.416)	(3.302)
N	48,529	48,529	48,529
	Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.505	-0.600*	-0.461
	(0.387)	(0.352)	(0.746)
N	48,529	41,023	16,978
Basic Controls	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: worker remains in the initial commuting zone (column 2) and worker switches to a different commuting zone (column 3). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

We also decompose the baseline result by three mutually exclusive groups of occupational classifications: low, middle, and high skill. This enables us to shed light on whether

import competition from China has caused job polarization in the UK. The phenomenon of job polarization - whereby employment shares in low and high quality occupations rise whilst the share of middle quality jobs declines - has been well documented in the UK (Goos and Manning, 2007).

In column 1 of Table 1.B.16 we show the baseline results considering all occupations pooled together. We then show the decomposed regression results for low, mid and high skill occupations in columns 2, 3 and 4, respectively. The results suggest that normalized total and average earnings fell for all categories of jobs. Average earnings fell most for workers employed in high skill occupations. On the other hand, total working years fell most for workers in mid skill occupations, and actually increased for workers in high skill positions, but these effects are not statistically significant.

Together, the results suggest that workers in high skill jobs (or who were able to move to such positions) suffered most in terms of average earnings growth conditional on being employed, but were able to offset these losses by having a greater probability of employment. We find no clear evidence of a causal effect of increased import penetration from China on job or wage polarization at the worker level in the UK. This is in contrast to the findings of Keller and Utar (2019), who show that, for Denmark, import competition has caused job polarization.

We repeat this analysis for the sample of manufacturing workers in Table 1.B.17. The results suggest that low skilled workers in manufacturing were more likely to be negatively affected than manufacturing workers in other occupation types. Again, this is an indication that import competition with China did not contribute to job polarization in the UK labor market. We also repeat the analysis for workers with low labor force attachment (but omit the table for the sake of space). Even though the results are broadly similar for this sample, the standard errors become large and the results generally

lose significance.

Table 1.B.16: Occupation Decomposition

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
	All	Low Skilled Occupation	Mid Skilled Occupation	High Skilled Occupation
Panel A	**Normalized Total Earnings**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-7.525	-2.726*	-4.705	-0.093
	(5.663)	(1.408)	(4.371)	(3.088)
N	48,529	48,529	48,529	48,529
Panel B	**Normalized Average Weekly Earnings**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.333**	-1.549*	-1.456**	-2.603**
	(0.634)	(0.790)	(0.718)	(1.287)
N	48,529	14,510	19,640	23,343
Panel C	**Normalized Average Hourly Earnings**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.188**	-1.363*	-0.934*	-2.076***
	(0.527)	(0.775)	(0.525)	(0.760)
N	48,529	14,501	19,631	23,325
Panel D	**Total Working Years**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.290	-1.423	-2.891	2.024
	(3.467)	(1.253)	(3.017)	(2.324)
N	48,529	48,529	48,529	48,529
Panel E	**Normalized Average Hours Worked**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.505	-0.683	-0.684	-0.813
	(0.387)	(0.633)	(0.446)	(0.607)
N	48,529	14,540	19,648	23,349
Basic Controls	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment in low skilled (column 2), mid skilled (column 3) , and high skilled (column 4) occupations. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.17: Occupation Decomposition - Manufacturing

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
	All	Low Skilled Occupation	Mid Skilled Occupation	High Skilled Occupation
Panel A	**Normalized Total Earnings**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-6.705	-5.297***	-1.914	0.507
	(5.757)	(1.922)	(4.461)	(2.967)
N	13,532	13,532	13,532	13,532
Panel B	**Normalized Average Weekly Earnings**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.982**	-2.321**	-0.795	-1.588**
	(0.468)	(1.021)	(0.543)	(0.680)
N	13,532	3,041	8,499	4,925
Panel C	**Normalized Average Hourly Earnings**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.689	-1.474*	-0.534	-1.498**
	(0.440)	(0.879)	(0.458)	(0.643)
N	13,532	3,041	8,498	4,925
Panel D	**Total Working Years**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-3.405	-3.233**	-1.386	1.214
	(3.718)	(1.526)	(3.493)	(2.360)
N	13,532	13,532	13,532	13,532
Panel E	**Normalized Average Hours Worked**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.341	-1.147	-0.400	-0.200
	(0.210)	(0.782)	(0.285)	(0.197)
N	13,532	3,052	8,505	4,929
Basic Controls	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers initially in the manufacturing sector with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment in low skilled (column 2), mid skilled (column 3) , and high skilled (column 4) occupations. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

The previous tables consider all occupations, i.e., we cannot observe, for example, if a workers in a low skill position is moving to a high skill job or staying in his original type

of occupation. Hence, it is not clear to identify how workers movements in a particular category affect their outcomes following the China shock. To better understand whether such movements are benefiting or hurting wokers in different occupational categories, Tables 1.B.18 to 1.B.20 repeat the decomposition by occupation category but restrict to workers initially in low, middle, or high skilled occupations, respectively. The results are broadly similar to our previous ones, showing that low and mid skilled workers gained in terms of employment and lost in terms of average earnings by moving to high skill positions. On the other hand, high skilled workers lost in terms of average earnings by moving to lower skill positions and still gained in terms of employment by *not* moving to low skilled jobs.

Table 1.B.18: Occupation Decomposition - Initially Low Skill Occupation

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
	All	Low Skilled Occupation	Mid Skilled Occupation	High Skilled Occupation
		Normalized Total Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-5.590	-8.936	1.353	1.993
	(6.249)	(8.263)	(5.334)	(3.493)
N	11,589	11,589	11,589	11,589
		Normalized Average Weekly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.054	-0.246	-0.566	-8.462
	(0.834)	(0.761)	(3.369)	(6.799)
N	11,589	10,935	1,700	1,663
		Normalized Average Hourly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.932	-0.012	1.074	-6.582*
	(0.978)	(0.870)	(1.999)	(3.565)
N	11,589	10,928	1,695	1,649
		Total Working Years		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-5.816	-7.615	-0.578	2.377
	(5.457)	(6.283)	(4.227)	(2.236)
N	11,589	11,589	11,589	11,589
		Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.697	-0.681	-0.605	-0.836
	(0.662)	(0.528)	(2.659)	(3.146)
N	11,589	10,942	1,705	1,656
Basic Controls	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000 and initially in low skill occupations. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment in low skilled (column 2), mid skilled (column 3) , and high skilled (column 4) occupations. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.19: Occupation Decomposition - Initially Middle Skill Occupation

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
	All	Low Skilled Occupation	Mid Skilled Occupation	High Skilled Occupation
		Normalized Total Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-11.277	-1.781	-9.696	0.200
	(7.223)	(1.724)	(8.058)	(2.422)
N	17,622	17,622	17,622	17,622
		Normalized Average Weekly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.300*	-2.767*	-0.958	-7.738
	(0.702)	(1.570)	(0.595)	(6.437)
N	17,622	2,556	16,633	2,784
		Normalized Average Hourly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.019*	-2.590**	-0.765*	-3.822*
	(0.543)	(1.293)	(0.459)	(2.238)
N	17,622	2,556	16,629	2,782
		Total Working Years		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.657	0.136	-6.211	1.417
	(4.079)	(1.848)	(5.528)	(1.729)
N	17,622	17,622	17,622	17,622
		Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.393	-0.561	-0.432	-1.125
	(0.285)	(1.071)	(0.277)	(1.103)
N	17,622	2,568	16,636	2,787
Basic Controls	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000 and initially in middle skill occupations. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment in low skilled (column 2), mid skilled (column 3) , and high skilled (column 4) occupations. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.20: Occupation Decomposition - Initially High Skill Occupation

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS
	All	Low Skilled Occupation	Mid Skilled Occupation	High Skilled Occupation
		Normalized Total Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-2.200	-2.372	1.166	-0.994
	(5.876)	(1.518)	(2.449)	(7.584)
N	19,318	19,318	19,318	19,318
		Normalized Average Weekly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.490*	-5.646*	-3.768	-1.529**
	(0.763)	(3.324)	(3.092)	(0.715)
N	19,318	1,019	1,305	18,896
		Normalized Average Hourly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.269*	-2.575	-2.577	-1.413**
	(0.671)	(2.504)	(2.183)	(0.632)
N	19,318	1,017	1,305	18,894
		Total Working Years		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	1.834	-2.949*	2.032	2.751
	(4.036)	(1.578)	(2.312)	(5.789)
N	19,318	19,318	19,318	19,318
		Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.713	-3.217	-1.488	-0.577
	(0.573)	(2.593)	(2.894)	(0.506)
N	19,318	1,030	1,305	18,906
Basic Controls	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E respectively represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Panel A) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000). Panel B) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Panel C) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Panel D) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Panel E) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000 and initially in high skill occupations. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment in low skilled (column 2), mid skilled (column 3) , and high skilled (column 4) occupations. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.21: Descriptive Statistics: Trade Shocks by Age, Gender and Earnings Capacity

	Male	Female	Old	Young	Low Earnings Capacity	Mid Earnings Capacity	High Earnings Capacity	Low Skill Occupation	Mid Skill Occupation	High Skill Occupation
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.008	0.004	0.007	0.006	0.007	0.007	0.004	0.003	0.011	0.004
	(0.020)	(0.017)	(0.020)	(0.018)	(0.022)	(0.019)	(0.014)	(0.014)	(0.024)	(0.014)
$\frac{Imports_{chi,00}}{Expenditure_{00}}$	0.006	0.003	0.005	0.004	0.005	0.005	0.003	0.002	0.008	0.003
	(0.018)	(0.015)	(0.018)	(0.016)	(0.021)	(0.017)	(0.012)	(0.012)	(0.021)	(0.013)
Percentile 10 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentile 25 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentile 50 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Percentile 75 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.006	0.000	0.001	0.000	0.000	0.003	0.000	0.000	0.010	0.000
Percentile 90 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.028	0.006	0.021	0.017	0.024	0.023	0.013	0.004	0.047	0.009

Notes: Each column o the table represents different samples of the high labor force data: males, females, old (above 39), young (below 40), high, mid and low skilled (based on earnings percentiles by cohort in 2000) and high, mid and low skilled occupations. Table shows mean (row with the name of the variable) and standard deviation (row immediately below the name of the variable) for the variables $\Delta_{00/07} Imports_{chi}/Expenditure_{00}$, $Imports_{chi}/Expenditure_{00}$ and CZ_{chi}. The table also shows percentiles of $\Delta_{00/07} Imports_{chi}/Expenditure_{00}$ and of CZ_{chi}. The UK Data Secure Data Service does not release results with simple percentiles of the distribution. Hence, to obtain percentile X we average the variable across individuals within percentiles X + 5 and X-5 of the variable. For example, percentile 10 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$" is the mean of Chinese Import Exposure between the percentiles 5 and 15 of the variable.

We also study the heterogeneous effects by adding an interaction of the change in Chinese import exposure with age in 2000, with a female dummy variable, or with average hourly earnings between 1997 and 2000 ($\overline{HE}_{97/00}$). Note that here we are using continuous values of age and earnings. If older, female workers, or lower-skilled workers are less mobile, and hence more affected in terms of employment and earnings, the coefficient of the interaction between Chinese imports and pre-period earnings would be positive, while the coefficients of the two other interactions would be negative.

Table 1.B.22 presents the results. The three panels represent regressions that include interactions of Chinese import exposure with age in 2000 (Panel A), female dummy variable (Panel B) and pre-period average earnings (Panel C). Each column considers a different dependent variable. The regressions are estimated using our baseline IV strategy and include the full set of controls. We instrument for the interaction terms using the interaction between the instrument and the variable of interest (Wooldridge,

2002).

Panel A suggests that older workers may actually have been slightly less affected by the China shock in terms of their earnings. Note that for workers of any age in our sample (maximum 59), the marginal effect of import penetration on average hourly earnings remains negative.[51] There is no statistically significant difference in total earnings for older workers.

Panel B shows that female workers appear to suffer relatively larger total earnings losses than male workers. This effect is through significantly reduced working years of female relative to male workers, with no difference in average earnings.

There is also evidence that lower skill workers suffer more in terms of their earnings growth than higher skill workers. This materialized in both average earnings and total working years.

[51]A worker who is initially 59 will have a marginal coefficient of $59 \times 0.026 - 2.199 =$ -0.665.

Table 1.B.22: Heterogeneity Interactions

	(1) 2SLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
	Normalized Total Earnings	**Normalized Average Weekly Earnings**	**Normalized Average Hourly Earnings**	**Total Working Years**	**Normalized Average Hours Worked**
Panel A					
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-11.575	-1.721	-2.199***	-4.115	-0.049
	(8.163)	(1.057)	(0.675)	(5.310)	(0.720)
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}} * Age_{00}$	0.103	0.010	0.026**	0.046	-0.012
	(0.128)	(0.021)	(0.012)	(0.095)	(0.014)
Panel B					
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-5.959	-1.315*	-1.176**	-1.232	-0.456
	(5.852)	(0.670)	(0.542)	(3.472)	(0.411)
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}} * Female$	-6.922**	-0.082	-0.051	-4.677***	-0.220
	(2.729)	(0.510)	(0.352)	(1.350)	(0.188)
Panel C					
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-36.222***	-6.408**	-4.390***	-11.163**	0.115
	(10.705)	(2.670)	(1.613)	(4.517)	(0.695)
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}} * \bar{HE}_{97/00}$	12.409***	2.194**	1.385**	3.837**	-0.268
	(3.591)	(1.087)	(0.593)	(1.666)	(0.329)
N	48,529	48,529	48,529	48,529	48,529
Worker Basic Controls	Yes	Yes	Yes	Yes	Yes
Worker Controls	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes

NOTES: Columns (1), (2), (3), (4), and (5) represent the following dependent variables for employee i working in industry k (in 2000) in the period 2001 to 2007. Column (1) Normalized Total Earnings - total earnings between 2001 and 2007 divided by average annual earnings between 1997 and 2000. Column (2) Normalized Average Weekly Earnings - average weekly earnings between 2001 and 2007 divided by average weekly earnings between 1997 and 2000; Column (3) Normalized Average Hourly Earnings - average hourly earnings between 2001 and 2007 divided by average hourly earnings between 1997 and 2000; Column (4) Total Working Years - the number of years employed between 2001 and 2007 divided by the number of years employed between 1997 and 2000; Column (5) Normalized Average Hours Worked - the average number of hours worked per week between 2001 and 2007 divided by the average number of hours worked per week between 1997 and 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. This is interacted with Age in 2000 (Panel A), a dummy for female (Panel B), or log average hourly earnings between 1997 and 2000 (Panel C). All regressions include average years of employment and hours worked, and log of average hourly and weekly earnings between 1997 and 2000 as controls. "Worker Controls" include sex, age, age-squared, the interactions of age with average hourly and weekly earnings and with average hours worked (1997-2000), occupation fixed effects (4-digit) and a part-time job dummy, all in 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW and China, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. We also instrument for the interactions above using this same instrument interacted with age, gender and hourly earnings in Panels A, B, and C. Standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.23: Heterogeneous Effects - Gender

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Total Earnings**				
				Female			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-19.582**	-11.489	-4.857*	-5.178	1.429	-5.433	5.945
	(8.490)	(7.141)	(2.684)	(3.808)	(3.605)	(7.506)	(3.595)
N	22,811	22,811	22,811	22,811	22,811	22,811	22,811
				Male			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-5.055	-18.049	-6.997**	-5.980	7.838**	8.613	9.519
	(5.401)	(11.565)	(2.713)	(3.639)	(3.105)	(7.114)	(6.020)
N	25,667	25,667	25,667	25,667	25,667	25,667	25,667
Panel B			**Normalized Average Weekly Earnings**				
				Female			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.689**	0.586	-17.241	-3.052	-0.904	-0.710	-7.713*
	(0.848)	(0.852)	(17.779)	(2.791)	(1.617)	(1.494)	(4.111)
N	22,811	15,859	2,049	3,190	896	7,015	2,586
				Male			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.649*	-0.156	-1.268	-2.613*	-1.522*	-2.241	-5.980
	(0.910)	(0.445)	(2.086)	(1.525)	(0.873)	(2.516)	(7.851)
N	25,667	17,514	1,877	2,428	2,787	7,966	3,445
Panel C			**Total Working Years**				
				Female			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-12.182**	-10.359*	-3.989*	-3.262	1.640	-1.743	5.532*
	(5.429)	(5.680)	(2.140)	(3.075)	(2.917)	(5.307)	(2.953)
N	22,811	22,811	22,811	22,811	22,811	22,811	22,811
				Male			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	1.025	-14.903	-5.676**	-4.493	7.529***	10.211*	8.358
	(3.501)	(9.180)	(2.226)	(2.922)	(2.664)	(5.738)	(5.385)
N	25,667	25,667	25,667	25,667	25,667	25,667	25,667
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B and C represent different outcome variables - see the notes of Table 1.3 for their definitions. In each panel, the results for the female sample are presented above the results for the male sample. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.24: Heterogeneous Effects - Age

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Total Earnings**				
				Young			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-12.968*	-12.352	-6.244**	-6.526*	0.814	2.814	8.526*
	(7.390)	(12.459)	(2.733)	(3.347)	(3.298)	(7.290)	(4.959)
N	20,919	20,919	20,919	20,919	20,919	20,919	20,919
				Old			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.726	-18.811*	-6.761**	-5.452	11.608***	9.374	9.316
	(6.401)	(10.508)	(2.842)	(3.363)	(3.598)	(7.423)	(5.642)
N	27,586	27,586	27,586	27,586	27,586	27,586	27,586
Panel B			**Normalized Average Weekly Earnings**				
				Young			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.011***	-0.217	1.297	-1.355	-1.728	-1.220	-4.115
	(0.657)	(0.649)	(4.542)	(2.404)	(1.227)	(1.417)	(2.631)
N	20,919	13,756	1,864	2,279	1,872	7,511	2,937
				Old			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.062	0.591	-1.920	-2.634	-1.329	0.727	1.174
	(0.685)	(0.430)	(2.670)	(1.589)	(1.154)	(1.839)	(6.037)
N	27,586	19,646	2,063	3,326	1,791	7,477	3,095
Panel C			**Total Working Years**				
				Young			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-4.427	-9.825	-4.766**	-4.377*	1.576	5.838	7.127*
	(4.734)	(9.314)	(2.167)	(2.560)	(2.565)	(5.008)	(4.181)
N	20,919	20,919	20,919	20,919	20,919	20,919	20,919
				Old			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.908	-17.945**	-5.822**	-4.150	10.569***	8.767	7.672
	(4.474)	(8.948)	(2.380)	(2.816)	(3.177)	(6.436)	(4.945)
N	27,586	27,586	27,586	27,586	27,586	27,586	27,586
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B and C represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, the results for the sample of workers initially below 40 are presented above the results for the sample of workers above or equal to 40. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.25: Heterogeneous Effects - Earnings Capacity

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Total Earnings**				
			Low Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-7.723	-16.323	-2.915	-0.665	7.163	1.740	3.277
	(6.946)	(10.664)	(2.060)	(4.546)	(6.025)	(6.027)	(2.735)
N	13,647	13,647	13,647	13,647	13,647	13,647	13,647
			Middle Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-3.689	-18.366	-6.361**	-4.002	4.432	8.707	11.901*
	(8.322)	(13.381)	(3.126)	(3.122)	(3.915)	(7.510)	(6.715)
N	17,058	17,058	17,058	17,058	17,058	17,058	17,058
			High Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-4.946	-6.098	-9.663***	-11.679**	7.112	6.716	8.665
	(6.635)	(11.188)	(3.282)	(4.858)	(4.567)	(8.528)	(6.004)
N	17,746	17,746	17,746	17,746	17,746	17,746	17,746
Panel B			**Normalized Average Weekly Earnings**				
			Low Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-0.452	-0.539	3.614	1.482	1.590	-1.880	-23.402
	(0.946)	(0.877)	(14.816)	(4.055)	(1.915)	(3.939)	(18.127)
N	13,647	9,480	976	1,410	955	4,882	1,504
			Middle Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.047	0.754	-2.910	-2.904	-1.093	0.320	2.688
	(0.977)	(0.688)	(5.378)	(2.702)	(1.417)	(1.784)	(1.951)
N	17,058	11,800	1,269	1,695	1,471	5,208	2,103
			High Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.143**	0.415	-0.370	-5.537**	-3.827***	0.307	-3.541
	(0.570)	(0.794)	(3.018)	(2.707)	(1.159)	(1.325)	(2.798)
N	17,746	12,063	1,619	2,436	1,179	4,830	2,341
Panel C			**Total Working Years**				
			Low Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-5.460	-12.322	-2.316	-0.733	4.489	2.672	2.751
	(4.814)	(7.939)	(1.569)	(3.648)	(4.439)	(3.932)	(2.007)
N	13,647	13,647	13,647	13,647	13,647	13,647	13,647
			Middle Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	0.124	-16.484	-5.283**	-2.377	5.295	9.489	9.484*
	(4.435)	(10.780)	(2.583)	(2.530)	(3.451)	(6.238)	(5.707)
N	17,058	17,058	17,058	17,058	17,058	17,058	17,058
			High Earnings Capacity				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-2.287	-7.532	-7.522***	-9.061**	6.625*	7.257	7.947
	(4.340)	(9.179)	(2.707)	(4.034)	(3.699)	(7.214)	(5.280)
N	17,746	17,746	17,746	17,746	17,746	17,746	17,746
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B and C represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, results are shown for the sample of workers with relative initial earnings in the lowest tercile (low capacity), those for the middle tercile (middle capacity) and highest tercile earnings (high capacity). The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.26: Heterogeneous Effects, Hourly Earnings and Hours - Gender

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Average Hourly Earnings**				
				Female			
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-0.941	0.837	-21.255	-1.512	-3.058	-0.924	-4.223**
	(0.766)	(0.705)	(16.601)	(1.639)	(1.953)	(0.999)	(1.992)
N	22,811	15,850	2,049	3,186	896	7,012	2,582
				Male			
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.486**	-0.665	-0.681	-1.923	-0.759	-1.607	-2.214
	(0.638)	(0.430)	(2.254)	(1.370)	(0.702)	(1.248)	(1.839)
N	25,667	17,508	1,876	2,425	2,785	7,963	3,444
Panel B			**Normalized Average Hours Worked**				
				Female			
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-0.695*	-0.591	1.428	0.525	-1.490	0.539	-2.678
	(0.358)	(0.419)	(8.637)	(1.886)	(1.500)	(0.966)	(1.856)
N	22,811	15,881	2,061	3,197	901	7,040	2,591
				Male			
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-0.385	-0.039	-0.963	-0.442	-0.539	0.480	-0.510
	(0.448)	(0.247)	(0.957)	(0.719)	(0.750)	(0.683)	(0.847)
N	25,667	17,528	1,880	2,430	2,788	7,980	3,448
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A and B represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, the results for the female sample are presented above the results for the male sample. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.27: Heterogeneous Effects, Hourly Earnings and Hours - Age

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	All	Same Firm and Sector	Same Sector	Same 2-dig Sector	Tradable Sector	Non-Tradable Sector	Residual Sector
Panel A			**Normalized Average Hourly Earnings**				
				Young			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.592**	-0.547	-2.405	-1.721	-1.197	-1.159	-2.571
	(0.614)	(0.550)	(4.504)	(1.894)	(0.860)	(1.185)	(1.912)
N	20,919	13,750	1,863	2,276	1,872	7,509	2,936
				Old			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.580	0.041	-2.783	-2.107*	-0.382	-0.503	-1.081
	(0.554)	(0.443)	(2.092)	(1.185)	(1.166)	(1.123)	(1.556)
N	27,586	19,637	2,063	3,322	1,789	7,473	3,091
Panel B			**Normalized Average Hours Worked**				
				Young			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.598*	-0.265	3.260	0.962	-0.752	0.369	-2.108*
	(0.357)	(0.284)	(2.144)	(1.170)	(0.813)	(0.762)	(1.143)
N	20,919	13,774	1,870	2,287	1,873	7,531	2,942
				Old			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.307	-0.287	-1.118	0.227	-0.713	0.457	-0.322
	(0.432)	(0.355)	(1.401)	(0.880)	(0.596)	(0.876)	(1.319)
N	27,586	19,660	2,072	3,327	1,796	7,493	3,100
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A and B represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, the results for the sample of workers initially below 40 are presented above the results for the sample of workers above or equal to 40. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.28: Heterogeneous Effects, Hourly Earnings and Hours - Earnings Capacity

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Average Hourly Earnings**				
			Low Earnings Capacity				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.184	-0.054	13.764	3.511	0.733	-0.927	-6.526*
	(0.440)	(0.611)	(19.256)	(3.401)	(1.720)	(0.990)	(3.517)
N	13,647	9,476	977	1,410	954	4,881	1,504
			Middle Earnings Capacity				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.134	-0.148	-2.941	-1.547	-1.331	-0.168	1.083
	(0.849)	(0.588)	(4.213)	(1.644)	(1.228)	(1.222)	(1.570)
N	17,058	11,794	1,269	1,693	1,469	5,204	2,099
			High Earnings Capacity				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.039**	-0.118	-2.314	-5.071***	-2.770***	0.449	-2.547
	(0.511)	(0.682)	(3.227)	(1.687)	(1.016)	(1.120)	(2.269)
N	17,746	12,058	1,617	2,432	1,181	4,829	2,340
Panel B			**Normalized Average Hours Worked**				
			Low Earnings Capacity				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.608	-0.712	-12.687	0.119	-0.284	-0.266	-4.689*
	(0.504)	(0.450)	(14.637)	(2.095)	(0.981)	(1.123)	(2.498)
N	13,647	9,497	982	1,414	959	4,894	1,509
			Middle Earnings Capacity				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.370	0.084	-0.630	-1.337	-0.347	0.537	0.571
	(0.341)	(0.304)	(3.100)	(1.276)	(0.527)	(0.953)	(0.955)
N	17,058	11,807	1,273	1,696	1,472	5,222	2,104
			High Earnings Capacity				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.533	-0.294	-0.420	-0.383	-0.935	0.696	-4.207
	(0.730)	(0.303)	(2.230)	(1.097)	(1.008)	(1.019)	(3.176)
N	1,7746	12,071	1,624	2,439	1,181	4,841	2,343
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A and B represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, results are shown for the sample of workers with relative initial earnings in the lowest tercile (low capacity), those for the middle tercile (middle capacity) and highest tercile earnings (high capacity). The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

In our last heterogeneity exercise, we show how the results vary with the skill ranking of each worker's initial occupation, defined based on the relative hourly wage of the occupation in 2000. We present the results in Tables 1.B.29 and 1.B.30. We can see that workers of all types were negatively affected by the China shock but there is some heterogeneity. First note that in terms of total earnings, mid skill workers were the most affected, followed by the low skill ones. High skill workers were still negatively affected, but the magnitude is smaller. This heterogeneity across types is driven by sharper falls in total working years for workers in low and mid skill occupations, with the effects on average earnings being negative and not very different in magnitude across all three categories.

It is interesting to compare these results with those in the decomposition by occupation skill in Table 1.B.16, noting that in the heterogeneity analysis we hold the workers fixed by initial occupation group and in the decomposition analysis we are allowing workers to switch across different types of occupation in the sample period (and holding the occupation groups fixed). The patterns seen in the results across the two analyses are broadly similar. There are some minor differences between the two analyses. For example, looking at total working years, in the decomposition analysis in Table 1.B.16, mid skill jobs suffered the hardest hit relative to low and high skill jobs, whereas in Tables 1.B.29 and 1.B.30 low skill workers suffered the most compared to the other two groups. The key difference between the two analysis is that in the decomposition exercise, we are focusing on a particular skill occupation category *position*, i.e., it encompasses workers who remained in or moved *to* that skill job category from 2001 to 2007. The heterogeneity analysis, however, focuses on *workers* who initially were in a particular skill occupation category in 2000 and could have remained in or moved *out* of that skill category at some point.

Table 1.B.29: Heterogeneous Effects - Occupation Skill

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Total Earnings**				
			Low Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-5.590	-17.199	-0.351	0.585	7.732	0.560	3.083
	(6.249)	(10.844)	(2.223)	(3.829)	(5.083)	(9.489)	(3.920)
N	11,589	11,589	11,589	11,589	11,589	11,589	11,589
			Mid Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-11.277	-19.652*	-5.706**	-5.573	2.306	7.723	9.625**
	(7.223)	(11.731)	(2.652)	(3.692)	(3.231)	(5.741)	(4.483)
N	17,622	17,622	17,622	17,622	17,622	17,622	17,622
			High Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-2.200	-5.749	-10.642**	-9.852**	11.909**	6.898	5.236
	(5.876)	(10.370)	(4.386)	(4.893)	(4.988)	(8.453)	(6.091)
N	19,318	19,318	19,318	19,318	19,318	19,318	19,318
Panel B			**Normalized Average Weekly Earnings**				
			Low Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.054	-0.124	-21.256	1.374	-3.074	1.101	0.536
	(0.834)	(1.051)	(18.047)	(3.931)	(2.758)	(2.503)	(2.096)
N	11,589	8,298	813	1,234	562	4,038	1,127
			Mid Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.300*	-0.040	1.344	-2.864	-0.721	-1.610	-1.658
	(0.702)	(0.475)	(2.435)	(2.187)	(0.860)	(2.533)	(7.356)
N	17,622	11,982	1,265	1,492	2,073	5,752	2,377
			High Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-1.490*	0.221	-5.911	-6.737	-1.672	-1.865	-4.115
	(0.763)	(0.803)	(3.837)	(4.193)	(1.221)	(1.879)	(3.432)
N	19,318	13,152	1,902	2,944	1,092	5,240	2,585
Panel C			**Total Working Years**				
			Low Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-5.816	-15.106*	0.259	0.915	6.942	0.498	0.677
	(5.457)	(8.644)	(1.597)	(3.339)	(4.195)	(6.491)	(3.186)
N	11,589	11,589	11,589	11,589	11,589	11,589	11,589
			Mid Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	-4.657	-16.123*	-4.763**	-4.075	2.943	9.054*	8.307**
	(4.079)	(9.213)	(2.246)	(3.025)	(2.698)	(4.891)	(3.724)
N	17,622	17,622	17,622	17,622	17,622	17,622	17,622
			High Skill Occupation				
$\frac{\Delta_{00/07}Imports_{chi}}{Expenditure_{00}}$	1.834	-6.863	-8.642**	-7.070*	10.562***	8.455	5.394
	(4.036)	(8.618)	(3.659)	(3.819)	(4.026)	(6.714)	(5.704)
N	19,318	19,318	19,318	19,318	19,318	19,318	19,318
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A, B and C, respectively, represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, results are shown for the sample of workers initially in occupations defined as low, mid and high skill, respectively, based on the average hourly earnings of each occupation (1-digit) in 2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.30: Heterogeneous Effects, Hourly Earnings and Hours - Occupation Skill

	(1) All	(2) Same Firm and Sector	(3) Same Sector	(4) Same 2-dig Sector	(5) Tradable Sector	(6) Non-Tradable Sector	(7) Residual Sector
Panel A			**Normalized Average Hourly Earnings**				
			Low Skill Occupation				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.932	-0.016	-13.318	4.123	-1.081	-1.661	1.919
	(0.978)	(0.824)	(10.490)	(3.201)	(2.898)	(1.599)	(2.275)
N	11,589	8,293	814	1,232	561	4,033	1,124
			Mid Skill Occupation				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.019*	-0.276	0.396	-2.649*	-0.145	-0.767	-1.802
	(0.543)	(0.379)	(1.584)	(1.484)	(0.815)	(0.818)	(1.990)
N	17,622	11,980	1,265	1,492	2,072	5,751	2,376
			High Skill Occupation				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-1.269*	-0.419	-5.216	-4.177	-1.394	-1.612	-2.367
	(0.671)	(0.726)	(3.961)	(2.884)	(1.055)	(1.530)	(2.384)
N	19,318	13,144	1,900	2,940	1,092	5,240	2,584
Panel B			**Normalized Average Hours Worked**				
			Low Skill Occupation				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.697	-0.846	-2.408	-3.462	-3.854	1.397	-2.288*
	(0.662)	(0.567)	(5.464)	(3.059)	(5.198)	(1.718)	(1.291)
N	11,589	8,312	818	1,235	564	4,044	1,131
			Mid Skill Occupation				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.393	-0.110	-0.415	0.297	-0.661	-0.034	-0.838
	(0.285)	(0.272)	(1.283)	(0.945)	(0.591)	(0.687)	(0.708)
N	17,622	11,990	1,268	1,494	2,077	5,769	2,378
			High Skill Occupation				
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.713	-0.419	-0.688	-0.486	0.133	0.234	-0.317
	(0.573)	(0.359)	(2.667)	(1.802)	(0.699)	(1.027)	(2.104)
N	19,318	13,163	1,909	2,950	1,092	5,254	2,588
All Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: Panels A and B represent different outcome variables - see notes of Table 1.3 for their definitions. In each panel, results are shown for the sample of workers initially in occupations defined as low, mid and high skill, respectively, based on the average hourly earnings of each occupation (1-digit) in 2000. The sample is restricted to workers with high labor force attachment in the period 1997-2000. The first column corresponds to the baseline model. The other columns show mutually exclusive channels: employment at the same firm in the same sector (column 2); employment at a different firm but within the same sector (column 3); employment at the same 2-digit sector but not the same 4-digit one (column 4); employment in tradable industries but not the same 2-digit sector (column 5); employment in non-tradable sectors (column 6); and a residual category (column 7). The explanatory variable of interest is the change in import penetration (2000-2007) in the worker's initial industry of employment. All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls and details on the IV. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ varies across samples). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.31: Local Labor Market - Manufacturing

	(1) 2SLS	(2) 2SLS	(3) 2SLS
	Normalized Total Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-6.705		-6.675
	(5.757)		(5.779)
CZ_{chi}		-1.511	-1.340
		(2.421)	(2.421)
	Normalized Average Weekly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.982**		-0.965**
	(0.468)		(0.469)
CZ_{chi}		-0.791**	-0.766**
		(0.342)	(0.341)
	Normalized Average Hourly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.689		-0.674
	(0.440)		(0.437)
CZ_{chi}		-0.690**	-0.673**
		(0.322)	(0.321)
	Total Working Years		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-3.405		-3.442
	(3.718)		(3.684)
CZ_{chi}		1.612	1.700
		(1.553)	(1.561)
	Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.341		-0.340
	(0.210)		(0.210)
CZ_{chi}		-0.088	-0.079
		(0.098)	(0.100)
1^{st} Stage(s) Statistics			
IV_{chi}	.012***		.012***
	(.004)		(.004)
F Stat IV	9.537		5.101
$IVCZ_{chi}$		.015***	.015***
		(.002)	(.002)
F Stat IVCZ		38.393	21.961
N	13,532	13,532	13,532
All Controls	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E, respectively, represent different outcome variables - see notes of Table 1.3 for their definitions. The sample is restricted to workers in the manufacturing sector with high labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The commuting zone shock (Imports China in CZ) is a weighted (by the share of the labor force) average of the sector import shock in each CZ adjusted by total employment in the CZ from ASHE (in thousands of individuals). All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. The instrument for change in imports in CZ, $IVCZ_{chi}$ is just a weighted (by the share of the labor force) average of the industry-level instrument. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ =52). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.32: Local Labor Market - Low Labor Force Attachment

	(1) 2SLS	(2) 2SLS	(3) 2SLS
	Normalized Total Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-17.799		-16.999
	(17.323)		(16.722)
CZ_{chi}		-23.302	-23.110
		(21.434)	(21.268)
	Normalized Average Weekly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-4.808		-4.575
	(4.105)		(3.935)
CZ_{chi}		-6.794	-6.742
		(5.415)	(5.374)
	Normalized Average Hourly Earnings		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.451		-0.396
	(0.869)		(0.856)
CZ_{chi}		-1.609***	-1.604***
		(0.380)	(0.378)
	Total Working Years		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-2.722		-2.864
	(2.924)		(2.869)
CZ_{chi}		4.080***	4.112***
		(0.892)	(0.892)
	Normalized Average Hours Worked		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.717		-0.715
	(0.593)		(0.592)
CZ_{chi}		-0.065	-0.057
		(0.163)	(0.162)
1^{st} Stage(s) Statistics			
IV_{chi}	.012***		.012***
	(.003)		(.003)
F Stat IV	14.749		7.786
$IVCZ_{chi}$		.018***	.018***
		(.001)	(.001)
F Stat IVCZ		289.82	144.868
N	88,955	88,955	88,955
All Controls	Yes	Yes	Yes

NOTES: Panels A, B, C, D and E, respectively, represent different outcome variables - see notes of Table 1.3 for their definitions. The sample is extended to include workers with low labor force attachment in the period 1997-2000. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The commuting zone shock (Imports China in CZ) is a weighted (by the share of the labor force) average of the sector import shock in each CZ adjusted by total employment in the CZ from ASHE (in thousands of individuals). All columns are estimated by 2SLS and include all worker- and industry-level controls - see notes of Table 1.3 for a list of the controls. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. The instrument for change in imports in CZ, $IVCZ_{chi}$ is just a weighted (by the share of the labor force) average of the industry-level instrument. Standard errors clustered by industry (ISIC3 - 3-digit) are in parentheses. ($N_{clusters}$ =110). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.33: Descriptive Statistics: Trade Shocks at the Firm-Level

	All Firms			No Entrants			Surviving		
	Trad.	Manuf.	All	Trad.	Manuf.	All.	Trad.	Manuf.	All
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.029	0.031	0.003	0.029	0.030	0.004	0.026	0.027	0.004
	(0.036)	(0.036)	(0.015)	(0.035)	(0.036)	(0.017)	(0.034)	(0.034)	(0.017)
Percentile 10 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.001	0.001	0.000	0.001	0.001	0.000	0.001	0.000	0.000
Percentile 25 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.003	0.005	0.000	0.003	0.003	0.000	0.003	0.003	0.000
Percentile 50 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.012	0.013	0.000	0.012	0.013	0.000	0.011	0.012	0.000
Percentile 75 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.053	0.055	0.000	0.046	0.052	0.000	0.038	0.040	0.000
Percentile 90 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.096	0.096	0.006	0.096	0.096	0.008	0.084	0.084	0.008
$\frac{Imports_{chi,00}}{Expenditure_{00}}$	0.024	0.025	0.003	0.023	0.024	0.003	0.021	0.022	0.003
	(0.040)	(0.040)	(0.016)	(0.039)	(0.040)	(0.017)	(0.037)	(0.037)	(0.017)

Notes: Each column of the table represents different samples, described in the text. The Table shows the mean and standard deviation (in parentheses) for the variables $\Delta_{00/07} Imports_{chi}/Expenditure_{00}$ and $Imports_{chi}/Expenditure_{00}$. The table also shows percentiles of $\Delta_{00/07} Imports_{chi}/Expenditure_{00}$. The UK Data Secure Data Service does not release results with simple percentiles of the distribution. Hence, to obtain percentile X we average the variable across individuals within percentiles X+5 and X-5 of the variable. For example, percentile 10 of $\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$" is the mean of Chinese Import Exposure between the percentiles 5 and 15 of the variable.

Table 1.B.34: Plant Employment Growth - Tradable Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
			Employment Growth		
Panel A			*Tradable - All Firms*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.324	-2.590**	-3.019***	-3.684*	-3.452*
	(1.096)	(1.106)	(1.006)	(2.098)	(1.758)
1st Stage(s) Statistics					
IV_{chi}		.024***	.024***	.018***	.018***
		(.005)	(.005)	(.005)	(.005)
KP F Stat		18.952	18.927	10.766	10.831
N	212,676	212,676	212,676	212,676	212,676
Panel B			*Tradable - No Entrants*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.785	-3.183***	-3.450***	-2.834	-3.588*
	(1.175)	(1.171)	(1.199)	(1.782)	(1.934)
1st Stage(s) Statistics					
IV_{chi}		.024***	.024***	.017***	.017***
		(.006)	(.005)	(.005)	(.005)
KP F Stat		18.825	18.888	10.264	10.412
N	135,378	135,378	135,378	135,378	135,378
Panel C			*Tradable - Surviving*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.664	-1.368***	-1.554***	-1.779**	-1.854**
	(0.413)	(0.492)	(0.552)	(0.866)	(0.912)
1st Stage(s) Statistics					
IV_{chi}		.023***	.023***	.016***	.016***
		(.005)	(.005)	(.005)	(.005)
KP F Stat		19.290	19.294	9.293	9.506
N	67,337	67,337	67,337	67,337	67,337
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes all plants in tradable goods sectors, Panel B restricts to the sample without new entrants, and Panel C restricts to firms alive at the start and end of the sample period. Employment Growth is defined as change in log(employment) between 2000 and 2007. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.35: Plant Activity Status - Tradable Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
			Activity Status		
Panel A			*Tradable - All Firms*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.808**	-0.899**	-0.840**	-0.791	-0.996*
	(0.322)	(0.364)	(0.323)	(0.554)	(0.541)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.024***	.024***	.018***	.018***
		(.005)	(.005)	(.005)	(.005)
KP F Stat		18.952	18.927	10.766	10.831
N	212,676	212,676	212,676	212,676	212,676
Panel B			*Tradable - No Entrants*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.956***	-0.899**	-0.833**	-0.639	-1.022*
	(0.346)	(0.388)	(0.342)	(0.615)	(0.586)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.024***	.024***	.017***	.017***
		(.006)	(.005)	(.005)	(.005)
KP F Stat		18.825	18.888	10.264	10.412
N	135,378	135,378	135,378	135,378	135,378
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes all plants in tradable goods sectors, Panel B restricts to the sample without new entrants. Activity Status is a dummy variable equals to 1 if a plants was alive in 2007 and 0 otherwise. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.36: Plant Employment Growth - All Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
			Employment Growth		
Panel A			*All Sectors - All Firms*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.177***	-5.580***	-3.290***	-3.278	-2.381
	(0.924)	(1.106)	(1.011)	(2.015)	(1.764)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.031***	.031***	.017***	.017***
		(.005)	(.005)	(.005)	(.005)
KP F Stat		31.002	30.902	11.125	11.129
N	1,799,189	1,799,189	1,799,189	1,799,189	1,799,189
Panel B			*All Sectors - No Entrants*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.522	-2.197	-3.579***	-2.199	-2.133
	(1.362)	(1.431)	(1.240)	(1.960)	(1.690)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.031***	.03***	.016***	.016***
		(.006)	(.006)	(.005)	(.005)
KP F Stat		30.494	30.361	10.610	10.638
N	930,975	930,975	930,975	930,975	930,975
Panel C			*All Sectors - Surviving*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-1.157***	-1.702***	-1.236**	-1.572**	-1.388*
	(0.438)	(0.508)	(0.482)	(0.761)	(0.743)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.029***	.029***	.016***	.016***
		(.005)	(.005)	(.005)	(.005)
KP F Stat		32.393	32.135	10.046	10.099
N	416,388	416,388	416,388	416,388	416,388
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes all plants in any sector, Panel B restricts to the sample without new entrants, and Panel C restricts to firms alive at the start and end of the sample period. Employment Growth is defined as change in log(employment) between 2000 and 2007. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.37: Plant Activity Status - All Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
			Activity Status		
Panel A			*All Sectors - All Firms*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.278	-0.189	-0.320	-0.231	-0.383
	(0.419)	(0.465)	(0.410)	(0.664)	(0.533)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.031***	.031***	.017***	.017***
		(.005)	(.005)	(.005)	(.005)
KP F Stat		31.002	30.902	11.125	11.129
N	1,799,189	1,799,189	1,799,189	1,799,189	1,799,189
Panel B			*All Sectors - No Entrants*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.129	0.468	0.002	0.088	-0.326
	(0.499)	(0.586)	(0.388)	(0.772)	(0.565)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.031***	.03***	.016***	.016***
		(.006)	(.006)	(.005)	(.005)
KP F Stat		30.494	30.361	10.610	10.638
N	930,975	930,975	930,975	930,975	930,975
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes all plants in any sector, Panel B restricts to the sample without new entrants. Activity Status is a dummy variable equals to 1 if a plants was alive in 2007 and 0 otherwise. Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.38: Sales - Manufacturing Sectors Surviving Plants

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A			*Plant-level Sales*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	0.057	-1.296	-1.351	-2.186	-1.985
	(0.425)	(0.986)	(0.981)	(2.143)	(2.108)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.023***	.023***	.017***	.017***
		(.005)	(.005)	(.006)	(.006)
KP F Stat		18.22	18.205	8.947	9.087
N	64,252	64,252	64,252	64,252	64,252
Panel B			*Firm-level Sales*		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-0.813	-2.660**	-2.662**	-2.280	-2.038
	(0.532)	(1.259)	(1.232)	(2.164)	(2.127)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.023***	.023***	.017***	.017***
		(.005)	(.005)	(.006)	(.006)
KP F Stat		18.22	18.205	8.947	9.087
N	64,252	64,252	64,252	64,252	64,252
Firm Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the plant level. The sample is surviving plants in the manufacturing sector. In Panel A, the dependent variable is Sales (Plant), defined as change in log(Firm Sales x Plant Share of Firm Employment). In Panel B, the dependent variable is Sales (Firm), defined as change in log(Firm Sales). Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.39: Entry - Manufacturing

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A			**Change in Entry**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	$-1.7e+03^{*}$	-728.283	-176.674*	744.004	-140.616
	(888.694)	(662.838)	(98.800)	(1268.546)	(192.598)
Panel B			**Change in Entry Rate**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.214**	-0.256**	-0.112**	0.124	-0.167
	(0.082)	(0.109)	(0.056)	(0.243)	(0.123)
Panel C			**Normalized Average Entry**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.839	-1.023	-0.236	0.933	-1.364
	(0.624)	(0.832)	(0.551)	(1.293)	(0.960)
Panel D			**Normalized Average Entry Rate**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.482	-0.515	0.226	1.787	-0.412
	(0.450)	(0.774)	(0.491)	(1.317)	(0.839)
1^{st} Stage(s) Statistics					
IV_{chi}		.021***	.02***	.014***	.013***
		(.005)	(.004)	(.005)	(.005)
KP F Stat		19.775	23.356	7.973	7.696
N	111	111	111	111	111
Other Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the industry level and are weighted by employment in 2000. Sample includes only manufacturing industries. Each panel represents a different dependent variable. Panel A) Entry: change in entry (number of entrant firms) between 2000 and 2007 in a sector; Panel B) Entry Rate: change in entry rate (number of entrant firms divided by the total number of active firms) between 2000 and 2007; Panel C) Normalized Average Entry: average entry between 2000 and 2007 (across all years); Panel D) Normalized Average Entry Rate: average entry rate between 2000 and 2007 (across all years); Column 1 is estimated by OLS and columns 2-5 by 2SLS. The explanatory variable of interest is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Other Controls" include entry and entry rate in 2000 as controls, as well as average entry rate and entry between 1997 and 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 52$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.40: Entry - Tradable Sectors

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A		**Change in Entry**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	$-1.7e+03^{*}$	-714.791	-154.992	763.455	-146.441
	(886.245)	(659.930)	(97.922)	(1317.401)	(185.185)
Panel B		**Change in Entry Rate**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.207**	-0.241**	-0.099*	0.125	-0.179
	(0.082)	(0.107)	(0.056)	(0.250)	(0.125)
Panel C		**Normalized Average Entry**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.850	-1.037	-0.273	0.987	-1.362
	(0.620)	(0.817)	(0.545)	(1.238)	(0.895)
Panel D		**Normalized Average Entry Rate**			
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	-0.477	-0.499	0.221	1.938	-0.312
	(0.445)	(0.758)	(0.485)	(1.332)	(0.827)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.021***	.02***	.014***	.013***
		(.005)	(.004)	(.005)	(.005)
KP F Stat		20.077	23.816	8.252	7.852
N	116	116	116	116	116
Other Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the industry level and are weighted by employment in 2000. Sample includes only tradable industries. Each panel represents a different dependent variable. Panel A) Entry: change in entry (number of entrant firms) between 2000 and 2007 in a sector; Panel B) Entry Rate: change in entry rate (number of entrant firms divided by the total number of active firms) between 2000 and 2007; Panel C) Normalized Average Entry: average entry between 2000 and 2007 (across all years); Panel D) Normalized Average Entry Rate: average entry rate between 2000 and 2007 (across all years); Column 1 estimated by OLS and columns 2-5 by 2SLS. Change in import penetration relative to plants' industry of employment in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Other Controls" include entry and entry rate in 2000 as controls, as well as average entry rate and entry between 1997 and 2000. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 56$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.41: Entry - All

	(1) OLS	(2) 2SLS	(3) 2SLS	(4) 2SLS	(5) 2SLS
Panel A			**Change in Entry**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	4089.903*	7130.445**	-481.902	3625.208	-155.289
	(2320.057)	(3206.626)	(966.263)	(3265.002)	(1033.381)
Panel B			**Change in Entry Rate**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.040	0.127	-0.028	-0.049	-0.258*
	(0.094)	(0.106)	(0.048)	(0.305)	(0.141)
Panel C			**Normalized Average Entry**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	0.002	0.265	-0.964	-0.738	-0.013
	(1.097)	(1.472)	(0.613)	(1.780)	(1.024)
Panel D			**Normalized Average Entry Rate**		
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{00}}$	1.665	2.584*	1.492**	-0.663	0.053
	(1.036)	(1.486)	(0.679)	(1.693)	(0.843)
1^{st} *Stage(s) Statistics*					
IV_{chi}		.025***	.025***	.012***	.012***
		(.005)	(.005)	(.004)	(.004)
KP F Stat		28.767	27.81	8.781	9.460
N	199	199	199	199	199
Other Controls			Yes		Yes
Industry Controls				Yes	Yes

NOTES: The regressions are estimated at the industry level and are weighted by employment in 2000. Sample includes all industries. Each panel represents a different dependent variable. Panel A) Entry: change in entry (number of entrant firms) between 2000 and 2007 in a sector; Panel B) Entry Rate: change in entry rate (number of entrant firms divided by the total number of active firms) between 2000 and 2007; Panel C) Normalized Average Entry: average entry between 2000 and 2007 (across all years); Panel D) Normalized Average Entry Rate: average entry rate between 2000 and 2007 (across all years); Column 1 estimated by OLS and columns 2-5 by 2SLS. Change in import penetration relative to plants' industry of employment in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Other Controls" include entry and entry rate in 2000 as controls, as well as average entry rate and entry between 1997 and 2000.The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.42: Heterogeneous Effects - Tradable Sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Old	Young	Small	Large	Old	Young	Small	Large
	Employment Growth				**Activity Status**			
Panel A	*Tradable - All Firms*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.256*	-2.867**	-1.010	-4.701*	-0.952	-0.996**	-0.614	-1.181*
	(2.440)	(1.328)	(0.618)	(2.579)	(0.685)	(0.476)	(0.418)	(0.705)
N	100,723	111,953	90,161	122,504	100,723	111,953	90,161	122,504
Panel B	*Tradable - No Entrants*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-6.596*	-2.370*	-0.901	-5.318*	-1.166	-0.928*	-0.667	-1.209
	(3.836)	(1.293)	(0.606)	(2.749)	(0.888)	(0.495)	(0.453)	(0.777)
N	47,959	87,419	59,184	76,187	47,959	87,419	59,184	76,187
Panel C	*Tradable - Surviving*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-3.082**	-1.112*	-0.600	-2.741*				
	(1.516)	(0.645)	(0.533)	(1.496)				
N	27,251	40,086	32,932	34,397				
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes the full sample of plants initially in any tradable sector, Panel B excludes entrants from this sample, and Panel C restricts to plants that survive the full estimation period. The dependent variable is either employment growth (columns 1-4), defined as change in ln(employment) between 2000 and 2007, or activity status (columns 5-8), defined as a dummy variable equals to 1 if a plant was alive in 2007 and 0 otherwise. Each column represents a different sample: old and young plants (columns 1, 2, 5 and 6); Small and large plants in terms of employment (columns 3, 4, 7 and 8). All columns are estimated by 2SLS. The explanatory variable of interest is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 56$) . * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Table 1.B.43: Heterogeneous Effects - All Sectors

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Old	Young	Small	Large	Old	Young	Small	Large
	Employment Growth				**Activity Status**			
Panel A	*All Sectors - All Firms*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-2.884	-1.593	-0.190	-3.517	-0.385	-0.393	-0.078	-0.587
	(2.199)	(1.570)	(0.497)	(2.764)	(0.595)	(0.495)	(0.387)	(0.719)
N	885,507	913,682	859,212	939,958	885,507	913,682	859,212	939,958
Panel B	*All Sectors - No Entrants*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-4.784	-0.940	0.088	-2.894	-0.467	-0.220	0.098	-0.595
	(3.498)	(1.160)	(0.407)	(2.172)	(0.841)	(0.497)	(0.376)	(0.734)
N	281,760	649,215	385,334	545,630	281,760	649,215	385,334	545,630
Panel C	*All Sectors - Surviving*							
$\frac{\Delta_{00/07} Imports_{chi}}{Expenditure_{97}}$	-2.644**	-0.743	0.182	-2.046*				
	(1.252)	(0.595)	(0.424)	(1.078)				
N	146,458	269,930	183,092	233,284				
Firm Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

NOTES: The regressions are estimated at the plant level. Panel A includes the full sample of plants in any sector, Panel B excludes entrants from this sample, and Panel C restricts to plants that survive the full estimation period. The dependent variable is either employment growth (columns 1-4), defined as change in ln(employment) between 2000 and 2007, or activity status (columns 5-8), defined as a dummy variable equals to 1 if a plant was alive in 2007 and 0 otherwise. Each column represents a different sample: old and young plants (columns 1, 2, 5 and 6); Small and large plants in terms of employment (columns 3, 4, 7 and 8). All columns are estimated by 2SLS. The explanatory variable of interest is the change in import penetration relative to plants' industry in 2000 or plants' industry in its entry year if plant enters after 2000. "Industry Controls" include pre-period employment growth and pre-period employment changes for two different periods, from 1986 to 1991 (2-digit industry) and from 1994 to 1996 (4-digit industry) and a broad outsourcing measure (share of input costs in value added at the 2-digit industry level); and other 4-digit industry measures such as pre-period change (1997-1999) in import penetration from China and the rest of the world (RoW); levels of import penetration from the RoW, real (log) sales, employment level, real (log) exports to China, R&D intensity, real purchase of computer services and real investment in machinery, all in 2000. "Firm Controls" include enterprise birth date fixed effects, a dummy for enterprise foreign ownership in the starting period and enterprise employment in the starting period. The instrument for change in industry Chinese import penetration, IV_{chi}, is the China fixed effect estimated for the 2000-2007 difference from an auxiliary regression of exports on sector dummies considering all countries of the world but the UK, divided by the level of expenditure in the industry in 1997 in the UK. Robust standard errors clustered by industry (ISIC3 - 3-digit) in parentheses ($N_{clusters} = 110$). * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

Chapter 2

The Labour Market Effects of Services Importing: Evidence from the United Kingdom

Abstract

This paper uses detailed data on international trade in services matched with employment information at both the worker and firm level to estimate the local labour market effects of services trade. In the cross-section, there is a wage premium at firms that trade services and in regions that trade a higher value of services. Looking at changes within a local labour market over time and using an instrumental variables strategy, I find that an increase in imports of services is associated with an increase in employment, suggesting evidence of an aggregate positive productivity effect from importing services. It is also associated with a redistribution of employment away from importing firms towards non-importers. Importing services has a negative effect on average wages in high skill occupations and on wages in the top half of the earnings distribution.

I am very grateful to Steve Bond, Swati Dhingra and Gabriel Ulyssea for continued guidance on this project, and to Treb Allen, Jan Bakker, Brian Bell, Andy Bernard, Emily Blanchard, Kirill Borusyak, Holger Breinlich, Davin Chor, Rui Costa, Nikhil Datta, Teresa Fort, Matt Grant, Elsa Leromain, Nina Pavcnik, João Paulo Pessoa, Charly Porcher, Ferdinand Rauch, Matt Slaughter, Cory Smith, Meredith Startz, and Catherine Thomas for helpful suggestions.

2.1 Introduction

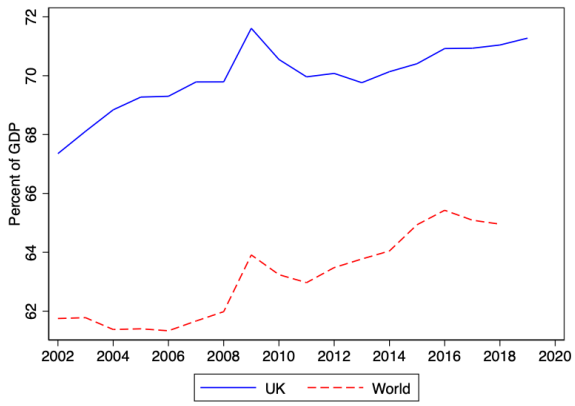
Services make up a large and increasing share of world output. International trade in services has also risen, particularly since the late 1990s, both as a share of total GDP and as a share of services value added. These trends are more pronounced in many developed countries. Figure 2.1.1 documents these trends for the world as a whole and for the UK.

The growth of global services trade has been driven by technological developments, most notably the fall in communication costs facilitated by the adoption of the internet, and efforts to liberalise trade policy both through deep preferential trade agreements, such as a deepening of the EU Single Market, and unilateral liberalisation, most significantly the General Agreement on Trade in Services (GATS).

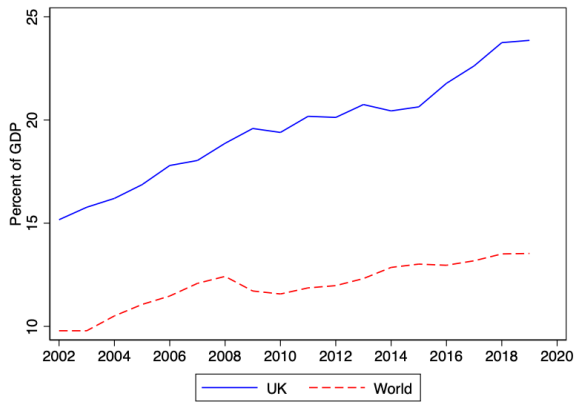
Despite this growth, there is still relatively little evidence on the labour market impacts of services trade relative to the extensive literature on the effects of goods trade. This has partly been due to the lack of high quality data on trade in services and to the absence of obvious shocks to services trade that would enable the empirical investigation of its effects. Yet there are reasons to believe that the labour market impacts of services trade may be different to those in goods and warrant separate investigation.

"Tradable" service sectors, such as legal services, engineering services, and advertising, comprise around 43% of UK employment, compared with just 11% in manufacturing. These tradable services industries tend to be high-skill intensive (Jensen, 2011; Gervais and Jensen, 2019) and business survey evidence across countries suggests that the skills of foreign services providers are becoming increasingly important to importing businesses (PWC, 2010). It is well documented that workers of different skill types experience different outcomes in response to goods trade shocks (e.g. Autor et al., 2014; De Lyon

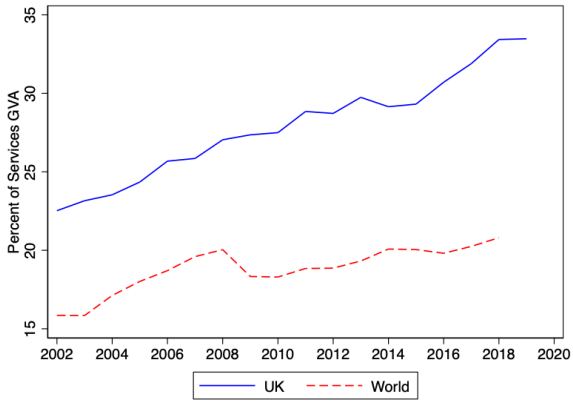
Figure 2.1.1: Growth of Services



(a) Services Value Added in GDP



(b) Services Trade in GDP



(c) Services Trade in Services Value Added

Notes: Data is from the World Bank. Panel (a) shows services value added as a share of GDP. Panel (b) is the share of services trade in GDP and panel (c) is the share of services trade in services value added. Each plot shows the world aggregate and the UK. Trade is measured as the sum of imports and exports.

and Pessoa, 2021), and Hummels et al. (2014) find that goods offshoring substitutes for low skill labour while augmenting high skill labour. Given that production of services, particularly traded services, is more skill intensive it is not clear that the same responses would hold for services. In particular, it may be that some domestic high skill labour is substituted for foreign high skill labour when domestic producers switch to importing services.

In this paper, I investigate the effects of the growth of services imports on local labour market (LLM) outcomes in the UK. Using detailed micro data at the employer-employee level and an instrumental variables strategy broadly similar to that of Hummels et al. (2014), I examine distributional and adjustment effects that are associated with a rise in services imports. Most notably, I find that an increase in services imports is associated with a relative fall in wages in the top half of the wage distribution within a LLM. The effects on the distribution of wages of services importing are different to those of goods offshoring (e.g. Hummels et al., 2014), import competition (e.g. Autor et al., 2014; De Lyon and Pessoa, 2021), and technological change (e.g. Autor and Dorn, 2013; Acemoglu and Restrepo, 2020), but similar to the predicted wage effects of artificial intelligence (e.g. Webb, 2020).

In interpreting the empirical results, I begin with the influential offshoring framework of Grossman and Rossi-Hansberg (2008). Following the existing services trade literature and noting that the types of services included in this paper are defined to be those that are used as inputs to production, I consider imports of services to be analogous to offshoring. That is, importing a service is similar to employing a foreign worker to provide the service. The Grossman and Rossi-Hansberg (2008) insight was to show that there are (at least) two contrasting labour market implications of offshoring, when trade is considered from the perspective of tasks instead of final products. First, a substitution effect occurs whereby employing foreign labour to carry out a task has a negative effect on demand for domestic workers. Second, a productivity effect occurs, whereby the decision to offshore is taken by optimising firms and therefore increases productivity, which can increase labour demand.[1] Therefore, a fall in the cost of offshoring has a theoretically ambiguous effect on aggregate employment and wages.

[1] A third effect occurs through relative price adjustments for the final good on the world market. When offshoring leads to an increase in the world supply of the final good, the price of the good falls, which is mirrored in falling prices for the factors used relatively intensively in its production.

To investigate the labour market effects of services trade empirically, I use a rich set of datasets collected by the Office for National Statistics (ONS) covering 2003 to 2016. Data on trade in services is provided by an annual survey of firms, covering all large firms and high value traders, reporting their value of imports (and exports) by the type of service and the partner country. The data is used by the ONS to construct the UK Balance of Payments statistics, and is amongst the most detailed services trade data in the world. This is supplemented with information on employment and industry for the universe of business establishments, as well as sales for the universe of firms. Additional balance sheet-type information at the firm level is provided by the Annual Business Survey. Finally, worker-level information on wages, detailed occupation, worker characteristics and a firm identifier is available for a nationally representative 1% sample of employees.

Looking at descriptive trends in the data, the share of employment in tradable services industries rose from 37% to 43% between 2004 and 2016. Employment in tradable service industries is relatively evenly spread across space, accounting for over 30% of employment in the majority of LLMs. The share of sales revenue accounted for by firms that import services increased from 18% to 22% over the same period, but the share of employment accounted for by these firms fell slightly from 15% to 14%.

The service sectors with the largest absolute growth in imports between 2004 and 2016 were communications, computer and information services, and business and management services. The largest source country in terms of both initial levels and growth was USA. As a block, the EU (excluding the UK) accounted for 44% of the UK's imports of services in 2004 and more than half of the growth of imports between 2004 and 2016. Imports from India and China had very high growth rates but in absolute terms they remain relatively small in terms of their share in total UK imports. Decomposing

growth from the perspective of UK firms and averaging over three year periods, the vast majority of growth comes from within firms that already traded, and over half comes from increases in imports for existing service-country trade relationships.

The growth of services trade has coincided with a period of stagnant real wages in the UK. Wage inequality has been relatively stable in the UK since the early 2000s, except for right at the top of the wage distribution where inequalities continued to widen. This follows a trend of increasing wage inequality more generally since the 1980s (Bell et al., 2021). The premium for working at a firm that either imports or exports services grew over this period. Controlling for worker, firm, and LLM characteristics, workers at importing firms earn 5.9% higher wages than those at firms that do not import, although this number reduces to 2.7% when controlling for whether the firm also exports. Being located in a LLM with higher imports of services is also associated with a small but statistically significant wage premium in the cross section, with 10% higher imports being associated with 0.09% higher wages. The firm-level trade premium has risen over time, while the LLM-level trade premium has fallen.

The main aim of the paper is to identify the labour market effects of changes in exposure to imports of services over time. LLM exposure to services trade is highly likely to be endogenously determined with respect to labour market outcomes due to, for example, demand or productivity shocks that shift both importing and wages. To overcome this endogeneity, I construct an instrument that is correlated with changes in LLM imports but uncorrelated with changes in labour outcomes. The instrument relies on the empirical observation that much of the growth of services imports is growth within existing service-country trade relationships. The instrument is a shift-share construct which uses a LLM's pre-sample period import shares for each service-country pair as exposure weights to changes in the world export supply (excluding the UK and deflating

by service-specific prices) of that service-country over a period. The instrumental variables (IV) strategy is a LLM analogue of that suggested by Hummels et al. (2014). I use this strategy to estimate the aggregate direct impacts of a plausibly exogenous rise in imports of services in a LLM, and utilize the detailed employer-employee micro data to estimate the distributional impacts as well as the reallocation of employment across firms and sectors.

The results suggest that a plausibly exogenous increase in LLM exposure to imports is associated with an increase in total employment. This is evidence of the productivity effect; LLMs that offshore benefit from efficiency gains of importing foreign services, generating increased total demand for labour overall. This is reinforced by the estimates for sales revenue, where increases in imports are associated with a positive but statistically insignificant change. The average wage in a LLM, however, falls with a rise in import exposure. This result can be explained by the distributional analysis. Employment at importing firms, who pay higher wages, falls, with the rise in employment driven by non-importing firms. The rise in employment is also driven by industries outside of tradable services and manufacturing.

Looking at the distributional effects on wages, I find that a rise in imports of services is associated with falls in wages at the 75th and 90th percentiles within a LLM, but not at other percentiles below and above this. The average wage of occupations involving non-routine cognitive tasks also falls with a rise in services imports. A rise in imports is also associated with a fall in the average wage of workers in managerial occupations, which appears to be driven by an increasing quantity of workers classed as managers.[2]

[2]I find a positive but statistically insignificant coefficient on employment of managers. Ariu et al. (2019) find that firm-level services offshoring in Finland is associated with an increase in employment of managers.

Related literature. This paper contributes to a small but growing literature on the labour market effects of services trade, which has broadly found mixed results. Most closely related, Magli (2020) uses the same data on trade in services for the UK to estimate the impacts of an increase in imports of services within a service-LLM on aggregate and firm outcomes. She finds that there are spillovers from offshoring firms to non-offshoring firms and that large firms benefit most from services offshoring. Ariu et al. (2019) use firm-level data for Finland to estimate that offshoring firms reduce employment of low skill workers, increase employment of managers, and improve overall performance as measured by, for example, productivity. Similarly, Eppinger (2019) uses German firm-level data to show that services offshoring of the firm is associated with an increase in employment, with greater effects for firms with a higher initial share of services offshoring. Liu and Trefler (2019) estimate a worker-level regression with an occupational shock for the US to examine the impact of services offshoring to India and China on employment outcomes, particularly occupational mobility and wages. They find a small negative impact on earnings, and an increase in occupational switching both up and down in terms of occupational quality.[3] Finally, Eckert (2019) quantitatively estimates a model of within-country trade for the US and shows that regions that are net importers of services experience a reduction in the skill premium. That is, importing services puts downward pressure on the high skill wage relative to the low skill wage. My main contribution to this literature is to estimate in detail the distributional impacts of services trade across the earnings distribution. I am also the first to make use of a worker-level panel with matched employer trade information.

[3]Using data from the British Household Panel Survey with an industry-level services import shock, Geishecker and Görg (2013) find that services offshoring is associated with a decrease in low and medium skill wages and an increase in high skill wages. Crinò (2010) estimates occupational level regressions to show that services offshoring increases the demand for high skill occupations more than low skill ones and, conditional on skill level of the occupation, services offshoring penalises tradable occupations relative to non-tradable ones. In work that motivated the subsequent literature, Amiti and Wei (2009) show that in manufacturing industries, offshoring services has a positive impact on labour and total factor productivity (more so than for goods offshoring).

There is a broader literature on services trade to which this paper contributes. Notably, Breinlich and Criscuolo (2011) use the same trade in services data for the UK to document the characteristics of firms that are engaged in services trade. Jensen (2011) writes comprehensively about the rise of global services trade and how it has materialised across the US economy. Eaton and Kortum (2018) show that gravity models holds for services trade data, while Head et al. (2009) estimate that the costs of distance in trading services are large but declining over time. Gervais and Jensen (2019) use a novel method of comparing production and use of services in US regions to impute values of trade in services. They show that services value added is unevenly distributed across regions and that labour productivity and wages are higher on average for tradable industries. I contribute to this literature by presenting new facts on services trade, including the firm and LLM services trade premiums at the worker level, and a decomposition of the margins of growth of services trade, as well as by examining margins of labour adjustment to services imports.

There is a vast literature on the labour market effects of international trade and offshoring of goods. Looking at the effect of import competition from China, Autor et al. (2013b) estimate that US commuting zones (LLMs) which are relatively more exposed to Chinese growth experience declining employment in manufacturing and a fall in wages.[4] Other research has looked at worker-level adjustments to the China shock, showing that workers initially employed in industries or LLMs exposed to the shock suffer in terms of their long term employment and wage outcomes (see Autor et al. (2014) for US, De Lyon and Pessoa (2021) for UK, and Utar (2018) for Denmark). Turning to offshoring, Hummels et al. (2014) use data for Denmark to estimate the firm-level effects of offshoring and exports of goods. They show that within job spells (i.e. a worker-firm match), offshoring increases high skill wages and reduces low skill wages, while exporting increases the wage

[4]Fort et al. (2018) summarise evidence on the causes of the decline in US manufacturing.

of all skill types.[5] Fort (2017) finds evidence that when manufacturing firms adopt new communications technologies, they are more likely to fragment their production process, but only with high income countries (as well as domestically) and not with low income income countries. Finally, Costa et al. (2019) use the currency depreciation that followed the UK's decision to leave the EU as a shock to the cost of intermediate imports (as well as an export depreciation), which allows them to examine both goods and services industries. They find that workers in the sectors more exposed to the increase in the costs of intermediate imports experienced lower wages and reduced training.

The remainder of the paper is structured as follows. Section 2.2 outlines the data used in the paper and presents descriptive evidence on the prevalence of services trade and its growth as well as the labour market characteristics of exposure to services trade. Section 2.3 discusses the estimation of the relationship of interest and the identification strategy. Section 2.4 presents the results and Section 2.5 concludes.

2.2 Data

I use a rich set of administrative and survey data on workers and firms in the United Kingdom between 2003 and 2016 provided by the Office for National Statistics (ONS). In this section, I first outline the key characteristics of each dataset used in the analysis and how they are aggregated to the LLM level. I then document descriptive statistics in the data.

2.2.1 Datasets

Information on services trade is from The International Trade in Services Survey (ITIS), which is an annual survey of firms conducted by the ONS and used to inform the UK's

[5]Hummels et al. (2018) review the literature on the labour market effects of offshoring.

Balance of Payments account and GDP statistics (Office for National Statistics, 2019c).[6] Surveyed firms record the value of their services imports and exports by the partner country and by service "product". ITIS includes around 16,000 businesses each year, including a panel of core contributors and larger firms. Firms that report a total value of services trade above a certain threshold will be surveyed in subsequent years. The sample excludes firms in the financial sector - that is, firms whose main industry is financial - although firms in sectors that are surveyed do report their trade in financial services.[7] Firms in the transport, travel, and higher education industries are also omitted, as well as many in the legal industry.

In 2017, ITIS covered around 59% of the total value of UK services exports and 48% of imports in the UK's Balance of Payments Trade in Services Account (Office for National Statistics, 2021b), with the remaining amounts accounted for by the omitted sectors discussed above as well as other services such as tourism which are not included in ITIS. For the balance of payments categories that predominantly contained producer services (the focus of this paper), Breinlich and Criscuolo (2011) report that ITIS covered 70% of exports and 85% of imports for their sample period (2000 to 2005).

The focus of the survey is on producer services - i.e. those which are typically used by UK firms in production and which are most relevant for the questions addressed in this paper. As with all services trade data, the product classifications are coarse. In this paper, I aggregate the service product categories to 16 service categories that are consistent over the sample period and can be matched to the UN eBoPs classifications.[8]

[6]The data is collected at the ONS "reporting unit" level which, for the vast majority of units, corresponds directly to the firm level. I aggregate remaining cases up to the firm level, defined as an enterprise by ONS.

[7]For example, if a manufacturing firm imports financial services from USA, this would show up in ITIS but all services trade activity by UK banks is omitted as it is collected by the Bank of England.

[8]I exclude royalties and license fees, government services not included elsewhere, and trade with foreign affiliates that does not fall under the other product categories.

Basic information including employment, industry, and location is available for the universe of business establishments from the Business Structure Database (BSD). The same variables are also available at the level of the firm, as well as additional information on sales revenue and foreign ownership, and plants can be matched to firms. The BSD is mainly derived from the Inter-Departmental Business Register (IDBR), an administrative register of businesses collected by HM Revenue and Customs via VAT and Pay As You Earn (PAYE) records (Office for National Statistics, 2019b).[9] If a business is liable for VAT and/or has at least one member of staff registered for the PAYE tax collection system, then the business will appear in the BSD. Businesses listed in the IDBR account for almost 99 percent of formal economic activity in the UK, with only very small businesses (such as those of self-employed individuals) not included in the register.

I supplement information from the BSD with more detailed firm-level information from the Annual Respondents Database (ARD) and the Annual Business Survey (ABS). These are surveys of approximately 62,000 businesses each year. The sample includes the universe of businesses with more than 250 employees and is otherwise stratified by local area, firm size, and industry, with weights provided to provide representative aggregations by strata. Businesses report a wide range of information, including gross value added, wage bill, expenditure on inputs of services as well as other inputs to production, whether they are a goods importer or exporter (since 2015), and their total value of purchases and sales of services at home and abroad (Office for National Statistics, 2021a).[10]

Worker-level data is available from the Annual Survey on Hours and Earnings (ASHE). It

[9]PAYE is the system that HM Revenue and Customs uses to collect Income Tax and National Insurance contributions from employees.

[10]The latter question is used as a filter for the ITIS sample, with firms responding above a certain threshold being selected for the ITIS sample in that year.

is an administrative dataset covering a one percent sample of employees, selected based on the last two digits of an individual's national insurance number.[11] ASHE is a panel dataset with workers repeatedly sampled each year, conditional on being employed. The resulting dataset contains around 150,000 employees per year. It provides information on workers' wages, detailed occupation, industry, and workplace location. It contains basic worker information such as age, sex, and whether they are a member of a union. It also contains a firm identifier, meaning that workers can be matched with firms in each year.

Finally, I use data on world trade in services from the OECD to construct the instrument. It provides the value of trade at the origin-destination-service-year level. OECD countries report their imports and exports with all countries in the world.[12] The OECD services trade data has the advantage that some checks have been carried out on data quality and it contains detailed product categorisations.

All values are deflated to 2016 pounds using industry specific measures for firm sales and trade values by service, and using a consumer price index for wages.

Throughout this paper, I use local labour markets (equivalent to US commuting zones) as the unit of analysis. I therefore aggregate the datasets described above to the level of ONS Travel to Work Areas which are based on where populations will typically commute and I refer to them as LLMs. Using the BSD plant level information, I have the population of employment by industry in each LLM. Given that ASHE is a random

[11]Much of the data is collected automatically through the PAYE system and the sample is broadly representative of employment in the UK, except for workers on very low pay. Sample weights are provided to account for under-represented cells and non-response and are used throughout the paper. Self-employed workers are excluded.

[12]The data does not include trade flows between two non-OECD countries but this is not a problem for the purposes of this paper. The instrument only requires that OECD countries report trade with all other countries.

sample, it is also representative at the LLM level.[13] Data on international trade in services and sales of the firm are only observed at the firm level, not at the plant level. Yet, it is likely that labour market exposure to services trade is not only transmitted through the location of the headquarter of the firm. Therefore, I distribute firm level values across LLMs according to the (non-retail) employment shares of plants within a firm. [14] I drop a very small number of LLMs where there is no trade in services in the initial period as the instrument is not defined for these LLMs. The final LLM dataset covers around 166 LLMs each period in England and Wales.

2.2.2 Descriptive statistics

This section summarises descriptive trends in the data relating to the evolution of the UK labour market, the growth of services trade and the links between services trade and labour markets.

2.2.2.1 Local labour market summary statistics

Table 2.2.1 presents summary statistics for the first and last years of the sample at the LLM level, weighted by employment of the area. Therefore, for all statistics denominated by employment, the statistics are nationally representative. Unweighted statistics, i.e. simple averages across LLMs, are presented in Table 2.A.1 of Appendix 2.A.2 and the trends discussed below all qualitatively hold when the LLM-level data is not weighted.

[13]One issue that arises with ASHE at the LLM level is that the sample count is small for some small areas. In the baseline analysis, I weight by pre-period employment of each LLM to represent employment across the economy. This also helps to address the issue of heteroskedasiticity introduced by small samples in the smallest LLMs (given that the form of heteroskedasticity is known to be a monotonic function of employment.)

[14]Non-retail establishments are not included when calculating the shares. The rationale is to distinguish between establishments that are likely to be involved in international services trade (for example Vodafone head office) from establishments that are not (for example a Vodafone high street shop).

The share of employment in tradable services industries has risen from 37% in 2004 to 43% in 2016. In contrast, manufacturing employment has fallen from 17% in 2004 to 11% in 2016. The share of workers in routine occupations has declined slightly while the share in tradable services occupations is almost unchanged.[15]

Average gross value added per worker has risen markedly over the period, from £58,000 to £94,000, yet there has been no increase in average wages. Measures of wage inequality based on wage ratios between p10, p50, and p90 within a LLM have declined slightly over the period. This is in line with aggregate trends in the UK over the period (Bell et al., 2021). The wage premium for being at an importer of services in a LLM has increased from 12% to 17% over the period.

The use of services as a share of inputs has declined slightly over the period, while the share of services imports in services inputs has increased from 1% to 4%. The data contains information on the total value of services purchased for resale (domestic or international); this, scaled by services inputs, has remained relatively constant over the period. Firms that import services tend to be large, accounting for 15% of employment in 2004 and 14% of employment in 2016. The share of sales accounted for by importing firms has risen from 18% in 2004 to 22% in 2016. Finally, in 2016, 19% of employment was at foreign multinationals.[16]

[15]Tradable services industries and occupations are defined using a manually created concordance from industries and occupations to traded services categories. For example, the occupation category "Actuaries, economists and statisticians" is matched to the services category "Other business and professional services" and is therefore considered tradable. Routine occupations are defined based on Autor et al. (2003).

[16]23% of firms that import services are foreign owned.

Table 2.2.1: Summary statistics by year

	2004		2016	
Female Share	0.33	(0.04)	0.34	(0.04)
Manufacturing Share	0.17	(0.07)	0.11	(0.05)
Tradable Service Industry Share	0.37	(0.05)	0.43	(0.05)
Collective Agreement Share	0.43	(0.07)	0.27	(0.07)
Routine Occupation Share	0.51	(0.10)	0.45	(0.09)
Tradable Service Occupation Share	0.43	(0.06)	0.44	(0.07)
GVA per Worker (ths)	57.9	(12.6)	94.3	(32.7)
Annual Wage (ths)	33.6	(6.1)	32.6	(5.3)
p90/p50 Wage Ratio	2.14	(0.21)	2.13	(0.20)
p90/p10 Wage Ratio	4.00	(0.65)	3.74	(0.57)
p50/p10 Wage Ratio	1.86	(0.14)	1.75	(0.13)
Importer Firm Wage / Mean Wage	1.12	(0.09)	1.17	(0.11)
Service Inputs / Non-Energy Inputs	0.15	(0.04)	0.09	(0.04)
Services Imports / Services Inputs	0.01	(0.01)	0.04	(0.03)
Services for Resale / Services Inputs	0.05	(0.03)	0.06	(0.04)
Importing Firm Employment Share	0.15	(0.03)	0.14	(0.03)
Importing Firm Sales Share	0.18	(0.07)	0.22	(0.07)
Foreign Owned Share	0.17	(0.04)	0.19	(0.05)
Observations	173		173	

Notes: The table shows the mean and standard errors (in parentheses) for 2004 and 2016. Statistics are weighted by employment.

2.2.2.2 The growth of UK services trade

I now turn to documenting the growth of UK services trade. Table 2.2.2 shows the initial value of imports and the value change in imports between 2004 and 2016 for the 16 services product categories. Overall, the value of UK imports more than doubled over the period, from £18.6 billion to £43.9 billion. In the initial period, the services with the highest import values were computer and information, business and management, architectural, engineering and technical, and research and development. Communications had the largest growth in imports, followed by computer and information, business and management, and research and development. Architectural, engineering and technical had very small growth, despite high initial imports.

Table 2.2.3 shows imports by country (group). The individual country that exports most to the UK is the US. The EU accounted for 44% of UK imports of services in 2004 and just over half of the subsequent growth. Unlike for goods trade, imports from China did not grow substantially over the period in absolute terms. Similarly, while the growth rate of imports from India was high, in absolute terms it still accounts for less than 4% of UK imports of producer services. It is also possible to split imports by the main language of the country in 2004 (using data from the CEPII gravity dataset). Imports from English speaking countries accounted for 35% of all UK imports, almost directly proportional to their share of world GDP (37%). By 2016, imports from English speaking countries accounted for 41% of imports (while their share of world GDP remained relatively constant).

Table 2.2.2: Imports by service

	Imports (2004)	Δ Imports
Computer and Information	2.5	3.9
Business and Management	2.3	3.2
Architectural, Engineering, Technical	2.3	0.2
Research and Development	2.2	3
Other Business Services	1.6	1.9
Merchanting	1.6	0.9
Communications	1.5	4.5
Financial	1.3	2.2
Advertising	1.2	2.2
Legal	0.5	0.6
Accounting	0.4	0.7
Operating Leasing	0.4	0.1
Personal, Cultural, Recreation	0.3	0.1
Construction	0.2	1.2
Insurance	0.2	0.2
Agriculture and Mining	0.1	0.4
Total	18.6	25.3

Notes: Units are 2016 billions of pounds.

Table 2.2.3: Imports by country group

	Imports (2004)	Δ Imports
EU	8.3	12.8
USA	3.7	5.4
Switzerland	0.6	0.9
Japan	0.5	0.4
India	0.3	1.3
Canada	0.2	0.3
China	0.1	0.5
Other	5	3.5
Total	18.7	25.1

Notes: Units are 2016 billions of pounds.

To understand the margins of import growth within and between firms, I conduct a decomposition of growth values following Bernard et al. (2009). The value of growth in any three year period is decomposed into three margins: entry and exit of firms into trade (across firm extensive margin); within firm growth but adopting or dropping a service-country source (within firm extensive margin); and within firm-service-country growth (intensive margin). [17] Table 2.2.4 shows that, aggregating over all three year periods, more than half of the growth in imports comes from within firm-service-country changes. The remainder of the growth is approximately evenly split between the within and across firm extensive margins. This empirical observation provides part of the motivation for the identification strategy used in this paper, discussed in detail in Section 2.3.2.

[17]Note that the entry and exit of firms may be due to the birth or death of the firm or could be that an existing firm begins trading.

Table 2.2.4: Growth Decomposition

	2004-2007	2007-2010	2010-2013	2013-2016	All
Importer Births	5.3	6.5	6.2	6.9	24.9
Importer Deaths	-4.9	-5.3	-5.0	-4.4	-19.6
Net Firm Entry	0.4	1.2	1.2	2.5	5.3
New Service-Country	9.1	7.3	8.7	9.5	34.6
Retired Service-Country	-5.4	-6.0	-9.5	-7.7	-28.6
Net Service-Country	3.7	1.2	-0.8	1.9	6.0
Service-Country Growth	8.4	9.8	9.5	11.4	39.1
Service-Country Decline	-3.6	-8.0	-7.2	-7.1	-25.9
Net Intensive Margin	4.8	1.9	2.3	4.3	13.3
Total Change in Imports	9.0	4.3	2.7	8.6	24.6

Notes: Units are 2016 billions of pounds.

2.2.2.3 Services trade wage premia

To document the cross-sectional wage premia associated with exposure to services trade at both the firm and LLM level, I estimate regressions of the following form:

$$\log Wage_{it} = \beta^j Importer_{j(i)t} + \beta^r \log Imports_{r(i)t} + \gamma_{\mathbf{1}} \mathbf{X_{it}} + \gamma_{\mathbf{2}} \mathbf{X_{j(i)t}} + \gamma_3 X_{r(i)t} + \tau_{\mathbf{t}} + \varepsilon_{\mathbf{it}} \tag{2.1}$$

for worker i at firm $j(i)$ in region $r(i)$ at time t. The outcome of interest is the log of the worker's weekly wage, $\log Wage_{it}$. The regression includes two measures of exposure to trade: $Importer_{j(i)t}$ is a dummy which equals 1 if the worker is at a firm that imports services and 0 otherwise; $\log Imports_{r(i)t}$ is the log value of imports in the worker's LLM. The regression includes three sets of controls. First, $\mathbf{X_{it}}$ is a vector of worker controls including age, age-squared and age-cubed, a dummy for union membership, a dummy for whether the job is full time, a dummy for whether the worker is female, and an occupation-year fixed effect.[18] Second, $\mathbf{X_{j(i)t}}$ includes information about the worker's firm, including log employment, log sales, a dummy for foreign ownership and

[18]Unfortunately ASHE does not contain information on education of the worker. However, it is likely that the included worker and firm controls are highly predictive of education.

an industry-year fixed effect. Finally, $X_{r(i)t}$ controls for the log of employment in the LLM, capturing employment density or city size. I estimate the regression using pooled OLS for two separate periods: 2003-2005 and 2013-2015.

The results are shown in Table 2.2.5. Column 1 does not include the controls and shows that workers at firms that import services earned 11% more than those at non-importing firms in the early period and 19% more in the later period, conditional on their LLM's log imports.[19] In terms of LLM imports, 10% more imports in a LLM is associated with around 0.4% higher wages, conditional on whether the worker is at a firm that trades. Column 2 adds the controls and shows that the positive premia hold, but are smaller in magnitude. Columns 3 and 4 repeat the exercise for exports instead of imports (with equation 2.1 modified accordingly). The export premia are larger than the corresponding import premia. Columns 5 and 6 include both import and export exposure measures together. Comparing columns 2 and 6, controlling for export exposure significantly reduces the import premia. In the early sample, the importing firm premia actually becomes marginally negative.

These results suggest that, in the cross-section, trade in services is associated with differential wages across LLMs and firms. These patterns are likely to be at least partly driven by unobserved factors correlated with engagement in international trade. The following section outlines an empirical strategy to estimate the impact of plausibly exogenous changes in services importing on wage and employment outcomes.

[19]The firm level trade premia also hold within LLMs, i.e. when including a LLM-year fixed effect.

Table 2.2.5: Services trade wage premia

	$\log Wage_{it}$	$\log Wage_{it}$	$\log Wage_{it}$	$\log Wage_{it}$	$\log Wage_{it}$	$\log Wage_{it}$
			2003-2005			
$Importer_{jt}$	0.107***	0.017***			-0.071***	-0.006*
	(0.003)	(0.002)			(0.005)	(0.003)
$\log Imports_{rt}$	0.042***	0.023***			0.019***	0.011***
	(0.000)	(0.000)			(0.001)	(0.001)
$Exporter_{jt}$			0.227***	0.037***	0.279***	0.040***
			(0.004)	(0.002)	(0.005)	(0.003)
$\log Exports_{rt}$			0.038***	0.022***	0.023***	0.013***
			(0.000)	(0.000)	(0.001)	(0.001)
			2013-2015			
$Importer_{jt}$	0.190***	0.059***			-0.022***	0.027***
	(0.003)	(0.002)			(0.005)	(0.003)
$\log Imports_{rt}$	0.044***	0.021***			0.015***	0.009***
	(0.000)	(0.000)			(0.001)	(0.001)
$Exporter_{jt}$			0.284***	0.068***	0.301***	0.050***
			(0.004)	(0.002)	(0.006)	(0.003)
$\log Exports_{rt}$			0.042***	0.020***	0.030***	0.013***
			(0.000)	(0.000)	(0.001)	(0.001)
Controls	No	Yes	No	Yes	No	Yes
N (2003-2005)	440446	401494	440446	401494	440446	401494
N (2013-2015)	445662	440640	444281	439271	442202	437218

Notes: The table presents results for pooled cross-sectional OLS regressions at the worker level. The dependent variable is log wage. The explanatory variables of interest are dummy variables for whether the firm is an importer or exporter, and the log value of imports and log exports of the local labour market. The controls are: age, age2, age3, union, full-time, sex, log employment, log sales, foreign owned, industry-year fixed effect, occupation-year fixed effect.

2.3 Empirical Strategy

In this section I outline the baseline estimating equation and identification strategy. The paper aims to identify the impacts of an exogenous increase in exposure to services imports on a range of labour market outcomes. I focus on LLMs as the unit of analysis for three main reasons. First, LLM boundaries are defined based on local opportunities

for work (equivalent to US commuting zones) and economic migration within the UK is relatively uncommon (Langella and Manning, 2019). Therefore, LLMs provide a natural unit of markets for factors of production. Second, it allows for analysis of distributional and adjustment effects within a labour market. Third, they capture a broad set of effects including the direct impact on exposed occupations and industries as well as the local impact on linked industries and local demand effects (Acemoglu et al., 2016).

2.3.1 Estimating Equation

With this in mind, I estimate the following regression for LLM r at time t:

$$\Delta_3 Y_{rt} = \beta \frac{\Delta_3 Imports_{rt}}{Employment_{r,t-3}} + \boldsymbol{\gamma} \boldsymbol{X}_{r,t-3} + \tau_t + \varepsilon_{rt} \tag{2.2}$$

The regression is specified in three year stacked differences (2004-2007, 2007-2010,2010-2013,2013-2016), denoted by Δ_3, to allow for medium-term labour market adjustments to materialise.[20] I weight observations by the pre-period (t-4) employment share of the LLM in national employment to be representative of employment outcomes across the UK.[21]

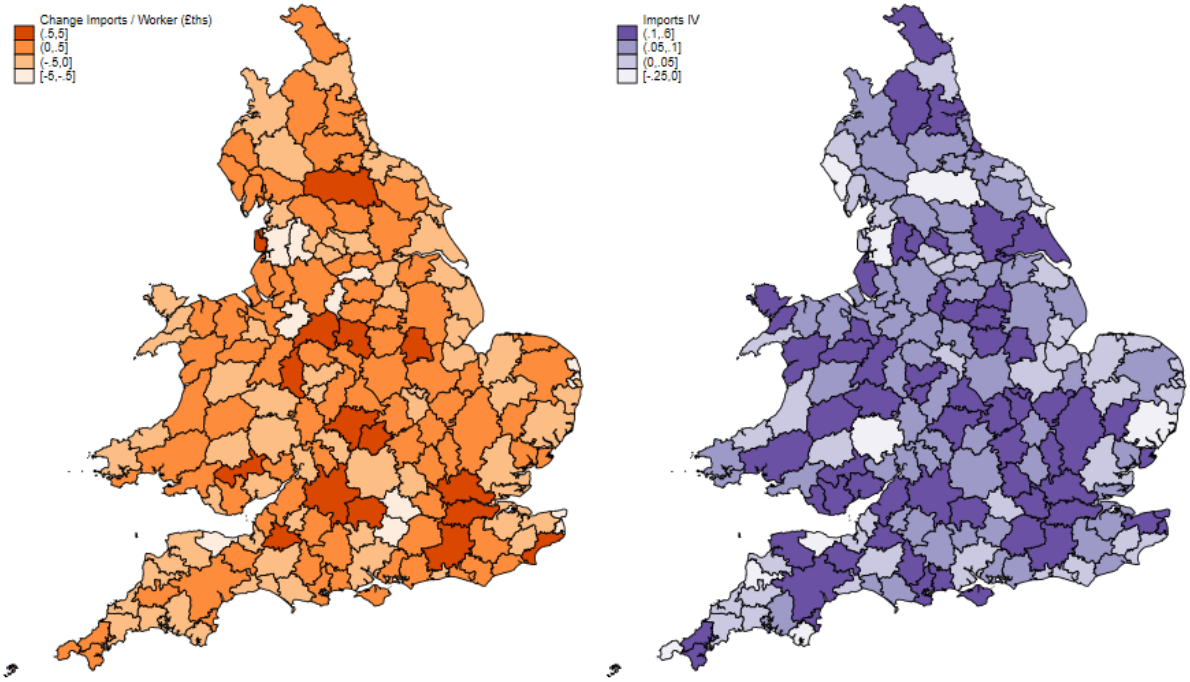
I define the measure of exposure to changes in services imports as the change in the value of imports in the LLM over the three year period, based on the location of business establishments within firms which import services as defined in Section 2.2.1, scaled by the initial employment of the LLM at the start of the three year period. Figure 2.3.1a shows the treatment variable across LLMs in England and Wales for the first period

[20] For example, wages - a key outcome side variable - are sticky and may take more than one year to adjust to the shock.

[21] As discussed above, this also helps to deal with the heteroskedasticity issue induced by the small sample size of ASHE in smaller LLMs.

(2004-2007), measured in thousands of pounds per worker (in 2016 real terms).[22] There is a significant degree of cross-sectional variation in exposure to growth of imports across the country. In particular, the treatment is not only concentrated in London and the South East.[23]

Figure 2.3.1: Instrumental Variable (2004-07)



(a) Change in Imports per Worker (2004-07) (b) Instrumental Variable (2004-07)

The baseline outcome variables of interest are the percentage changes in aggregate employment and average weekly wages.[24] I then exploit the worker-level micro data to estimate the impact of services import growth on wages across percentiles of the wage distribution within a LLM. I consider further cuts of wages according to the type of tasks (non-routine cognitive, routine cognitive, manual) involved in a worker's four

[22]Figure 2.B.1 in Appendix 2.B.1 shows the long change in the treatment variable over the full sample period.

[23]There is also serial correlation in the treatment variable within areas, and I account for this in the clustering of standard errors in the preferred specification, as discussed below.

[24]The estimated coefficients are very similar in magnitude if log changes are used, and qualitatively similar if level changes are used.

digit occupation based on Autor et al. (2003) and the broad occupational group of the worker (managerial, professional, supportive, other). I also look at within-worker wage outcomes whereby the left hand side variable is defined at the worker-level and the changes are for a particular worker over time. This captures the wage effects controlling for composition, and allows analysis of the impacts on workers conditional on their initial status - for example, whether they were initially at a firm that imports services. Finally, I look at cuts of employment according to whether the employer imports services, and by industry group.

The vector $\boldsymbol{X}_{r,t-3}$ represents a set of initial period controls. First, this includes measures of exposure of the LLM to imports of services in the initial period, which are captured by the share of employment in tradable services industries and the share of employment in tradable services occupations, as well as the share of employment at foreign owned firms and the share of routine occupation employment. Second, I control for initial employment characteristics of the LLM, including the share of employment initially in tradable service occupations (defined based on a manually created concordance of services products to occupation codes) and the share of employment in key industries - specifically financial services, telecommunications, and manufacturing. I control for pre-period (t-4) log employment, to capture the differential effects across city sizes, and for pre-period log wage. I present results with and without these controls.[25] Finally, τ_t is a period fixed effect which controls for changes in macroeconomic conditions in each period.

The parameter of interest is β, which measures the marginal percentage change in the outcome of interest $\%\Delta Y_{rt}$ for an increase in imports in the LLM over the three year period of one thousand pounds per worker initially employed, conditional on the

[25]The results are also robust to the inclusion of a LLM fixed effect in the baseline differences equation, which flexibly controls for all observed and unobserved labour market characteristics with a linear time trend.

controls.

The specification is similar in nature to the influential research of Autor et al. (2013b). They relate changes in the value of imports of goods from China per worker in a LLM to the change in manufacturing employment share in the US. One key difference is that they observe national-level trade by industry and use pre-period LLM employment shares by industry to distribute the shocks to LLMs. In contrast, I have firm-level trade in services data and I therefore make use of information on the location of where the trade is taking place. I argue that, at least for services trade, using the location of the firm to measure exposure to changes in services trade is more appropriate. Services are not typically resold, meaning that when firms in an area exogenously increase their imports of services, the effects are likely to materialise locally. Put differently, knowing the location of the firm provides additional information on the extent of the treatment in a LLM beyond the pre-period employment shares in nationally traded products.[26]

Table 2.3.1 presents summary statistics for the LLM level treatment and control variables in the estimation sample. The mean level of imports per worker at the start of each period is £1,000 per worker compared with an average change of £180 over each three year period. The standard deviation of the treatment variable is large relative to the mean, suggesting that there is variation across labour markets, as seen in Figure 2.3.1a.

[26]Ideally I would also like to be able to distribute national service level trade to LLMs based on employment shares as a robustness check. However, the definition of services products, which would need to be mapped to industries, is too coarse so there would not be enough variation in the treatment and, in particular, for identification using the shift-share instrument discussed below.

Table 2.3.1: Estimation sample summary statistics

	mean	sd
Treatment		
Imports / Employment (t-3), £ths	1.00	0.99
(Change Imports) / Employment(t-3), £ths	0.18	0.51
Controls		
Services Occupation Employment Share (t-3)	0.44	0.06
Services Industry Employment Share (t-3)	0.39	0.05
Finance Services Employment Share (t-3)	0.02	0.02
Telecoms Employment Share (t-3)	0.01	0.01
Manufacturing Employment Share (t-3)	0.14	0.07
Foreign Owned Employment Share (t-3)	0.19	0.05
Routine Occupation Share (t-3)	0.48	0.09
Sum Import Shares (t-4)	0.80	0.13
Observations	662	

Notes: The unit of analysis is local labour market by year and statistics are weighted by t-3 local labour market employment share.

2.3.2 Identification

Changes in imports per worker in a LLM are likely to be endogenously determined with respect to labour market outcomes. There is a wide range of unobservable factors that may affect aggregate employment and wages, and the composition of employment and wages, as well as firms' decision to offshore services. For example, the OLS estimator of β could be downward biased if firms in a LLM respond to negative shocks, such as increased output market competition or rising costs, by offshoring to reduce input costs (Antràs et al., 2017; Bernard et al., 2020; Monarch et al., 2017). On the other hand, firms that import services tend to be more productive and pay higher wages, both in the cross section (Breinlich and Criscuolo, 2011) and within firms over time (Ariu et al., 2019), which would lead β to be upward biased. The problem is further complicated by

differential effects for markets for factors within a LLM. For example, imported services tend to be high skill and therefore may displace workers from high wage occupations. Yet optimising firms benefit from a boost to productivity from offshoring which could boost demand for workers in other occupations, meaning that the bias of OLS may differ according to the outcome variable of interest.[27] Finally, given that the treatment variable is constructed by distributing firm-level trade to LLMs based on within-firm business establishment employment shares, it is almost certain that the treatment variable is measured with some error, which will cause β in an OLS regression to be biased towards 0.

I therefore require variation in the treatment variable that is uncorrelated with unobserved shocks to these labour market outcomes. I construct a shift-share instrument which uses a LLM's pre-period service-country import shares as exposure weights to changes in the world export supply of each service by each country. The instrument is broadly analogous to a LLM version of that used in Hummels et al. (2014).

The instrument relies on the empirical observation that the structure of imports by service-country is relatively constant over time. Put differently, it is clear from the growth decomposition of Table 2.2.4 in Section 2.2.2 that the majority of growth of services over any three year period is within firm-service-country, a pattern which also holds at the LLM level. Therefore, the pre-period shares are a good measure of exposure of a LLM to world trade shocks. The exposure shares are defined as the value of imports in a particular service with a particular partner country divided by the total value of

[27]These factors all concern demand for labour, which is more likely to shift over a three year period. Labour supply factors could also bias OLS. An increase in the supply of high skill labour may increase average wages and reduce offshoring of high skill services.

imports in the LLM, written:

$$impshare_{rsc,t-4} = \frac{Imports_{rsc,t-4}}{\sum_{sc \in \mathcal{S} \times \mathcal{C}^*} Imports_{rsc,t-4}}$$

for region r, service $s \in \mathcal{S}$ and country $c \in \mathcal{C}^*$ in the pre-period (t-4). The set $\mathcal{S}$ denotes the set of services discussed in Section 2.2 while $\mathcal{C}^*$ represents a restricted set of countries including all OECD countries, all EU countries, and some rapidly growing economies such as China and India. The country set is restricted to minimise issues with sporadic reporting in the OECD world services trade data. There are also a small number of country and service codes that cannot be matched to the world data, which are also excluded from the sets. To account for the fact that the amount of trade with the restricted country set may differ across LLMs (i.e. restricting the country set induces an incomplete shares issue), I include an additional control variable, defined as the sum of included shares in a labour market in all specifications, following Borusyak et al. (2021a):

$$sumshares_{r,t-4} = \sum_{sc \in \mathcal{S} \times \mathcal{C}^*} \frac{Imports_{rsc,t-4}}{\sum_{sc \in \mathcal{S} \times \mathcal{C}} Imports_{rsc,t-4}}$$

Table 2.3.1 shows that the mean value of this control variable is 0.80, meaning that on average trade with the included countries covers 80% of total trade.

The shocks, or shifters, are the change in the value of exports of service s by country c to a set of other developed countries in the world excluding the UK.[28] The aim is to

[28]I winsorize the shocks at the 1st and 99th percentile. The set of countries included in the other developed countries is restricted to improve the strength of the first stage regressions, mainly based on countries with more consistent reporting in the world trade data. The countries are: Australia, Denmark, Finland, Ireland, Japan, Portugal, and Singapore. This is a similar number of countries to that used by Autor et al. (2013b). Note that the number of countries included in the set of exporters, $\mathcal{C}^*$, is much larger.

capture shifts in the supply of each service from each country which would therefore encourage UK firms to increase their imports of growing service-country pairs. One issue is that services trade is observed in values which capture the product of price and quantity. Clearly, rises in price and quantity are likely to shift UK imports in different directions. To the best of my knowledge, information on world prices by service-country is unavailable. Therefore, I aim to hold prices fixed by deflating values by a service-specific price index available for the UK published by the ONS. The shocks therefore primarily capture changes in the quantity supplied to the rest of the world of each service by each country, aiming to capture a shift in the supply curve.

At the LLM level, the instrument aggregates these shocks using the exposure weights described above:

$$IV_{rt}^{Imports} = \sum_{sc \in \mathcal{S} \times \mathcal{C}^*} \underbrace{impshare_{rsc,t-4}}_{\text{Exposure share}} \times \underbrace{\Delta_3 WorldExportSupply_{sct}}_{\text{Shock}}$$

The instrument is plotted for the first time period in Figure 2.3.1b.

A recent literature outlines properties of shift-share instrumental variables specifications (Borusyak et al., 2021a; Goldsmith-Pinkham et al., 2020; Adão et al., 2019; Jaeger et al., 2018). They provide frameworks for interpreting the identifying assumptions, as well as how to construct the appropriate standard errors. The issue with the standard errors on the two stage least squares (2SLS) estimated for LLM level data is that the instrument is correlated across LLMs with a determinable structure - specifically through the exposure shares.[29]

[29] A highly stylized example is as follows. Suppose Bristol, in the south-west of England, and Sunderland, in the north-east of England, both import a high share of accountancy services from USA in the pre-period. Their values of the instrument will be correlated, but typical approaches to clustering, such as by broad geographic region, would not account for this correlation.

In this paper, I follow Borusyak et al. (2021a) in estimating the regression at the level of the *shocks* (denoted with the subscript *sct*) instead of at the LLM level (denoted with the subscript *rt*). The approach relies on the Frisch-Waugh-Lovell theorem to show that using the exposure weights to aggregate the outcome variables (residualised on LLM level controls) to the level of the shocks and then estimating the regression at the shock level yields the same estimate of β that is obtained from 2SLS on the LLM level regression. This equivalence result is described in more detail in the context of my estimator in Appendix 2.B.2. The shock level estimating equation is estimated by 2SLS and enables the direct inclusion of shock-level controls, discussed later, and an alternative representation of the identifying assumption. It also yields standard errors that are consistent and account for correlation in exposure to the shocks as described above. To transform the outcome variables to the level of the shocks, the LLM-level outcomes are regressed on all variables other than the treatment variable. Then the residuals are weighted using the service-country import shares of each LLM to obtain the shock level representation of the data (more details are in Appendix 2.B.2). The shock level estimating equation for service s and country c at time t is:

$$\Delta_3 Y_{sct}^{\perp} = \beta \left(\frac{\Delta_3 Imports_{sct}}{Employment_{sc,t-3}} \right)^{\perp} + \varepsilon_{sct} \tag{2.3}$$

and can be directly instrumented using the shocks ($\Delta_3 WorldExportSupply_{sct}$). The superscript $\perp$ denotes that the shock level variables have been residualised with respect to the LLM controls. The shock-level first stage plots are included in Figure 2.B.2 in Appendix 2.B.2.

The exclusion restriction necessary for identification requires that the shocks are quasi-randomly assigned to LLMs with respect to labour outcomes, conditional on LLM and shock level controls. At the shock level, the exclusion restriction requires:

$$\mathbb{E}[\Delta_3 WorldExportSupply_{sct} | \boldsymbol{\varepsilon}, \boldsymbol{impshare}] = constant \, \forall \, sct$$

where $\boldsymbol{\varepsilon}$ is the vector of error terms and $\boldsymbol{impshare}$ the vector of import exposure shares for each service-country-year unit. Put differently, the values of the shocks must be uncorrelated with unobservable characteristics that affect labour market outcomes for LLMs exposed to those shocks through their import shares.

Liu and Trefler (2019) develop a model of trade in services tasks which considers three potential factors that shift services offshoring: changes in domestic demand; changes in the cost of offshoring; and changes in foreign costs. The model suggests that only changes in foreign costs provides a shock that is exogenous to domestic labour outcomes. The service-country specific shocks are shifted by relative productivities of each country at supplying a particular service, as well as world demand changes for each service from each country. To the extent that these are exogenously determined with respect to UK labour market outcomes, the exclusion restriction is satisfied.

One potential threat to identification is that there are service-specific technology shocks that are common across countries. For example, a new accounting software developed in USA could be adopted by firms in the UK using accountancy inputs as well as in other countries across the world. If this adoption affects labour outcomes in the UK, such as by substituting domestic accountants or increasing their productivity, and labour markets that import more accountancy services in the pre-period are subject to higher world shocks as a result of this new technology then the exclusion restriction would be violated. To address this concern, I present results that include a service-period fixed effect α_{st} as a control in the shock-level regression, such that the identifying variation comes within

a service across countries.[30] This soaks up any service-specific shocks common across countries, including service-specific demand shocks. This causes a reduction in the estimation precision such that the standard errors are often larger, but the key takeaway is that the estimated coefficients are typically relatively similar.[31]

Another concern could be that the shocks are serially correlated. To address this, I also present results where the first lag of the shock is included as an additional (exogenous) explanatory variable. Finally, a remaining concern could be the activities of multinational corporations who offshore services from business establishments in both the UK and other countries in the world, thus driving both the world export supply and labour market outcomes in the UK. To the extent that they offshore the same service from each country, this would be soaked up by the service-period fixed effect. But if they offshore different services to the same country, the issue may persist. I control for the initial presence of multinationals in a LLM to try to mitigate this effect. I provide further discussion of the identifying assumptions and conditions required for consistency in Appendix 2.B.3.

2.4 Results

This section presents the regression results from the empirical strategy outlined above. The right-hand-side of all of the regressions included has the same structure. Column 1 presents OLS results without LLM controls while column 2 shows OLS with LLM controls. They are estimated at the LLM level and there are 662 LLM-year observations. The remaining columns present results for the IV regressions estimated at the level of the shocks - there are 2013 service-country-period observations. Column 3 shows IV

[30] The identification condition is then $\mathbb{E}[\Delta_3 WorldExportSupply_{sct} | \boldsymbol{\varepsilon}, \alpha_{st}, \boldsymbol{impshare}] = constant \, \forall \, sct$.

[31] Formal Hausman tests could also be conducted on the estimates and will be conducted in future work.

without any controls and column 4 does not include the LLM controls but does include the shock level service-period fixed effect. Column 5 includes LLM controls but no shock controls while column 6 additionally adds the service-period fixed effect. Finally, column 7 is the most stringent specification and includes the LLM controls, service-period fixed effect and the lagged value of the shocks as an additional control.

Column 5 is the preferred specification. The Kleibergen-Paap F statistic is 28.8, above the Montiel Olea Plueger maximal 10% bias critical value of 23.1.[32] the estimated coefficients (δ) on the excluded instrument in the first stage regressions are positive, suggesting that an increase in the quantity of world supply is associated with an increase in UK imports. In the specifications that include the service-period fixed effect, the power of the first stage is reduced, as it relies only on variation across countries within a service-period. The F statistics are therefore smaller and the standard errors tend to be larger. I include these results to show that the estimated second stage coefficients are relatively similar (in a Hausman test sense) when controlling for potentially correlated shocks specific to a service across countries.

The remainder of the section discusses the estimated second stage coefficients for a range of dependent variables. I first document aggregate LLM outcomes: employment, sales and wages. I then show the effects on the distribution of wages, and results which suggest where in the wage distribution these effects are materialising. Finally, I document changes in the composition of employment.

Table 2.4.1 presents the regression results for four dependent variables. Panel (a) column 5 shows that an increase in imports per worker of £1,000 causes an increase in employment of 4%, recalling that the mean change in imports per worker is £180 in a three year period. This is consistent with the productivity effect of importing

[32]The methodology of Montiel Olea and Pflueger (2013) is robust to serial correlation, heteroskedasticity, and clustering.

services outweighing the domestic labour substitution effect (Grossman and Rossi-Hansberg, 2008). There are numerous channels through which this productivity effect may materialise at the LLM level. For example, upstream and downstream industries may benefit from increases in efficiency of offshoring industries, or there may be an increase in demand for workers conducting complementary tasks to imported services. Evidence of this productivity effect is reinforced in Panel (b) which shows that the coefficient on total sales revenue of firms in the LLM is positive although statistically insignificant.

Turning to wages, there is tentative evidence to suggest that an exogenous increase in imports of services reduced overall wages. Panel (c) shows that the estimated effect on the mean weekly wage in a LLM is negative in all IV specifications but is statistically insignificant in the preferred specification (column 5). The dependent variable used in Panel (d) aims to capture the average wage in a LLM controlling for individual-specific characteristics. It is constructed by running a worker-level regression for each relevant year on the full national sample of workers of log wage on worker controls and the full set of LLM dummy variables. The estimated coefficients on the LLM dummy variables capture the conditional mean log wage in a LLM and are used as the dependent variable. The approach follows Kovak (2013). The estimated coefficient in Panel (d) column 5 is statistically significant at the 10% level. Noting that the units in Panel (d) are log wage changes and in Panel (c) are the percentage change in wages, the economic magnitudes of the coefficients in column 5 are very similar, suggesting that an increase of £1,000 in imports per worker reduces aggregate wages by approximately 1.5%.

In Appendix 2.C.1 I present results for within-worker wage changes which make use of the panel nature of the employee data, and additionally control for worker characteristics. The estimated coefficients on within-worker wages, which essentially hold fixed the

workforce composition, are similar to those for overall wages in a LLM. In column 5, the estimated coefficient is -1.77 and is statistically significant at the 10% level.

In the framework of LLM-level aggregate labour demand and supply, such a fall in wages is only consistent with a rise in employment if an increase in imports per worker causes a shift out of the labour supply curve, which seems implausible. In the remainder of the section, I present evidence to suggest that imports of services, which tend to be higher skill, have a negative impact on the wages of high wage workers, and a redistribution of employment across firms (and industries). This redistribution could explain both the fall in average wage and rise in total employment. That is, it is necessary to consider disaggregated markets within the LLM to explain the aggregate LLM effects.

Table 2.4.1: Employment, sales and wages

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel (a)				**%Δ Employment**			
$\Delta Imports/worker$	1.055***	0.654	8.722***	6.259*	4.703**	4.279	4.976*
	(0.393)	(0.451)	(2.046)	(3.432)	(2.168)	(3.144)	(2.999)
Panel (b)				**%Δ Sales**			
$\Delta Imports/worker$	-1.318	2.927***	7.819	3.124	13.956	3.331	4.755
	(2.361)	(0.970)	(5.769)	(7.494)	(10.007)	(8.408)	(9.301)
Panel (c)				**%Δ Wage**			
$\Delta Imports/worker$	-0.255	0.273	-2.794*	-3.257	-1.463	-2.705	-2.916
	(0.371)	(0.536)	(1.503)	(2.206)	(1.742)	(2.159)	(2.246)
Panel (d)				**Δ LLM Log Wage Estimate**			
$\Delta Imports/worker$	0.000	0.000	-0.012***	-0.011	-0.015*	-0.011	-0.011
	(0.002)	(0.003)	(0.004)	(0.013)	(0.008)	(0.013)	(0.013)
1^{st} *Stage Statistics*							
δ			.135	.09	.085	.08	.082
F			214.7	11.2	28.8	9.4	8.6
Estimation	OLS	OLS	IV	IV	IV	IV	IV
LLM Controls		Yes			Yes	Yes	Yes
Shock Controls				α_{st}		α_{st}	α_{st}, lag shock
Dimension	LLM	LLM	Shock	Shock	Shock	Shock	Shock
N	662	662	2013	2013	2013	2013	2013

Notes: Columns 1 and 2 present OLS results at the local labour market level while columns 3-7 present IV results at the level of the shocks (service-country-year). Standard errors are clustered by area in (1) and (2), by country in (3) and (5), and by country-year in (4), (6), and (7).

Table 2.4.2 shows the estimated effects on selected wage percentiles within a LLM. The negative wage effects are driven by the 75th and 90th percentiles. The estimated effects on the 50th wage percentile and below are close to zero and statistically insignificant, as are those right at the top of the distribution (95th percentile). These results suggest that services imports affected workers at the top of the distribution, unlike goods offshoring and import competition which have typically harmed low wage workers and in some

cases benefited higher wage or high skill workers. The rise in services imports over the past 20 years may therefore explain part of the reversal of the trend of rising wage inequality towards the top of the distribution (such as the p90/p50 ratio), which had been rising up until the early 2000s and has been relatively constant since then.

Table 2.4.3 examines wage effects by the tasks involved in an occupation, based on Autor et al. (2003). It shows that the rise in imports of services is associated with a fall in the average wages of workers in non-routine cognitive occupations, which tend to be higher skill. The estimated coefficient for routine cognitive wages is also negative but is insignificant in the preferred specification. Unsurprisingly given the nature of traded services, the coefficients on wages in manual occupations are small and statistically insignificant.

Looking at wages by broad occupational group, Table 2.4.4 shows that the average wage of workers in managerial occupations declines with a rise in services imports, while there is no evidence of an impact on wage changes in other broad occupational groups. One possible explanation for the fall in managerial wages is that the quantity of workers employed in managerial occupations increased and the marginal manager is lower paid than incumbent managers. I find tentative but statistically insignificant evidence of this in my data, but Ariu et al. (2019) find evidence that within firms, an increase in services offshoring is associated with an increase in employment of managers. Such an increase in employment of managers may mean that the average ability or the quality of the occupational match may be lower on average, explaining the lower managerial wage. Put differently, the effects are similar to a LLM-level analogue of the Caliendo and Rossi-Hansberg (2012); Caliendo et al. (2015) model whereby when a firm adds a layer of workers as it expands - for example foreign services workers - the average wage

of existing layers can fall.[33]

Table 2.4.2: Wage changes across the distribution

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel (a)				**%Δ Wage (p10)**			
$\Delta Imports/worker$	0.062	0.640	0.443	0.713	3.409	2.028	0.991
	(0.331)	(0.403)	(2.573)	(2.060)	(2.637)	(1.941)	(1.644)
Panel (b)				**%Δ Wage (p25)**			
$\Delta Imports/worker$	-0.339	0.217	-1.569	-2.507	0.813	-1.593	-2.711
	(0.384)	(0.533)	(2.297)	(1.966)	(2.591)	(1.743)	(1.913)
Panel (c)				**%Δ Wage (p50)**			
$\Delta Imports/worker$	-0.530	-0.041	-0.118	0.145	2.704	1.196	0.392
	(0.408)	(0.612)	(2.312)	(1.647)	(2.570)	(1.481)	(1.676)
Panel (d)				**%Δ Wage (p75)**			
$\Delta Imports/worker$	-0.406	0.079	-4.354**	-5.562*	-3.779	-5.037*	-5.288*
	(0.404)	(0.616)	(1.860)	(2.991)	(2.405)	(2.950)	(3.105)
				%Δ Wage (p90)			
$\Delta Imports/worker$	-0.365	0.338	-6.171***	-6.833	-5.666**	-6.497	-6.259
	(0.465)	(0.662)	(1.987)	(4.481)	(2.751)	(4.282)	(4.152)
				%Δ Wage (p95)			
$\Delta Imports/worker$	-0.039	0.173	-1.494	2.326	-0.464	3.052	3.749
	(0.350)	(0.536)	(1.648)	(3.517)	(2.920)	(3.883)	(3.846)
1^{st} *Stage Statistics*							
δ			.135	.09	.085	.08	.082
F			214.7	11.2	28.8	9.4	8.6
Estimation	OLS	OLS	IV	IV	IV	IV	IV
LLM Controls		Yes			Yes	Yes	Yes
Shock Controls				α_{st}		α_{st}	α_{st}, lag shock
Dimension	LLM	LLM	Shock	Shock	Shock	Shock	Shock
N	662	662	2013	2013	2013	2013	2013

Notes: Columns 1 and 2 present OLS results at the local labour market level while columns 3-7 present IV results at the level of the shocks (service-country-year). Standard errors are clustered by area in (1) and (2), by country in (3) and (5), and by country-year in (4), (6), and (7).

[33]Consistent with this explanation, there is no negative affect on wages when looking at within-worker wage changes for workers initially in managerial occupations at importing firms. Meanwhile, wages of workers initially in "supporting" and "other" occupations at importing firms do decline.

Table 2.4.3: Wage by occupational task

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel (a)			**%Δ Wage (Non-routine Cognitive)**				
$\Delta Imports/worker$	0.017	0.463	-3.678***	-3.920	-3.724**	-4.094	-3.654
	(0.352)	(0.524)	(1.165)	(3.135)	(1.677)	(3.195)	(3.170)
Panel (b)			**%Δ Wage (Routine Cognitive)**				
$\Delta Imports/worker$	0.045	0.637	-2.188*	-2.977	-1.870	-2.790	-2.838
	(0.380)	(0.476)	(1.294)	(3.057)	(1.837)	(3.583)	(3.710)
Panel (c)			**%Δ Wage (Manual)**				
$\Delta Imports/worker$	-0.259	0.320	-0.241	0.025	2.233	0.733	0.548
	(0.415)	(0.517)	(1.090)	(2.001)	(1.420)	(2.151)	(2.305)
1^{st} *Stage Statistics*							
δ			.135	.09	.085	.08	.082
F			214.7	11.2	28.8	9.4	8.6
Estimation	OLS	OLS	IV	IV	IV	IV	IV
LLM Controls		Yes			Yes	Yes	Yes
Shock Controls				α_{st}		α_{st}	α_{st}, lag shock
Dimension	LLM	LLM	Shock	Shock	Shock	Shock	Shock
N	662	662	2013	2013	2013	2013	2013

Notes: Columns 1 and 2 present OLS results at the local labour market level while columns 3-7 present IV results at the level of the shocks (service-country-year). Standard errors are clustered by area in (1) and (2), by country in (3) and (5), and by country-year in (4), (6), and (7).

Table 2.4.4: Wage by occupational group

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel (a)				%Δ **Wage (Managers)**			
$\Delta Imports/worker$	-0.010	0.321	-5.315***	-11.682**	-9.353***	-14.380**	-13.708**
	(0.587)	(0.858)	(0.944)	(5.239)	(1.749)	(6.032)	(6.089)
Panel (b)				%Δ **Wage (Professional)**			
$\Delta Imports/worker$	0.037	0.828	-4.088	1.273	-1.718	3.651	2.964
	(0.622)	(0.763)	(3.067)	(5.281)	(5.052)	(5.988)	(5.868)
Panel (c)				%Δ **Wage (Supporting)**			
$\Delta Imports/worker$	-0.698	0.043	-3.578***	-1.935	-1.944	-0.843	-0.690
	(0.573)	(0.800)	(0.834)	(3.576)	(1.390)	(3.874)	(3.683)
Panel (d)				%Δ **Wage (Other)**			
$\Delta Imports/worker$	0.195	0.405	-0.627	-1.436	1.223	-0.914	-1.235
	(0.319)	(0.453)	(0.973)	(2.013)	(1.173)	(2.221)	(2.387)
1^{st} *Stage Statistics*							
δ			.135	.09	.085	.08	.082
F			214.7	11.2	28.8	9.4	8.6
Estimation	OLS	OLS	IV	IV	IV	IV	IV
LLM Controls		Yes			Yes	Yes	Yes
Shock Controls				α_{st}		α_{st}	α_{st}, lag shock
Dimension	LLM	LLM	Shock	Shock	Shock	Shock	Shock
N	662	662	2013	2013	2013	2013	2013

Notes: Columns 1 and 2 present OLS results at the local labour market level while columns 3-7 present IV results at the level of the shocks (service-country-year). Standard errors are clustered by area in (1) and (2), by country in (3) and (5), and by country-year in (4), (6), and (7).

Turning now to the allocation of employment across firms, Table 2.4.5 shows that the rise in imports per worker caused a redistribution of employment away from importing firms towards firms that do not import services. A rise of £1,000 of imports per worker is associated with a fall in employment at importing firms of 13% and a rise at non-

importers of 7%.[34] This is consistent with the aggregate trend in the economy that, while the share of sales accounted for by importing firms rose over the period, the share of employment at these firms declined slightly.

Table 2.4.5: Employment by trade status

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Panel (a)				**%Δ Employment (Importer)**			
$\Delta Imports/worker$	3.095**	3.807***	-9.416***	-13.203	-13.214***	-9.035	-7.568
	(1.321)	(1.350)	(3.497)	(9.424)	(4.465)	(8.619)	(8.055)
Panel (b)				**%Δ Employment (Not Importer)**			
$\Delta Imports/worker$	0.655**	0.160	10.410***	8.137**	7.009**	5.763	6.224*
	(0.322)	(0.410)	(1.938)	(3.894)	(2.745)	(3.572)	(3.435)
1^{st} *Stage Statistics*							
δ			.135	.09	.085	.08	.082
F			214.7	11.2	28.8	9.4	8.6
Estimation	OLS	OLS	IV	IV	IV	IV	IV
LLM Controls		Yes			Yes	Yes	Yes
Shock Controls				α_{st}		α_{st}	α_{st}, lag shock
Dimension	LLM	LLM	Shock	Shock	Shock	Shock	Shock
N	662	662	2013	2013	2013	2013	2013

Notes: Columns 1 and 2 present OLS results at the local labour market level while columns 3-7 present IV results at the level of the shocks (service-country-year). Standard errors are clustered by area in (1) and (2), by country in (3) and (5), and by country-year in (4), (6), and (7).

The key results of the paper are qualitatively robust to excluding the period of the financial crisis (2007-2010) and to dropping London from the sample. They are also qualitatively robust to including lagged changes in wage and employment in a LLM as controls (and excluding the first time period). The effects on the distribution of wages across percentiles are qualitatively robust to using a measure of wages that partials out observable individual characteristics such as a polynomial in age and a dummy

[34]Note that employment at importing firms accounts for only around 15% of total employment across England and Wales, explaining why the rise in imports is associated with an increase in total employment while the negative coefficient for importing firms is larger than the positive coefficient for the non-importers.

for female. The effects on the distribution of wages are robust to including controls for the pre-period percentiles of wages. One concern with specifying the outcomes in percentage changes is that they can generate extreme values which drive the results, but the results are very similar when specifying the dependent variable in log differences (with coefficients approximately 100 times smaller as expected). The baseline results are also qualitatively robust to including a LLM fixed effect in the baseline differences equation (instead of the lagged LLM controls), which flexibly controls for any linear observed or unobserved LLM-specific effects and suggests that non-random allocation of the shocks across LLMs is not driving the results.

2.5 Conclusion

This paper documents the effects of a rise in exposure to imports of services in a LLM. Total employment increases with imports of services while average wages decrease, driven by redistribution of employment across firms and industries. A rise in imports of services causes a fall in average wages of high skilled non-routine cognitive occupations, and a decline in wages in the top half of the wage distribution.

The results suggest that the labour market impacts of services trade are different to those of import competition of goods, offshoring of goods, and skill or routine biased technological change, but more similar to the predicted impacts of artificial intelligence on the wage distribution.

The results presented in this paper represent the partial effects and miss aggregate general equilibrium effects. For example, there is likely to be an overall fall in the price index as a result of cheaper services imports, which would benefit firms through improved productivity and benefit consumers through lower prices, assuming some pass-through.

The findings have important implications for policy, as global services trade continues to rise. For example, a further round of the General Agreement on Trade in Services (GATS) would have differential impacts across the earnings distribution, and would cause redistribution of factors across firms and industries. On the flip side, Brexit is predicted to cause a fall in services trade in the UK (Dhingra et al., 2017) which would also translate to labour market effects.

Appendix

2.A Data

2.A.1 ASHE

This section outlines the data cleaning process for the ASHE worker panel data. Firstly, I drop all individuals if their earnings were affected by absence based on an indicator included in the data. I exclude any workers that report negative or zero earnings. I exclude workers with total working hours in a week above 168 or equal to 0. I drop a small share of workers with a missing personal identifier.

There are a small number of cases where a worker appears in multiple jobs within a year. To construct a worker-year panel, I deal with these cases by making the following sequential restrictions. First, I keep the observation marked as the main job of the worker. Second, I keep the job with the highest hours worked. Third, I keep the job with the highest earnings. Finally, I remove the jobs marked as part time, where the other is marked as full time.

I winsorize earnings at the top and bottom one percentile. There are some cases in particular years where the LLM codes do not exist, in which case I replace the code with the matched location of the worker's firm.

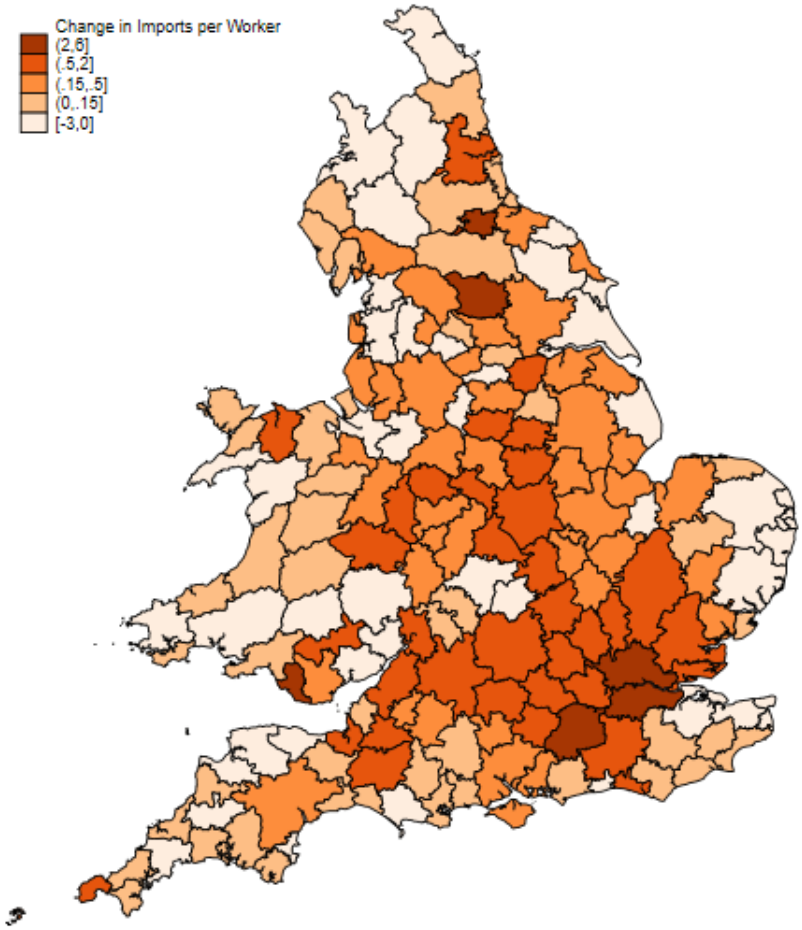
2.A.2 Descriptive statistics

Table 2.A.1: Summary statistics by year

	2004		2016	
Employment (ths)	104	(246)	122	(323)
Female Share	0.32	(0.06)	0.33	(0.05)
Manufacturing Share	0.19	(0.07)	0.13	(0.06)
Tradable Service Industry Share	0.35	(0.05)	0.40	(0.05)
Collective Agreement Share	0.42	(0.10)	0.28	(0.08)
Routine Occupation Share	0.58	(0.09)	0.52	(0.09)
Tradable Service Occupation Share	0.39	(0.07)	0.39	(0.08)
GVA per Worker (ths)	53.1	(12.6)	81.9	(44.8)
Annual Wage (ths)	28.9	(4.5)	28.3	(3.8)
p90/p50 Wage Ratio	2.04	(0.20)	2.00	(0.23)
p90/p10 Wage Ratio	3.56	(0.50)	3.27	(0.48)
p50/p10 Wage Ratio	1.74	(0.16)	1.63	(0.13)
Importer Firm Wage / Mean Wage	1.10	(0.18)	1.16	(0.21)
Service Inputs / Non-Energy Inputs	0.14	(0.05)	0.09	(0.05)
Services Imports / Services Inputs	0.01	(0.02)	0.02	(0.03)
Services for Resale / Services Inputs	0.04	(0.03)	0.05	(0.05)
Importing Firm Employment Share	0.13	(0.05)	0.11	(0.04)
Importing Firm Sales Share	0.16	(0.09)	0.19	(0.09)
Foreign Owned Share	0.14	(0.06)	0.15	(0.07)
Observations	173		173	

Notes: The table shows the mean and standard errors (in parentheses) for 2004 and 2016.

Figure 2.B.1: Treatment: change in imports per worker, 2004-2016



2.B Empirical Strategy

2.B.1 Additional figures and tables

	mean	sd
Treatment		
Imports / Employment (t-3), £ths	0.49	0.76
(Change Imports) / Employment(t-3), £ths	0.07	0.50
Controls		
Services Occupation Employment Share (t-3)	0.40	0.07
Services Industry Employment Share (t-3)	0.38	0.05
Finance Services Employment Share (t-3)	0.01	0.01
Telecoms Employment Share (t-3)	0.01	0.01
Manufacturing Employment Share (t-3)	0.16	0.07
Foreign Owned Employment Share (t-3)	0.15	0.06
Routine Occupation Share (t-3)	0.55	0.09
Sum Import Shares (t-4)	0.81	0.17
Observations	662	

2.B.2 Shock level estimation

The estimating equation at the local labour market (LLM) level is:

$$\Delta_3 Y_{rt} = \beta \frac{\Delta_3 Imports_{rt}}{Employment_{r,t-3}} + \boldsymbol{\gamma} \boldsymbol{X}_{r,t-3} + \tau_t + \varepsilon_{rt}$$

which is weighted by the LLM's share of employment in the country total employment, denoted $EmpShare_{r,t-3}$. The instrumental variable can be written as the exposure-share weighted average of the world export supply shocks:

$$IV_{rt}^{Imports} = \sum_{sc \in \mathcal{S} \times \mathcal{C}^*} \underbrace{impshare_{rsc,t-4}}_{\text{Exposure share}} \times \underbrace{\Delta_3 WorldExportSupply_{sct}}_{\text{Shock}}$$

To translate the regression model to the level of the shocks, first residualise the LLM level outcome and treatment variables by the LLM controls. I denote residualised variables with the superscript $\perp$. For example, for outcome variable$\Delta_3 Y_{rt}$ I regress:

$$\Delta_3 Y_{rt} = \boldsymbol{\gamma} \boldsymbol{X}_{r,t-3} + \tau_t + \Delta_3 Y_{rt}^{\perp}$$

and do the equivalent for the treatment variable. The key result of Borusyak et al. (2021a) is to show that the residualised outcome and treatment variables can be weighted by to the exposure shares $impshare_{rsc,t-4}$ and the LLM weights $EmpShare_{r,t-3}$ to be represented at the same dimension as the shocks. Again focusing on the outcome variable, the shock level measure is:

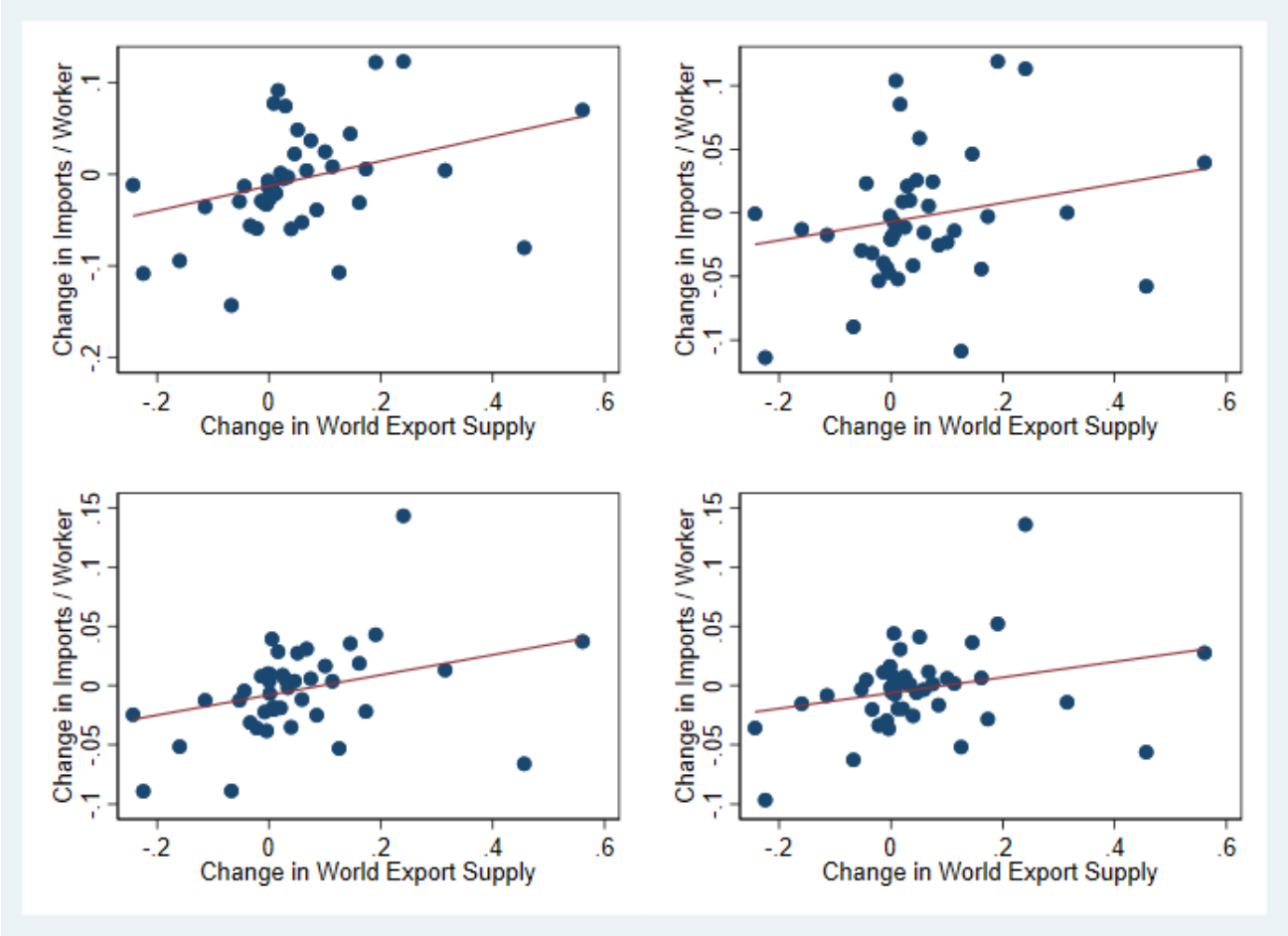
$$\Delta_3 Y_{sct}^{\perp} = \frac{\sum_r EmpShare_{r,t-3} \times impshare_{rsc,t-4} \times \Delta_3 Y_{rt}^{\perp}}{\sum_r EmpShare_{r,t-3} \times impshare_{rsc,t-4}}$$

Given this weighting and having residualised the variables with respect to the controls $\boldsymbol{X}_{r,t-3}$, by the Frisch-Waugh-Lovell theorem, the following shock level relationship

$$\Delta_3 Y_{sct}^{\perp} = \beta \left(\frac{\Delta_3 Imports_{sct}}{Employment_{sc,t-3}} \right)^{\perp} + \varepsilon_{sct}$$

can be estimated by 2SLS to obtain the same estimator of β as the LLM. The shock level regression is weighted by $impshare_{sc,t-4} = \sum_r EmpShare_{r,t-3} \times impshare_{rsc,t-4}$ and the instrument is now just the shocks $\Delta_3 WorldExportSupply_{sct}$. Additional controls at the level of the shocks can also be directly included. In this paper, I present results that

Figure 2.B.2: Shock-level first stages



include a service-period fixed effect and a lag of the shock as controls.

The shock level first stage plots are shown in Figure 2.B.2. The top left panel corresponds to the specification in column 3 (no LLM controls, no shock controls) of the results tables, as outlined at the beginning of Section 2.4. The top right panel corresponds to specification 4 (no LLM controls, service-period fixed effect). The bottom left panel shows the first stage of specification 5 (LLM controls and no shock controls) and the final plot presents the specification in column 6. (LLM controls and a service-period fixed effect).

2.B.3 Identifying assumptions

It is of course impossible to formally test the exclusion restriction. However, it is possible to regress the shocks on LLM characteristics in the initial period. Some of the LLM level controls included in the model are correlated with the shocks. Notably, the initial share of employment in financial services is correlated with the shocks (in the regression without the service-period fixed effect), because financial services tend to grow quickly and labour markets with employment in financial services tend to have systematically different outcomes. In this case, the LLM controls account for this direct effect. Other factors, such as the share of females in a LLM, or the share of employment in routine occupations, are uncorrelated with the shocks.

The concern is that these correlations represent other unobservable factors which may affect identification. In a robustness check, I have included a LLM fixed effect in the baseline differences equation which controls for any observable and unobservable linear trends in a LLM, leaving only non-linear unobservable trends.

Consistency of the shift-share estimator requires that the average exposure to each shock is small and there are many uncorrelated shock clusters, where clustering occurs at the shock level. The mean of the share at the shock level is small - just 0.0037 - meaning that the importance weight of each service-country shock is small. There is a trade-off on clustering. It is likely that shocks are correlated within a country, such as through a country-level policy shock. At the country-year level, the number of shock clusters is well above the suggested threshold of 20 (Borusyak et al., 2021a) in each year. However, it is also possible that shocks are correlated within a country over time, which would suggest a need to cluster at the country level. Then, the effective cluster sample size is below 20. It is also not possible to cluster at the country level in the specifications with the service-period fixed effect as it nests the identifying variation. Where possible, I opt

to cluster standard errors by country.

2.C Additional Results

2.C.1 Within-worker estimation

To estimate the within-worker effects, the estimating equation can be redefined at the level of worker i in LLM r at time t:

$$\Delta_3 Y_{irt} = \beta \frac{\Delta_3 Imports_{rt}}{Employment_{r,t-3}} + \gamma_1 X_{r,t-3} + \gamma_2 W_{i,t-3} + \tau_t + \varepsilon_{irt}$$

where $W_{i,t-3}$ includes age, age-squared, age-cubed, sex, and union membership. The regression can be estimated at the worker level, as are the results presented for the OLS in columns 1 and 2 of Table 2.C.1. Alternatively, the same estimator of β can be obtained from a LLM-level equation, adhering to the Frisch-Waugh-Lovell theorem and first orthogonalising worker wages with respect to the worker level controls and aggregating to the LLM level. For the within-worker regressions, I use the count of workers sampled in ASHE in a LLM as the employment weights instead of using the universe of business establishments in a LLM. These two measures of employment are highly correlated. For the IV regressions, I aggregate workers to the shock level, as in the main regressions. Columns 3-7 of Table 2.C.1 are therefore presented at the shock level.

Table 2.C.1: Within-worker wage effects

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
				$\%\Delta$ **Wage**$_{it}$			
$\Delta Imports/worker$	1.331**	0.355	1.760**	-1.802	-1.771*	-3.604	-3.525
	(0.576)	(0.220)	(0.715)	(1.686)	(1.015)	(2.411)	(2.437)
1^{st} *Stage Statistics*							
δ			.153	.098	.084	.079	.083
F			62.5	13.9	27.1	12.3	12.3
Estimation	OLS	OLS	IV	IV	IV	IV	IV
LLM Controls		Yes			Yes	Yes	Yes
Shock Controls				α_{st}		α_{st}	α_{st}, lag shock
Dimension	LLM	LLM	Shock	Shock	Shock	Shock	Shock
N	79106	79106	2013	2013	2013	2013	2013

Notes: Columns 1 and 2 present OLS results at the local labour market level while columns 3-7 present IV results at the level of the shocks (service-country-year). Standard errors are clustered by area in (1) and (2), by country in (3) and (5), and by country-year in (4), (6), and (7).

Chapter 3

Multinational Enterprises and International Tax Shifting: Evidence from Shutting Down the Mauritius Route to India

with Swati Dhingra and Mathieu Parenti

We are very grateful to Shania Bhalotia, Ning Jia, and Kristen (Dilan) Yang for excellent research assistance.

Abstract

Multinational enterprises exploit gaps in international taxation rules to artificially shift their tax liability to low-tax countries. Huge empirical challenges arise in understanding international tax loopholes due to limited coverage of tax haven countries in available data sources and even more limited experience of plugging tax loopholes internationally. This paper contributes to both these areas by examining foreign investments and international tax loopholes through new administrative transaction data from India. Gravity models of Foreign Direct Investment (FDI) inflows to India show a stark outlier - Mauritius -with which India has a bilateral tax treaty that contained a loophole allowing both Indian and foreign firms to avoid capital gains tax on profits of company sales. In 2016, India and Mauritius agreed to reform treaty, removing the loophole. and changing effective tax rates to investments in India through Mauritius. Following the reform, we show that the volume of FDI flowing to India through Mauritius falls, compared to FDI from other routing countries. Firm-level micro data confirms the finding that foreign investors reduced their investments through Mauritius, with some diversion to investments from other tax haven channels. Indian firms who had received FDI through Mauritius before the policy change did not experience a relative fall in total FDI inflows. Plugging international tax loopholes therefore reduced tax avoidance possibilities without sacrificing the potential to attract foreign investment.

3.1 Introduction

Multinational enterprises exploit gaps in international taxation rules to artifically shift their tax liability to low-tax countries. This enables them to avoid paying tax anderodes the tax base of many economies and leads to an international redistribution of incomes.[1] Historic multilateral policy cooperation has recently advanced to address this growing problem of tax avoidance by global firms. But there are already discussions that it may not succeed in plugging tax loopholes and boosting government revenues, especially in developing countries.[2] Unilateral measures can alleviate some of the inadequacies of international rules, as has been argued in the case of digital services taxes. There is however active debate on the appropriateness of unilateral measures, which some expect will create a double taxation burden on firms and complex international disputes arising from a plethora of different measures from governments across the world.[3]

The share of global investments that go to empty corporate shell companies has risen in recent years and now accounts for 40% of global flows (Damgaard et al., 2019). These investments which are channeled through empty shell companies to make investments in other companies located in other countries is termed "phantom FDI". In the absence of high quality data on economic activity in tax haven countries, pioneering work in public economics and macroeconomics has estimated the scale of profit shifting by cross-examining various data sources, such as mirror flows across sending and receiving countries. Importantly, a growing literature is starting to show that tax loopholes matter for profit shifting and plugging them has direct implications for tax revenues and indirect effects on real economic activity.

[1] https://www.oecd.org/about/impact/combatinginternationaltaxavoidance.htm. Retrieved July 11, 2022.

[2] https://www.project-syndicate.org/commentary/problems-with-global-tax-reform-proposals-by-joseph-e-stiglitz-2021-07

[3] https://home.kpmg/xx/en/home/insights/2021/05/global-minimum-tax-an-easy-fix.html

Understanding tax loopholes and the impacts of plugging them are crucial for designing appropriate international tax policy. But there are still huge empirical challenges in doing so. First, data is often limited by self-reporting and adequate coverage of tax haven countries in available data sources. Second, there have been few episodes of plugging tax loopholes internationally as yet. The bulk of our knowledge therefore comes from plugging tax differences within a single country, rather than from international tax policy externalities across countries. This paper contributes on both these aspects by examining international tax loopholes in India, which is one of the largest recipients of foreign investments, including phantom FDI, in the world.

The paper builds a database of the universe of foreign direct investment transactions into India from administrative sources. The unit of information is a foreign direct investment transaction into a receiving Indian firm from a sending firm in a foreign country. It is mandatory in India for corporations to report transactions to the central bank and this information has been collected for almost an entire decade now. We supplement the transaction-level FDI data with bilateral country-level gravity variables and matched investor and investee firm-level information on the global ultimate owner (GUO) of the multinational group and its associated country of residence.

A first key finding is that 65.4% of India's inward FDI came from countries classified as tax havens between 2010 and 2015. The single largest investor in India was Mauritius, which accounted for 0.016% of world GDP in 2015 but an astonishing 29% of all FDI coming to India between 2010 and 2015. Many commentators have argued that this has much to do with Mauritius' comparative advantage (arising from structural factors like skilled labour and historic ties with India), rather than its status as a tax haven.

We begin by documenting that Mauritius is indeed a huge outlier in the volume of FDI that it was sending to India, even after controlling for a rich set of gravity variables, which

explain about half the variation in FDI inflows to India across source countries, where a source country is defined as the immediate country from which the FDI comes through. Nonetheless, this disproportionate share of Mauritius could be reflecting its relative growth performance or comparative advantage as a source country. Examining inflows at the level of the receiving or sending firm, the estimation can account for a rich set of fixed effects that account for productivity differences across source countries and even firm-level productivity shocks. The microdata confirm the finding that Mauritius-based firms make up a disproportionate share of FDI inflows into India.

The second contribution of our analysis is to link the structure of foreign investment flows directly to international tax loopholes. India and Mauritius have a bilateral tax treaty (BTT) which, until 2017, enabled profits from sales of Indian companies to be reported in Mauritius if the transaction came from a Mauritius-based firm. The treaty has been in place since 1982, before India's New Economic Policy and before Mauritius had emerged as a tax haven. There were no strict requirements to establishing a presence in Mauritius such as demonstrating significant operating costs or employment in Mauritius. This meant that profits on sales of Indian assets made through Mauritius would be taxed at the rate of capital gains tax in Mauritius, 0%, which completely avoids the 10 to 40% capital gains tax that would be charged in India.[4] This generated incentives for "treaty shopping" - whereby foreign investors in a third country, like the United States, would invest in India through a Mauritius-based subsidiary - and to "round tripping" whereby Indian firms would set up a Mauritian subsidiary to avoid capital gains taxes.

In 2016, India and Mauritius agreed to an amendment to the treaty which would remove this loophole.[5]It specified that any sales of Indian assets that had been purchased after

[4]https://www.withersworldwide.com/es-es/insight/investing-into-india-mauritius-and-beyond

[5]A similar loophole in India's tax agreement with Singapore - the second largest investor to India - had been amended in 2005.

April 2017 would be subject to capital gains taxation in India.[6] It therefore reduced the incentives for treaty shopping and round tripping through Mauritius. The paper exploits this plugging of an international tax loophole to examine the impacts on the volume and source of foreign investments coming into India. It finds that there is a robust and large relative fall in the volume of FDI sent to India through Mauritius following the policy amendment. FDI inflows through Mauritius fell by 47.4% relative to investments from other countries (excluding other tax havens), noting that we do not assume that investments from other havens were unaffected by the amendment for this interpretation. There is a fall in the number of Indian firms receiving FDI from Mauritius and a fall in the number of firms in Mauritius investing in India. There is an offsetting rise in the relative value of FDI received through other low tax jurisidications. Notably, these other tax havens do not offer the level and ease of tax avoidance that was available through the BTT with Mauritius. In particular, only the Mauritius BTT lacked a substantial presence test to identify shell companies.

Using an event study design, we show that there was no differential trend in FDI through Mauritius relative to other countries before 2015. There is a spike upwards in investments from Mauritius in 2016 and 2017, when the amendment had been announced but subsequent capital gains on purchases made would still be eligible to be taxed at 0% in Mauritius. Then in 2018, 2019, and 2020 (before the Covid lockdown), there is a clear relative fall in investments from Mauritius. Estimating difference-in-differences regressions at the level of the foreign investor, the main finding is that foreign investments from Mauritius fell after the tax loophole was fully plugged by the amendment to the tax treaty.The results are robust to numerous other specifications, including alternative timings of the sample.

[6]There was an initial phase-in period for sales of firms purchased between April 2017 and April 2019 would be taxed at 7.5% before the full 15% tax rate was implemented.

The tax and investment literature has pointed out that the role of taxes in investments is often confounded with country-level business cycles or productivity differences. Comparing affected and unaffected firms can therefore provide a way of overcoming the omitted variable bias arising from aggregate investment data (e.g. Yagan, 2015). Using data on the network of the foreign investor's subsidiaries, we show that investors with a wider network of affiliates in other tax havens were more likely to reduce their investments through Mauritius.

Finally, we set up the data as a panel at the level of the Indian receiving firm. Indian firms that had previously received investments through Mauritius (before the treaty amendment) received no less FDI in total after the amendment than firms who had not received any investments from Mauritius before the policy change. In other words, the amendment did not seem to reduce the amount of FDI received by Indian firms, at least for the intensive margin of firms that had received FDI before the amendment. This is consistent with the findings that the volume of FDI through Mauritius fell; firms that had received FDI through Mauritius before the amendment had also received less investment from other countries earlier but they started to receive more investments from outside Mauritius after the amendment.

Overall, the results provide evidence that tax loopholes distort observed flows of international investments, with investments being routed through tax havens. We show that plugging tax loopholes has the expected impact of reducing the volume of investments routed through the tax haven relative to through other countries or directly from the owner country. There are concerns among developing countries that plugging tax gaps would reduce the volume of much needed international investment. Unilateral measures would be particularly damaging for attracting investment because of a race to the bottom with other potential recipient countries. Our findings show that neither of these

is necessary. Indian firms did not see a reduction in the foreign investment inflows they had been receiving. There was some diversion to other tax haven sources after the loophole with Mauritius was plugged. But these other tax havens were lower down the pecking order of tax avoidance possibilities that could be exploited by multinational firms.

Related literature The early literature on bilateral tax treaties did not find any impact on FDI flows. Blonigen and Davies (2009) use country-level data to study the impact of BTTs on FDI, finding no evidence that treaty formation promotes new investments. di Giovanni (2005) estimates a gravity model to study the cross-border mergers and acquisitions (M&A) activities in 1990-1999 and finds no significant impact of BTTs on M&A activities. Blonigen and Piger (2014) use Bayesian Model Averaging to identify the relevant covariates to explain FDI flows. They find that double taxation treaties should be included in the covariates for the sample covering the whole world but not for the sample of only OECD countries (where at least one country in the transaction is in OECD). This could be because the benefits are concentrated in countries classified as tax havens.

Blonigen et al. (2014) suggest that the lack of a significant impact of BTTs on FDI flows in country-level studies may be due to heterogeneity of effects across industries. They use firm-level data for the United States from the Bureau of Economic Analysis (BEA). They propose that firms with more differentiated inputs may benefit more from BTTs because, as arms-length prices are difficult to observe, the allocation of earnings across countries is more complex. They find that BTTs increase FDI for firms with more differentiated inputs. Kovak et al. (2021) use BTTs as an instrument for outward foreign investments of US firms in a study of the impact of offshoring on employment. Their first-stage regressions show that BTTs increase the amount of employment at

foreign affiliates in the country of the BTT.

We contribute to the literature on the impact of BTTs on FDI flows by showing its positive impact on FDI flows. Mauritius is a huge outlier in terms of its Indian investments and there was a sharp relative fall in investments through Mauritius after the BTT reduced the possibility of tax avoidance through the treaty. The use of a specific policy change for an influential BTT allows us to identify the role that BTTs play in re-directing FDI.

We contribute to a broader literature on profit shifting of multinationals. Guvenen et al. (2022) show that offshore profit shifting by US multinational enterprises is large in scale and affects several key measures of the US economy. From 1982 to 2016, offshore profit shifting has led to 38 percent of income recorded by US MNEs on their foreign direct investment should have been reattributed to US GNP. Suárez Serrato (2018) shows that removing firms' access to tax havens can reduce firms domestic investment and employment using data on US firms and a restriction on profit shifting to affiliates in Puerto Rico. We show that a loophole in an international tax treaty was causing FDI to be routed through a third country, Mauritius, to reduce exposure to capital gains taxation. Furthermore, it did not appear that Indian firms received any less investment as a result of the change in policy. Delatte et al. (2022) show that gravity models cannot explain the location of around 40% of global foreign assets, which they attribute to the role of tax havens.

Finally, we contribute to the literature on capital gains taxation. Much of the literature on multinational taxation has focused on transfer pricing and debt shifting as channels for profit shifting (Bilicka, 2019; Tørsløv et al., 2022). The findings in our paper point to capital gains taxation as another important channel through which multinationals shift profits across borders and exploit international treaties to do so. Moon (2022)

studies the effects of capital gain taxes on investment in Korea, and found that following a reform in 2014, firms with a tax cut increased investment by 34 log points and issued more equity by 9 cents per dollar of lagged revenue compared to unaffected firms. More generally however, alternative payout taxes need not have a negative impact on investment (Yagan, 2015; Boissel and Matray, 2022). In either case, the bulk of firms affected by the U.S. and South Korea reforms were not foreign investors. In contrast, the variation in our paper is driven by international tax policy differences and their evolution which only affect multinational investors. We show that changing international capital gains taxation rates shifts the patterns of investments across countries but that a change in the effective tax rate faced by firms does not reduce the volume of total investments.

The remainder of the paper is structured as follows. Section 3.2 discusses the India-Mauritius tax treaty, the amendment, and the surrounding policy situation. Section 3.3 describes the data used and the matching procedures. The empirical analysis is contained in Section 3.4. It contains three sub-sections. The first documents that Mauritius is a major outlier in its share of Indian FDI inflows. The second sub-section presents analysis of the impact of the change in policy on the routing country of FDI. Sub-section 3.4.3 presents estimates on the impact of the policy change on the FDI received by Indian firms. Section 3.5 concludes.

3.2 Bilateral Tax Treaties and the India Amendment

Bilateral tax treaties (BTTs) are designed to prevent multinational firms facing double taxation both in their home jurisdiction and in the jurisdiction of their foreign affiliate,

therefore encouraging FDI. An influential literature has highlighted the importance of foreign investment for knowledge spillovers and productivity, especially in developing countries, which often use tax breaks to attract foreign investments (e.g. see Harrison and Rodríguez-Clare, 2010, and Alfaro, 2017, for recent reviews of the literature).

The India-Mauritius BTT was implemented in 1982 with the aim of securing India's strategic interests in the Indian Ocean and its close cultural ties with Mauritius. Over two-thirds of Mauritius's population is of Indian origin, comprising Hindus predominantly (Ganapathi, 2015). The treaty provides for a capital gains tax exemption to a Mauritius resident on transfer of Indian securities but the use of this clause was largely dormant until the 1990s. By 1991, India had opened up to foreign investment following its New Economic Policy. At the same time, Mauritius was emerging as a non-banking offshore jurisdiction with new laws to reduce taxes on Mauritian companies. During this phase of concurrent liberalisation, investors appear to have discovered the tax arbitrage opportunities available under the Treaty (Kotha, 2016). By the early 2000s, official data showed that Mauritius companies were by far the largest investors in India.

As India taxed worldwide income of corporations, the critical tax arbitrage opportunity related to capital gains (rather than corporate income tax arbitrage). Capital gains arising from sale of shares were taxed at 0% in Mauritius and at 10-40% in India based on the type of capital gains accrued.

Article 13(4) of the India-Mauritius BTT enabled a company with a presence in Mauritius that sold its shares of an Indian company to report any capital gains to be taxed in Mauritius, where there is no capital gains tax imposed on sales of foreign equities. This generated two potential routes through which the Indian government would miss out on tax revenue. The first is known as "round tripping", whereby an Indian firm may establish a subsidiary in Mauritius to report capital gains in Mauritius instead of India.

The second is "treaty shopping" in which a company in a third country, such as the United States, looking to invest in India could do so through a subsidiary in Mauritius to avoid the capital gains taxes in both itshome country and in India.

BTTs are notoriously difficult to remove because they require ratification by both signatory countries in their legislative bodies. Successive Indian governments had questioned the legality of the treaty with Mauritius. The landmark case that prompted a change was the acquisition of Hutchison Essar Telecom, one of the largest players in the Indian telecom industry, by Vodafone, the UK-headquartered telecommunications multinational, in April 2007 for 11.2 billion USD. The sale was transacted through a Dutch subsidiary of Vodafone, Vodafone International Holdings, to a Cayman Islands shareholding group of Hutchison Essar Telecom, CGP Investments, which was itself immediately owned by Hutchison International (also resident in Cayman Islands). CGP Investments had been established in 1998 and purchased by Hutchison International in 2006 when Hutchison Whampoa, the Hong Kong based ultimate owner of Hutchison International, decided it would sell its stake in the Indian firm Hutchison Essar Telecom. The Indian tax authority claimed that the transaction is liable to taxation in India because it is a sale of an Indian asset, and Vodafone contested this in court. The Indian Supreme Court ruled in favour of Vodafone, prompting the Indian government to review its international taxation laws and bilateral agreements.[7]

Since no part of the Vodafone-Hutchison transaction was registered as involving an Indian company, it is not even considered FDI and does not fall under the purview of taxation in India, and is therefore not included in Indian official FDI data as a direct transaction. Nonetheless, official FDI data which we have compiled confirms that 78 transactions, worth a total of over 12 billion US dollars, feature Vodafone as either

[7]https://timesofindia.indiatimes.com/business/india-business/Vodafone-Hutchison-deal-Vodafone-wins-Rs-11000-crore-tax-case/articleshow/11566027.cms

the Indian firm or the immediate investing firm (or includes Vodafone in the name of the transaction - to capture its direct subsidiaries). Of these, 76 transactions involved Mauritius as the source country, while the remaining two were with Singapore.

The salience of the Vodafone and related cases and growing public dissent over tax corruption shifted the tide of government action on the treaty. Previously, various court judgements and government clarifications over the treaty had put attracting "scarce foreign capital or technology" over the conflicting goal of widening the tax base (e.g., Azadi Bachao Andolan in 2003).[8] The election of Prime Minister Narendra Modi's government changed this.

The new government came to power on the promise of action on dirty money stashed abroad.[9] In 2015, Prime Minister Modi visited Mauritius and by 2016, India and Mauritius had signed a protocol amending the 1982 India-Mauritius income and capital gains tax treaty.[10] Article 13 of this amended protocol, which covers capital gains taxes, states that:

> 3A. Gains from the alienation of shares acquired on or after 1st April 2017 in a company which is resident of a Contracting State may be taxed in that State.
>
> 3B. However, the tax rate on the gains referred to in paragraph 3A of this Article and arising during the period beginning on 1st April, 2017 and ending on 31st March, 2019 shall not exceed 50% of the tax rate applicable on

[8]See the Supreme Court judgement in Union Of India And Anr vs Azadi Bachao Andolan And Anr on 7 October, 2003. Azadi Bachao Andolan translates directly to The Campaign to Save Independence, which was a movement started by nationalist activists to protect Indian industry from multinational corporations that were seen to be gaining ground from increased globalisation in the 1990s.

[9]See Forbes 2016 for a succinct overview. http://www.forbesindia.com/blog/economy-policy/india-mauritius-tax-treaty-an-end- and-a-new-beginning/

[10]The following articles were amended: Article 5 (permanent establishment), Article 11 (interest), Article 13 (capital gains), Article 22 (other income) and new articles are added: Article 12A (technical fees), Article 26A (collection of taxes), Article 27A (limitation of benefits).

such gains in the State of residence of the company whose shares are being alienated.

This means that for transactions made between April 2017 and April 2019, any capital gains on the eventual sale of an Indian company stemming from new investments from a Mauritius company will be taxed at half of the Indian rate (currently 7.5%). Sales of companies purchased after April 2019 will be charged the full rate (currently 15%). All investments made before April 2017 will not be impacted. Note that the initial purchase date of the firm is the relevant criteria, not the eventual sale date of the firm.

According to Article 27 of the protocol, which specifies the conditions under which Article 13 applies, the partial tax relief on transactions made between April 2017 and April 2019 does not apply to purchases made by shell companies. It states that companies in Mauritius must have more than 1.5 million Mauritian Rupees in operations expenditure in Mauritius or be listed on the stock exchange of Mauritius in order to benefit from the tax relief.[11] Specifically, it states:

> 1. A resident of a Contracting State shall not be entitled to the benefits of Article 13(3B) of this Convention if its affairs were arranged with the primary purpose to take advantage of the benefits in Article 13(3B) of this Convention.
>
> 2. A shell/conduit company that claims it is a resident of a Contracting State shall not be entitled to the benefits of Article 13(3B) of this Convention. A shell/ conduit company is any legal entity falling within the definition of resident with negligible or nil business operations or with no real and

[11] While it is clear that the limitations on benefits clause applies to investments during the phase-out, it is a bit less clear whether it would apply to shares acquired before the amendment but sold after. Most interpretations suggest early investments are entirely grandfathered, meaning it qualifies for the previous tax exemptions.

continuous business activities carried out in that Contracting State.

3. A resident of a Contracting State is deemed to be a shell/conduit company if its expenditure on operations in that Contracting State is less than Mauritian Rs.1,500,000 or Indian Rs.2,700,000 in the respective Contracting State as the case may be, in the immediately preceding period of 12 months from the date the gains arise.

4. A resident of a Contracting State is deemed not to be a shell/conduit company if:

(a) it is listed on a recognized stock exchange of the Contracting State; or

(b) its expenditure on operations in that Contracting State is equal to or more than Mauritian Rs.1,500,000 or Indian Rs.2,700,000 in the respective Contracting State as the case may be, in the immediately preceding period of 12 months from the date the gains arise.

The protocol applies to capital gains on equity sales but does not apply to other derivatives such as mutual funds, exchange-traded derivatives and convertible or non-convertible debentures.

The bilateral amendment of the treaty was also made possible to some degree by the general shift in international tax policy during the period. In 2016, over 100 jurisdictions concluded negotiations on the Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting ("Multilateral Instrument" or "MLI"). Mauritius overhauled its own tax laws following pressure from international institutions. It removed its Global Business License 1, the form of shell company

that many nations argued was a tool for tax avoidance. It subsequently also put in place requirements for investing firms to have a reasonable level of local employment and a physical office in Mauritius to benefit from its tax treaties and low tax rates.[12] Importantly, however, the bilateral tax treaty between India and Mauritius was left outside the scope of the MLI by Mauritius and the provisions of the MLI for curbing treaty shopping did not enter into effect before 2020 in India. Overall, the multilateral development on tax avoidance influenced the decision to amend the BTT but it did not have any direct bearing on treaty clauses until after our sample period.

The treaty with Mauritius was not the only treaty that India reformed in 2016. The 3rd protocol amending the 1994 India-Singapore treaty was signed in 2016. It grants a capital gains exemption in a very similar fashion to that of the Mauritius amendment, with the same phase-out. However, the Singapore treaty had already been amended in 2005 to include a provision on capital gains tax to avoid treaty shopping. See Appendix 3.A for more detail on the India-Singapore treaty and its amendments.

To summarise, profits on sales of firms are subject to a capital gains tax. Before the amendment, foreign investors could make firm purchase transactions through Mauritius and be subject to no capital gains tax on profits according to the treaty. The amendment to the treaty stated that any sales on firm assets that had been purchased after April 2017 would now be subject to the tax.

In events that followed, the International Consortium of Investigative Journalists (ICIJ) released the Mauritius Leaks in 2019 - information from a whistleblower on how multinationals were using Mauritius to avoid tax. One Indian company implicated in the leaks was Greenko, a green technology and energy storage company. Headquarterd in Hyderabad, India, Greenko subsidiaries in India received 17 investments from "Greenko

[12]https://www.icij.org/investigations/mauritius-leaks/treasure-island-leak-reveals-how-mauritius-siphons-tax-from-poor-nations-to-benefit-elites/

Mauritius" over the period 2010 to 2019 to the value of 555 billion USD (Greenko's largest external investors are the Government of Singapore and the Abu Dhabi Investment Authority). Figure 3.2.1 shows the values of FDI into India by country for the periods 2010-2015, before the amendment was agreed, and 2018-2020 Q1 after the treaty had been amended. Before the amendment, Mauritius accounted for 29% of all FDI into Mauritius. After the amendment, it had fallen by a third to under 20%. Singapore, Netherlands, United States, and Cayman Islands all rose as a share of investments to India.

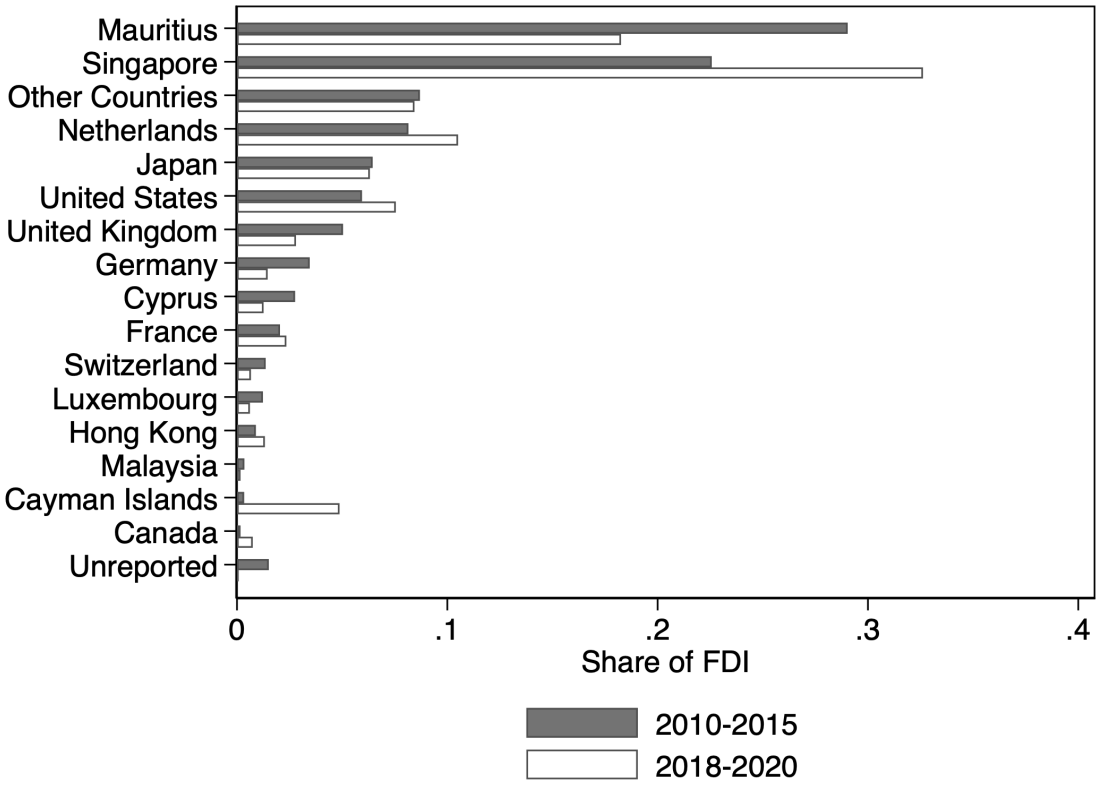
These patterns of reduced sourcing from Mauritius are evident in specific case studies. For example, Naspers, one of the leading technology investment firms worldwide, invested nearly 1.5 billion USD in India between 2010 and 2020, either directly or through one of its subsidiaries. Before 2018, more than 92% of its investments to India were made through Mauritius. Since 2018, it has made over 1 billion USD of investments, with less than 1% made through Mauritius. Instead, the investments have mainly been made through the Netherlands and United Kingdom.

In the analysis that follows, we examine these patterns systematically to understand the role of tax havens and plugging tax loopholes in attracting international investments.

3.3 Data

In this section, we describe the datasets used as well as the processes for cleaning and matching firms across data sources.

Figure 3.2.1: FDI by immediate/routing country



Note: The chart plots the share of FDI flows into India by country in the period 2010-2015 and 2018-2020. Data is from DIPP.

3.3.1 DIPP

We use administrative investor-investee data on FDI inflows to India by source country covering 2010 to the first quarter of 2020.[13] The data is published by the Department of Industrial Policy and Promotion (DIPP) at the Ministry of Commerce and Industry through the Secretariat for Industrial Assistance (SIA) newsletter as a PDF which we

[13]The data are available back to 2005 but we choose to omit the period of the Global Financial Crisis and the liberalisation reforms of 2001 to 2006 studied in (Bau and Matray). We stop at Q1 2020 as India went into lockdown on 25th March 2020.

While the data is available monthly up to 2015 and then quarterly, we aggregate to yearly for the analysis here.

download and digitise for each month or quarter. It provides the value of the FDI transaction, the immediate country from which the FDI was received, the name of the Indian firm receiving the investment, and the name of the foreign investor firm. The data provide a near-complete list of inward FDI transactions to India that can be aggregated to very closely match government-published statistics, as well as OECD statistics on Indian FDI.[14] The data has been used in Indian policy reports (Rao and Dhar, 2016; Jaiswal, 2017) but to the best of our knowledge we are the first to use it for academic research.

The data include only FDI transactions, not foreign portfolio investments. However, the definition of FDI by the Indian government is broad and follows international standards from April 2012 onwards. Specifically, it states that FDI "is the investment through capital instruments by a person resident outside India (a) in an unlisted Indian company; or (b) in 10 percent or more of the post issue paid-up equity capital on a fully diluted basis of a listed Indian company".

Some foreign investments can be made without government approval (84% of observations) while some require government approval (2% of observations) and can also be made through acquisition of company shares (the remaining 14% of observations). Foreign investments can be made through a variety of capital instruments: equity shares; debentures; preference shares; and share warrants issued by the Indian company, with equity making up the vast majority of the foreign direct investment stock (RBI Bulletin January 2022).

[14]Some data is missing for December 2011, April 2013 and May 2014 due to poor quality of files.

3.3.2 Orbis

While much of our analysis relies on the DIPP data, we also use the Bureau van Dijk Orbis data to get information on firm characteristics of investors and investees in the DIPP database. We obtain historical yearly information on the firm's name, revenue, employment, industry, and country from the data store at the London School of Economics and Political Science (LSE). This data covers the period 2010-2018 and is for all firms in the Orbis database worldwide - approximately 400 million firms. We supplement this with data on the global ultimate owner (GUO) of firms which we extracted from the Orbis web. This information is only available to us for a contemporaneous snapshot but provides information on the full affiliate network of GUOs as well as the country that the GUO is registered to. Unfortunately, the variables are missing for some firms in some years. We discuss the use of the Orbis data, as well as its representativeness and limitations, in the following sub-section.[15]

3.3.3 Firm name cleaning and matching

The firm names reported in the DIPP FDI data are very noisy, containing spelling mistakes, different spellings of the same firm, and different versions of firm suffixes such as "PLC" or "Private Limited Company". This causes issues when constructing firm counts, conducting within-firm analysis, and when matching datasets. To address this issue, we proceed in three steps, summarised here and discussed in detail in Appendix 3.B.[16]

First, we conduct basic string cleaning on both the Indian firm and foreign investor

[15]We are in the process of gaining access to a more complete version of the Orbis database which contains more variables and more complete coverage over the full time period of the analysis, including yearly information on the GUO.

[16]We use parallel processing implemented using Vega Yon and Quistorff (2019).

firm names from the DIPP data, as well as on the Orbis data for consistency. This includes cleaning double and trailing spaces, removing special characters, correcting common spelling mistakes, and removing unhelpful suffixes. For the Indian firms, there are 43,713 unique firm names before the cleaning and 38,536 after cleaning. For the foreign investors, there are 75,150 unique firms before cleaning and 61,725 after cleaning. Note that there are more foreign firms than Indian firms as each Indian firm may receive investments from multiple foreign firms, either within a year or over time, and this occurs more than a unique foreign firm investing in multiple Indian companies.

Second, we conduct a preliminary match of the cleaned DIPP firm names to the cleaned Orbis firm names. Given the very large number of firms in Orbis and the computational requirements of complex matching algorithms, the preliminary match reduces the feasible set to conduct more complex matching algorithms, which are computationally intensive. The preliminary match collects all pairs of firms that have either: (1) the same first word; (2) the same first 10 characters (excluding spaces); or (3) are above a threshold of phonetic similarity calculated using the soundex score. We only consider potential matches within the same country (in DIPP and Orbis) and with the same first letter to drastically reduce the dimensionality.[17]

Third, for the candidate matches produced in the previous step, we compute additional similarity scores using gram-based algorithms, the Levenshtein distance, and the Jaro-Winkler distance. We combine these with scores assigned to each of the similarities in the previous method. We then apply a sequential decision rule on the scores to get a many to one match from firms in the FDI data to firms in Orbis.[18] We manually check for false positive and false negative matches and find very few.

[17]We use the dtalink command developed by Kranker (2018).

[18]We make use of commands to implement these methods developed by Raffo (2015), Barker and Pöge (2012), and Feigenbaum (2014).

For Indian firms that received foreign investments, we match around 90% of the value of FDI in each year to a corresponding Indian firm in Orbis, and around 70% of the value can be matched to a GUO (because GUO information is missing for some firms in Orbis). The share of value that is matched is relatively constant over time, shown in Figure 3.B.1 of the Appendix.[19] Some of the unmatched value of FDI is likely to be investments made by individuals, which would be included in DIPP but are unlikely to be included in Orbis. The share of value matched for foreign firms is similar and shown in Figure 3.B.2. Table 3.B.1 in the Appendix presents summary statistics for matched and unmatched observations, where an observation is at investor-investee-country-year level. Unmatched transactions are on average smaller than matched observations. The share of value matched to Orbis is similar across investor countries, although there is more variation across countries for the GUO match, shown in Table 3.B.2 of the Appendix. We use the matched Orbis firm names as firm identifiers in the analysis of this paper.

3.4 Empirical Analysis

In this section, we present empirical results on the role of bilateral tax treaties on FDI flows to India. In particular, we show that a high volume of FDI flows to India come from Mauritius and that this is not explained by standard gravity variables. Then, following the reform to the BTT that reduced the tax advantage of routing FDI to India through Mauritius, there is a robust relative fall in the volume of FDI flowing to India through Mauritius. Finally, we show that Indian firms who had received FDI through Mauritius before the policy change did not experience a relative fall in total FDI inflows because they received a relative rise in FDI from other countries.

[19]Note that because our historical Orbis data ends in 2018, the share of matched firms declines slightly in 2019 and 2020 because new small entrants will not be in the data.

3.4.1 Tax policy as a source of comparative advantage

Gravity regressions have been shown to fit well for FDI flows (Head and Mayer, 2014; Head and Ries, 2008; Portes and Rey, 2005), without including information on whether the country pair has a tax treaty. The early literature on BTTs typically did not find a role for BTTs in explaining FDI flows (di Giovanni, 2005; Davies et al., 2009), although more recently Blonigen et al. (2014) do find a positive impact of BTTs on FDI flows.

In this section, we estimate a cross-sectional gravity regression for Indian FDI at the investor country level. Specifically, we estimate by OLS:

$$\log(Y_c) = \beta \, \mathbf{X_c} + \varepsilon_c \tag{3.1}$$

Where Y_c is the total value of FDI received in India from country c over the period 2010-2015 and X_c is a vector of controls obtained from the CEPII database (Head and Mayer, 2014). These controls include: log distance; log population; log GDP; log common religion index; a dummy for common official or primary language; a dummy for common colonizer after 1945; a dummy for the presence of a regional trade agreement; a dummy for whether the partner is a member of the European Union; and a dummy for whether the country is in the WTO.[20]

The results from this regression are shown in Table 3.C.1 of the Appendix. The included variables explain half of the cross-sectional variation in FDI flows in the data.

[20]We can also include a control for the value of trade flows between the country and India. It does not make much difference to the estimates of the other coefficients or to the total amount of variation that is explained, as shown in Table 3.C.2 of the Appendix. We therefore omit it because we want to include India in the sample for the GUO level regressions shown in the Appendix and, since we do not observe trade flows between India and itself, we would have to drop it from the sample.

Notably, when looking at the residuals of each country, the value of the residual for Mauritius is far higher than that for all other countries. To construct the residuals such that each observation does not influence the estimated coefficients, we estimate equation 3.1 for the subsample of countries excluding country c^* then use the estimated parameter vector $\hat{\beta}$ multiplied by the values X_{c^*} to get the predicted value Y_{c^*} from which we can estimate $\hat{\varepsilon}_{c^*}$. We plot the estimated residuals in Panel (a) of Figure 3.4.1, showing that a far higher volume of FDI into India comes through Mauritius than is predicted by a broad set of gravity, economic, social, and trade policy variables.[21] Panel (b) of Figure 3.4.1 shows a graphical representation of the regression estimates, plotting the value of FDI residualised on all control variables other than GDP, against GDP residuals on those same variables. It shows that, while Mauritius has a relatively average GDP controlling for other factors, its investments into India are far above predicted.[22]

Figure 3.C.3 of the Appendix repeats the analysis but uses the country of the GUO's headquarter reported in Orbis instead of using the country of the affiliate through which the FDI is routed. Doing this, Mauritius is no longer the biggest outlier, although its residual is still large because some firms still report Mauritius as the headquarter of the GUO. The country with the largest residual when using the country of the GUO is India, suggesting evidence of round tripping.[23]

3.4.2 FDI flows after the policy change

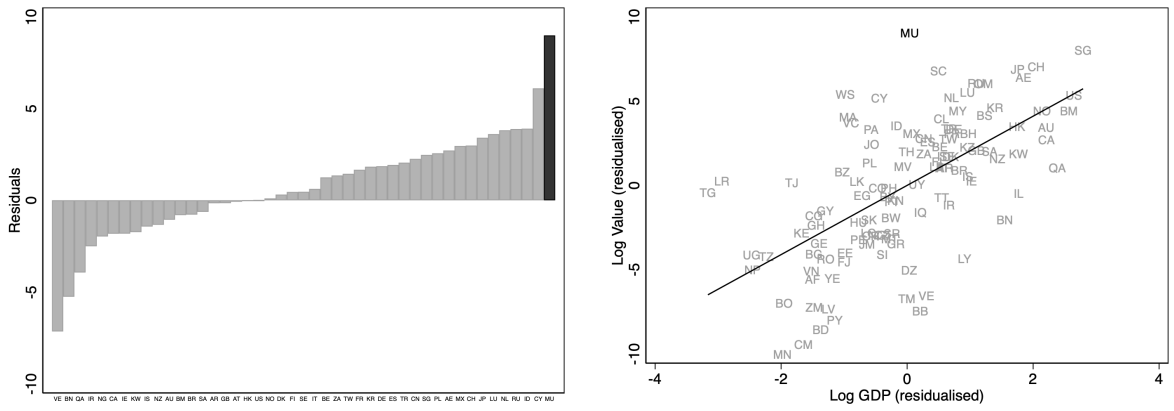
In this section, we estimate the effect of a withdrawal of an exemption on capital gains taxes for Mauritius-based firms investing in Indian firms.

[21] In the plot, we only include countries that are either in the top 20 globally by GDP or by GDP per capita, or are listed as a tax haven.

[22] Table 3.C.2 shows the predicted residuals and regression line for a standard single regression with all observations in one sample. The results are not qualitatively different. We have also estimated the gravity models non-parametrically and the ranking of residuals does not change significantly.

[23] Jaiswal (2017) also match the firm-level DIPP data to the home country of the firm and find that the value from Mauritius is smaller than is suggested by using the GUO country in Orbis.

Figure 3.4.1: Country-level gravity estimate



(a) Error Terms (b) Log Value against Log GDP, residualised

Note: Panel (a) plots the country residuals from estimating cross-sectional gravity regressions on pooled data for 2010-2015. The plot includes selected countries based on their global rank of GDP, GDP per capita, and countries classified as tax havens. Panel (b) plots log value and log GDP, each residualised on other controls, and country error terms. The methodology for estimating the gravity regressions and included controls is detailed in Section 3.4.1

In 2016, India and Mauritius agreed to reform the conditions of their BTT such that sales of assets located in India would now be liable to capital gains tax in India and could not be reported in Mauritius, where there is no capital gains tax on offshore assets. The deal was to be phased in between April 2017 and April 2019, with transactions made during that period liable to be taxed at half of the full rate of Indian capital gains tax (currently 7.5%). However, firms that could not prove that they had a real presence in Mauritius, defined as being listed on the Mauritian stock exchange or having over 1.5 million Mauritian Rupees of operating expenditures in Mauritius in the previous year, did not qualify for the exemption. All transactions made after April 2019 would be taxed at the full 15% rate of capital gains tax. More details on the policy change are provided in Section 3.2.

We estimate difference-in-differences and event study regressions comparing FDI flows from Mauritius with FDI flows from other countries. The post period is defined as 2018

to 2020 quarter 1, inclusive, taking into account that the policy was implemented during 2017.[24] We also examine the extent to which FDI deviates to other tax havens following the implementation of the Mauritius BTT amendment.[25]

The first part of this sub-section presents results at the country level while the second part presents results estimated at the investor-country level.

3.4.2.1 Country-year level

We estimate the following regression specification for source country c in year t:

$$Y_{ct} = \beta\ Post_t \times Mauritius_c + \gamma\ Post_t \times OtherHaven_c + \alpha_c + \alpha_t + \varepsilon_{ct} \tag{3.2}$$

where $Mauritius_c$ equals 1 for Mauritius and 0 otherwise, $OtherHaven_c$ equals 1 if the country is in the list of other havens defined above and 0 otherwise, $Post_t$ equals 1 after and including 2018 and 0 otherwise, α_c is a country fixed effect, and α_t is a time fixed effect. At the country level, we consider four different outcomes, Y_{ct}, in each year t: the total value of FDI from c; the number of unique Indian firms receiving an investment from c; the number of unique investor firms sending a transaction from c; and the number of unique firm pairs. All the dependent variables contain zeros and are heteroskedasitic. Other than the value of FDI, the other dependent variables are count data. We therefore estimate the regression by pseudo-poisson maximum likelihood (PPML), an implementation of poisson regression with robust standard errors that provides a semi-elasticity interpretation to β (Santos Silva and Tenreyro, 2006).

[24]For the baseline difference-in-differences, we include all years up to 2017 in the pre period but show that the results are robust to alternative specifications of the timing variable, which is also demonstrated in the event studies. We use yearly data as there is some noise in the exact timing of the FDI transactions at the monthly (the level at which the data is reported up to 2015) and quarterly levels.

[25]The other countries defined as tax havens are: Singapore; Cyprus; Netherlands; Luxembourg; Cayman Islands; Ireland; Bermuda' Virgin Islands; Jersey; and Hong Kong.

Following Head and Mayer (2014), we also present results of all baseline regressions estimated by OLS. Here, we, take the inverse hyperbolic sine transformation (IHS) to allow for zeros whilst still allowing for a semi-elasticity interpretation of β.[26]

We interpret the estimated β coefficient as the change in FDI from Mauritius relative to other countries, other than tax havens. For this interpretation, we do not rely on the assumption of no spillovers from the policy change to other countries, which we expect is unlikely to hold given that the policy change caused a change in the relative costs of investing in India through Mauritius relative to other countries. For the interpretation that the policy change caused this relative shift, we still require the parallel trends assumption, which we provide evidence on in the event study estimates.

Table 3.4.1 presents summary statistics of the dependent variables. The mean value of FDI sent to India from each country in each year is 12,698 million Indian Rupees, but it is highly positively skewed, with the median country-year sending 7 million Indian Rupees. The number of investee firms, investor firms, and firm pairs is also very positively skewed. The average country has 28 investing firms and invests in 26 Indian firms (in both cases the maximum is the US). The remaining variables show that 27% of the observations are in the post period and 1% of the observations are for Mauritius.

The results of the regression estimations are presented in Table 3.4.2. The value of investments from Mauritius fell by 47.4% relative to other non-tax haven countries after the policy change, while the value of investments from other low tax areas rose by 43.8%

[26]The IHS transformation approximates the log but is sensitive to the units of the variable which is clearly an undesirable property for this estimator. Aihounton and Henningsen (2021) propose that choosing the units that provide the highest R-squared is the best general purpose solution to this issue. For our OLS estimation, we present results in Rupees, millions of Rupees, and billions of Rupees.

A further recommendation of Head and Mayer (2014) was to estimate gravity regressions by Gamma poisson maximum likelihood. (Gamma-PML) However, Weidner and Zylkin (2021) show that Gamma-PML is only consistent under a restrictive set of assumptions. We therefore do not estimate the regressions by Gamma-PML.

Table 3.4.1: Country-level summary statistics

	mean	sd	min	p10	p25	p50	p75	p90	max	count
Value	12698	73582	0	0	0	7	552	11776	1086273	1694
# Indian Firms	26	106	0	0	0	0	4	52	1273	1694
# Foreign Firms	28	112	0	0	0	0	4	56	1508	1694
# Firm pairs	32	132	0	0	0	0	4	58	1612	1694
Post	0.27	0.45	0	0	0	0	1	1	1	1694
Mauritius	0.01	0.08	0	0	0	0	0	0	1	1694

Note: The table presents summary statistics on the dependent variables for the country-year level regressions. The sample period is 2010-2020. Value is in millions of Indian Rupees. Firms are defined using the matched Orbis firm.

relative to other countries. The number of Indian firms invested in from Mauritius fell by 20.5% relative to other non-tax haven countries but there is no statistically significant change for investments from other havens. There is a relative decline in the number of foreign investors from Mauritius, of 42.2% with no change in the number of firms investing from other havens, suggesting that the increase in value of FDI from other havens is driven by the average size of each firm's investments rather than an increase in the number of firm's investing or being invested in.[27]

Table 3.C.3 shows that the results are qualitatively robust to estimating Equation 3.2 by OLS, taking the inverse hyperbolic sine (IHS) transformation of the dependent variable to give an approximation of a percentage change interpretation. The estimated coefficients are also very similar in magnitude which, as discussed in Head and Mayer (2014), is reassuring.[28] Table 3.C.4 shows that the results are qualitatively robust to dropping 2016 and 2017. The event study, shown in Figure 3.C.4, shows no clear pattern of pre-trends. We leave a full discussion of the event study results for the next section,

[27]Note that columns (2) to (4) require that the firm name can be matched to Orbis so countries where no firms can be matched are omitted. If these countries contain one year where the value is non-zero, they will be included in the sample of column (1). The estimated coefficient for column (1) is very similar if we restrict to the sample of columns (2) to (4).

[28]Note that, as recommended by Aihounton and Henningsen (2021), the preferred measurement of units for the dependent variable is billions because it has the highest R-squared. This is the coefficient estimate that is closest to the baseline estimated by PPML.

Table 3.4.2: Country-level regression results

	(1) Value	(2) # Indian Firms	(3) # Foreign Firms	(4) # Firm pairs
Post × MU	-0.474***	-0.205**	-0.422***	-0.170**
	(0.113)	(0.0629)	(0.0654)	(0.0655)
Post × OtherHaven	0.438**	0.125	0.0447	0.112
	(0.140)	(0.112)	(0.107)	(0.116)
Observations	1672	1166	1166	1166
Estimation	PPML	PPML	PPML	PPML
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table shows regression results from the difference-in-differences regressions estimated at the country-year level. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. Standard errors are clustered by country.

noting that the estimated coefficients from the firm-country-year level with no additional controls and a balanced panel with all zeros filled in are equivalent to the estimates at the country-year level, other than for minor changes in the sample. This is a feature of PPML and does not hold for OLS, even when weighting by firm counts.

3.4.2.2 Investor-country-year level

We now turn to estimation at the level of the foreign investor by country by year. The mean foreign investor firm makes transactions with 1.31 Indian firms and invests in 1.64 years but, as expected, there is a lot of heterogeneity driven by a long right tail. The maximum number of Indian firms that a foreign investor makes investments in is 69, while some investors make transactions in every year. Using information on the foreign investor allows for new specifications of the outcome variable, firm-specific controls, and heterogeneity analysis. We assume that the value of transactions for investor-country-years that we do not observe in the data was 0. In other words, we fill in all zeros to construct a balanced panel over the period 2010-2020 Q1. The baseline

specification is now:

$$Y_{fct} = \beta\ Post_t \times Mauritius_c + \gamma\ Post_t \times OtherHaven_c + \alpha_f + \alpha_c + \alpha_t + \varepsilon_{fct} \quad (3.3)$$

where all variables are defined as above, α_f is a firm fixed effect and Y_{fct} is the outcome variable.[29] We consider three outcomes. First, a dummy variable for whether the firm-country investment value is greater than 0 (the extensive margin of FDI). Second, conditional on non-zero investments, the log of the value of investment (intensive margin). Third,the total value of investments, including zeros. We estimate the total value by PPML, and the intensive and extensive margins by OLS. The extensive margin can be interpreted as a linear probability model. [30]

Table 3.4.3 presents summary statistics on the dependent variables for the baseline sample. The average value of FDI into India for a firm-country-year is 55 million Indian Rupees. There are many zeros in the value distribution, with a long right tail. Specifically, 14% of observations are non-zero. It is possible that a foreign investor firm invests in Mauritius through multiple countries over the sample period, for example through both their home country and a routing country. In the data, this is a rare occurance, with most foreign investor firms only investing in India through one routing country. This is shown in Figure 3.C.5 in the Appendix, which plots the cumulative density function of the value of investments by the number of countries through which

[29]Note that with only mutually exclusive categorical variables in the regression, it is equivalent to include separate firm and country fixed effects as to including a firm-country pair fixed effect. For regressions with linear controls, our preferred specification is to use separate firm and country fixed effects as presented here. We have run the regressions with a firm-country fixed effect and the results are very similar.

[30]When we obtain access to the updated Orbis database, we plan to add an interaction for whether the investor met the criteria to prove that it is not a shell company (had operating expenditures in Mauritius above 1.5 million Mauritian Rupees or was listed on the Mauritius stock exchange).

the foreign firm invests in India, and in Table 3.C.5 which shows investor-level summary statistics (aggregating over the country and year dimensions). Still, we control for both firm and country fixed effects to account for cases where the foreign firm invests through multiple countries.

Table 3.4.3: Summary Statistics on Regression Variables

	mean	sd	min	p10	p25	p50	p75	p90	max	count
$\mathbb{1}\{Value > 0\}$	0.14	0.35	0	0	0	0	0	1	1	336963
Log(Value)	3.22	2.80	-4.61	-0.53	1.55	3.37	5.19	6.65	11.95	27315
Value	55.2	1084.2	0.0	0.0	0.0	0.0	0.0	2.0	154902	336963
Post	0.27	0.45	0	0	0	0	1	1	1	336963
Mauritius	0.08	0.27	0	0	0	0	0	0	1	336963

Note: The table presents summary statistics for the key regression variables at the investor-country-year level. The sample period is 2010-2020. Value is in millions of Indian Rupees.

The baseline results are presented in Table 3.4.4. There is a relative fall in investments from Mauritius at all margins of adjustment. At the extensive margin, there is a 10.1% fall in the number of positive investor-country-year cells in Mauritius relative to other non-haven countries after the policy change compared with before. Conditional on an investment, the average value of an investment from Mauritius fell by 36.9% relative to other countries. Finally, the total value of FDI from Mauritius fell by 46.5% relative to other non-haven countries. Note that this coefficient is almost identical to the estimate from the country-year level PPML in Section 3.4.2.1, with the only differences driven by changes in the sample due to the small number of missing firm names. In line with the country-level analysis, we find that the value of FDI received through other havens increased. There is no statistically significant extensive margin increase in the number of firms investing through other havens. There is no statistically significant change in the average value of intensive margin investments through other havens relative to other countries, suggesting that the overall increase in FDI through other havens is due to the average entrant investing more than the average exiting firm.

Table 3.4.4: Baseline difference-in-differences regression results

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.101***	-0.369***	-0.465***
	(0.00926)	(0.0535)	(0.124)
Post × OtherHaven	0.00898	-0.0352	0.326*
	(0.0185)	(0.0819)	(0.136)
Observations	336963	27315	336963
R-squared	0.103	0.752	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. Standard errors are clustered by firm and by country.

The result on the total value of FDI has the same sign and is statistically significant when estimated by OLS on the IHS transformation of value. However, as shown in Table 3.C.6 of the Appendix, the estimated coefficient is highly sensitive to the choice of scale. For these investor-country-year level regressions, we strongly prefer the value regressions estimated by PPML due to the prevalence of zeros and heteroskedasticity, and the sensitivity of OLS-IHS to the choice of units. The results are also robust to estimating at the level of the Indian firm-country-year.

Another potential concern could be that the relative fall from Mauritius is driven by a rise in investments from other countries in the control group. We expect two types of adjustments following the amendment. First, foreign investors may switch their investments from Mauritius to other affiliates in low tax areas. We control for this in the baseline regression by including all other tax havens as a separate interaction, therefore excluding them from the control group. A second type of adjustment could be that firms

are more likely to invest in India directly through their headquarter. We expect that countries most likely to see rising investments through this mechanism are those with the highest volume of Phantom FDI into Mauritius. Using data from Damgaard et al. (2019), we show that the results are qualitatively robust to dropping investments from the ten non-tax haven countries with the largest value of Phantom FDI to Mauritius in 2015.[31] These countries account for 12.5% of all FDI flows to India in the sample period. The results are presented in Table 3.C.10.

We also estimate the impact of the policy in an event study design. We estimate the following regression specification:

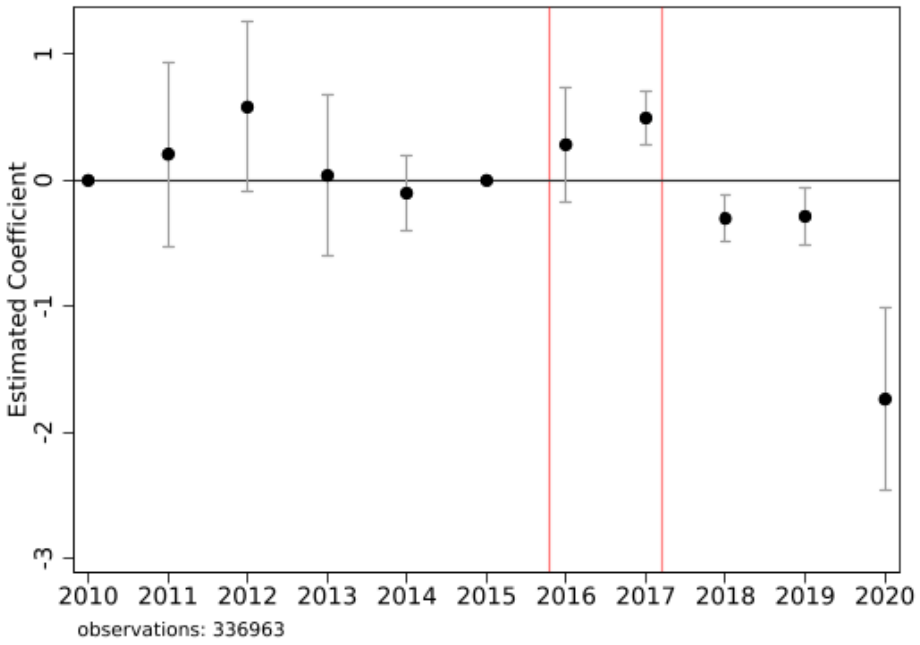
$$Y_{fct} = \sum_{s \in \mathcal{S}} \beta^s \ Mauritius_c \times \mathbb{1}\{year = s\} + \alpha_f + \alpha_c + \alpha_t + \varepsilon_{fct} \tag{3.4}$$

where $\mathbb{1}\{year = s\}$ is a dummy variable that equals 1 in year s. The set of years $\mathcal{S}$ includes all years between 2011 and 2020 except for 2015. The sample period is still 2010-2020 and we drop two periods as base years, 2010 and 2015 following the presciption of Borusyak et al. (2021b). We present the estimated coefficients and 99% confidence intervals in Figure 3.4.2. There is no clear evidence of a differential pre-trend for FDI from Mauritius relative to other countries. There is an uptick in relative FDI received through Mauritius in 2017, suggesting that foreign investors sought to make investments before the implementation of the policy change. Following the implementation, there is a statistically significant relative decline in FDI through Mauritius in 2018, 2019, and 2020.

Based on the patterns in the event study, we show that the difference-in-differences estimates are robust to dropping 2016 and 2017 (Table 3.C.7), to dropping 2020 Q1 (Table 3.C.8), and to dropping 2010-2012 and having a shorter pre period (Table 3.C.9).

[31]The data is available at: https://www.nielsjohannesen.net/fdidatabase/

Figure 3.4.2: Event study estimates



Note: The figure plots estimated coefficients and 99% confidence intervals on the interaction of the Mauritius dummy variable with year dummy variables. The sample period is 2010 to 2020, with 2010 and 2015 interactions omitted. The regression includes firm, country, and year fixed effects. Standard errors are clustered by firm and country. The regression is estimated by PPML.

The event study charts also look similar when dropping the ten non-haven countries with the highest value of Phantom FDI into Mauritius in 2015, shown in Figure 3.C.6.

The estimated effect of the policy change on FDI is likely to be heterogeneous across firms. In particular, firms with a wider network of affiliates in other tax havens may have lower adjustment costs than those with a smaller network. We therefore augment equation 3.3 to include a triple interaction with the (inverse hyperbolic sine of) the number of affiliates that the firm's GUO has in other tax havens. We estimate the following specification:

$$
\begin{aligned}
Y_{fct} = &\beta\, Post_t \times Mauritius_c \times asinh(AffHaven_f) \\
&+ \gamma\, Post_t \times OtherHaven_c \times asinh(AffHaven_f) \\
&+ \delta\, Post_t \times asinh(AffHaven_f) \\
&+ \zeta\, Post_t \times Mauritius_c \\
&+ \kappa\, Post_t \times OtherHaven_c \\
&+ \lambda\, Mauritius_c \times asinh(AffHaven_f) \\
&+ \nu\, OtherHaven_c \times asinh(AffHaven_f) \\
&+ \alpha_f + \alpha_c + \varepsilon_{fct}
\end{aligned}
$$

where $AffHaven_f$ is the number of affiliates the firm's GUO has in other tax havens. We only have matched GUO information for a subset of firms, covering around 70% of the value of FDI as detailed in Section 3.3. Therefore, in Table 3.C.12 we present the baseline results, equivalent to Table 3.4.4, for the restricted matched sample. The estimated coefficients are similar, meaning that selection of the matched sample is not driving the heterogeneity results.

Table 3.4.5 presents summary statistics for the matched sample, including the variable for affiliates in other havens. The mean transaction has a GUO with 49.10 affiliates in other havens, but the median has none, while the max has 7,952. The mean value of an transaction is slightly larger in the matched sample compared with the unmatched sample used in the baseline, at 79.99 million Indian Rupees compared with 55.20 million.

The results are presented in Table 3.4.6. Firms with more affiliates in other havens were indeed more likely to reduce their investments through Mauritius, although we only find a statistically significant effect for the total value estimated by PPML. A 10% rise in

Table 3.4.5: Summary Statistics on Regression Variables for Matched Sample

	mean	sd	min	p10	p25	p50	p75	p90	max	count
$\mathbb{1}\{Value > 0\}$	0.15	0.36	0	0	0	0	0	1	1	172073
Log(Value)	3.47	2.78	-4.61	-0.15	1.86	3.61	5.37	6.83	11.95	16743
Value	80.0	1415.8	0.0	0.0	0.0	0.0	0.0	5.4	154902.4	172073
AffHaven	49.1	207.9	0	0	0	0	16	120	7952	172073
$asinh(AffHaven)$	1.68	2.29	0.00	0.00	0.00	0.00	3.47	5.48	9.67	172073
Post	0.27	0.45	0	0	0	0	1	1	1	172073
Mauritius	0.05	0.21	0	0	0	0	0	0	1	172073

Note: The table presents summary statistics for the key regression variables at the investor-country-year level. The sample is restricted to the firms that can be matched to a GUO in Orbis. The sample period is 2010-2020. Value is in millions of Indian Rupees. AffHaven is the number of affiliates the firm's GUO has in other tax havens.

the number of affiliates the GUO has in other tax havens is associated with a further 2.19% fall in firms' investments to India through Mauritius. However, the number of affiliates in other havens is not associated with an increase in investments through other havens. An important caveat to these results is that the match from firms to their GUO is only available in 2020, and the network of affiliates is from 2017. Therefore, there is a possibility that the firm-GUO relationship changed after the policy change and the interaction term could therefore be endogenous.[32]

3.4.3 Impact on FDI received by Indian companies

We have shown that the relative volume of FDI routed through Mauritius fell in response to the policy change. A remaining question is whether this resulted in a fall in FDI received by Indian firms. To examine this, we use data on FDI received by Indian firms over time. We compare the FDI trends of Indian firms that had received FDI from Mauritius before the policy change with those that had not. Specifically, we estimate:

[32]Note that the remaining coefficient estimates in column (3) show that the conditional average value of investments from both Mauritius and other havens was smaller from firms with more affiliates (seen in the coefficients on Mauritius and Other Haven with the affiliates measure).

Table 3.4.6: Difference-in-differences regression results for interactions with GUO haven affiliates

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.125***	-0.213*	-0.566***
	(0.00683)	(0.0848)	(0.154)
Post ×$asinh(AffHaven)$	-0.00798***	-0.00345	-0.0436
	(0.00134)	(0.0186)	(0.0366)
Post × MU ×$asinh(AffHaven)$	-0.00239	0.155	-0.219*
	(0.00133)	(0.228)	(0.107)
OtherHaven ×$asinh(AffHaven)$	0.00228	-0.226	-0.807***
	(0.00707)	(0.115)	(0.191)
Post × OtherHaven	0.0394**	-0.0632	0.497*
	(0.0144)	(0.166)	(0.210)
Post × OtherHaven ×$asinh(AffHaven)$	-0.00203	0.00775	-0.0279
	(0.00275)	(0.0499)	(0.0535)
MU ×$asinh(AffHaven)$	0.00446	-0.0570	-0.855**
	(0.00928)	(0.283)	(0.304)
Observations	172073	16743	172073
R-squared	0.121	0.724	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates, including interactions with the IHS of the number of affiliates in tax havens that the investor firm's GUO has. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. Standard errors are clustered by firm and by country.

$$Y_{it} = \beta\ Post_t \times Treat_i + \alpha_i + \alpha_t + \varepsilon_{it} \tag{3.5}$$

for Indian firm i in year t, where $Post_t$ is defined as before and $Treat_i$ equals 1 if the firm had received FDI from Mauritius in the pre period and 0 otherwise. We restrict the sample to firms that received some FDI in the pre period. We consider three definitions of Y_{it}: a dummy for the value of FDI received by the firm being greater than 0 (extensive margin); the log of the value of FDI received, conditional on it being greater than 0 (intensive margin); and the total value of FDI.

The parallel trends assumption requires that firms who received FDI from Mauritius in the pre-period had similar trends to those who had never received FDI from Mauritius. We present evidence on this in the event study estimates. Under the further assumption that firms that did not receive FDI from Mauritius in the pre-period were unaffected by the policy change, we can interpret the β coefficient as the causal impact of the policy change on FDI flows for incumbent firms.

Around 40% of the total value of FDI in India over the period 2010-2020 was to Indian firms that received FDI from more than one country (Figure 3.C.5). This suggests that we may see adjustments within the firm and across countries in the FDI received. We explore this margin in this section by estimating separate regressions first defining Y_{it} as FDI received from all countries and then defining Y_{it} as FDI received from countries other than Mauritius.

Table 3.4.7 presents summary statistics for the regression variables at the investee-year level. The share of observations that are non-zero is 0.16. The average value of FDI received by a firm in a year is 69 million Indian Rupees and excluding the value from Mauritius is 64 million Indian Rupees. The proportion of firms that had received FDI from Mauritius in the pre period is 15%.

Table 3.4.8 presents the regression results. Columns 1-3 are for FDI received from all countries while columns 4-6 are for FDI received from countries other than Mauritius.

Table 3.4.7: Investee-year summary statistics

	mean	sd	min	p10	p25	p50	p75	p90	max
$\mathbb{1}\{Value > 0\}$	0.16	0.37	0	0	0	0	0	1	1
Log Value	3.3	2.6	-4.61	-0.06	1.70	3.41	5.14	6.54	12.84
Value	69	1497	0.00	0.00	0.00	0.00	0.00	7.32	377000
$\mathbb{1}\{Value(non-MU) > 0\}$	0.16	0.37	0	0	0	0	0	1	1
Log Value (non-MU)	3.1	2.7	-4.61	-0.31	1.55	3.20	4.94	6.40	11.86
Value (non-MU)	63	1182	0.00	0.00	0.00	0.00	0.00	6.33	149998
Treat	0.15	0.35	0	0	0	0	0	1	1
Observations	248809								

Note: The table shows summary statistics for Indian firms in each year. The sample period is 2010-2020. Value is in millions of Indian Rupees. The sample is restricted to firms that had received some FDI before the policy implementation.

There is no significant change in total FDI received for firms initially exposed to Mauritian investors compared with firms that had never received investments from Mauritius after the policy change relative to before. Under the assumption that the FDI trends of untreated firms were unaffected by the policy change, this suggests that the policy did not reduce the total amount of FDI received by incumbent firms.[33]

Columns 4 to 6 of Table 3.4.8 rationalize the findings of the previous section and the estimates in columns (1)-(3): while there was a fall in FDI received from Mauritius (Section 3.4.2) there was no fall in FDI received by exposed Indian firms (columns 1-3) because their investments from other countries increased relative to untreated firms (columns 4-6). Column 6 suggests that treated firms received a relative rise of 87.6% in FDI from countries other than Mauritius relative to untreated firms after the policy change relative to before. One important note on this estimated coefficient, and its large magnitude, is that for the non-Mauritius value of FDI received, the pre-trends assumption does not hold. This is because firms that previously received FDI through

[33]If untreated firms had been affected by the policy change, it is most likely that they would have received relatively more FDI. This is because the policy increased the cost of channeling FDI to India through Mauritius and, if adjustment is costly, this could increase the relative competitiveness of untreated firms. This would therefore bias β downwards towards finding an effect.

Mauritius received less FDI from other countries in the pre-period. Therefore, the interpretation of relative increase in the post period relative to the pre period is crucial. The following event study analysis clarifies this further.

When estimating by OLS, there is a small statistically significant fall in FDI received by treated firms relative to untreated firms and a similar-in-magnitude relative increase in FDI received from countries other than Mauritius.

Table 3.4.8: Baseline investee difference-in-differences regression results

	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}\{Value > 0\}$	Log Value	Value	$\mathbb{1}\{Value(non-MU)\}$	Log Value (non-MU)	Value (non-MU)
Post x Treated	-0.00208	-0.0915	0.0193	0.101***	0.414**	0.876***
	(0.00472)	(0.0841)	(0.222)	(0.00369)	(0.151)	(0.220)
Observations	248809	26927	248809	248809	22816	227271
R-squared	0.130	0.731		0.135	0.737	
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	None	None	None	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents estimates for the difference-in-differences regressions at the firm-year level. The sample is restricted to firms that received some FDI in the pre period. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The treatment variable is equal to 1 if the firm received FDI from Mauritius in the pre period and 0 otherwise. Standard errors are clustered by firm.

We also estimate event studies comparing treated and untreated firms. We estimate:

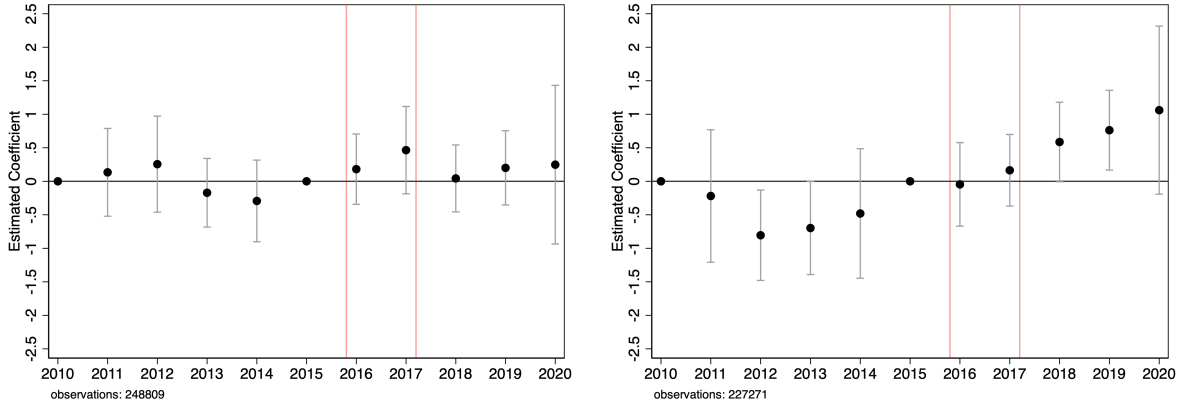
$$Y_{it} = \sum_{s \in \mathcal{S}} \beta^s \; Treat_i \times \mathbb{1}\{year = s\} + \alpha_i + \alpha_t + \varepsilon_{it} \tag{3.6}$$

where $\mathbb{1}\{year = s\}$ is a dummy that equals 1 in year s and the set of years S includes all years between 2011 and 2020, except for 2015. The sample is 2010-2020.

The estimated coefficients are plotted in Figure 3.4.3. Panel (a) shows the event study for total value of FDI while Panel (b) shows the event study for only the value of FDI received from countries other than Mauritius. In panel (a), there is no evidence of a

pre trend, meaning that firms who were receiving FDI from Mauritius had no different FDI trends to those receiving FDI only from other countries. Following the policy change, there is still no differential trend in FDI received by treated and untreated firms. In Panel (b), it is clear that firms who were receiving FDI from Mauritius in the pre period were receiving less FDI from other countries. In the post period, they then received relatively more FDI from other countries, explaining the large positive coefficient estimated in the difference-in-differences regression.

Figure 3.4.3: Investee event studies



(a) Total value

(b) Non-Mauritius value

Note: The figure plots estimated coefficients and 95% confidence intervals on the interaction of the treatment dummy variable with year dummy variables. Panel (a) has the total value of FDI as the dependent variable while Panel (b) has the value of FDI from countries other than Mauritius. The sample period is 2010 to 2020, with 2010 and 2015 interactions omitted. The regression includes firm and year fixed effects. Standard errors are clustered by firm.The regression is estimated by PPML.

A potential concern with the specification at the firm level is that the control group may contain firms with connections to Mauritius. Specifically, a firm in the control group may not directly receive any investments from Mauritius in the pre-period but other firms owned by the same GUO may have received investments through Mauritius. Therefore, these connected firms may also be affected by the amendment. We show that the results are qualitatively robust to estimating the difference-in-differences specification and the

event study at the level of the GUO, whereby GUOs are considered to be treated if any of their affiliated firms received an investment from Mauritius in the pre period. The results are presented in Table 3.C.15 and Figure 3.C.7.

One caveat on the results is that the sample only includes firms that had received some FDI before 2018. It is possible that new entrants received less FDI as a result of the policy change as the cost of investing through Mauritius increased.

3.5 Conclusions

We have shown that a large amount of FDI was arriving in India through Mauritius before the policy implementation. The volume of FDI through Mauritius went well beyond what can be explained by typical gravity variables. This is most likely due to the tax treaty in place between Mauritius and India which enabled foreign investors to avoid taxation in India on capital gains made when Indian assets were sold. To examine this, we focus on investments coming from Mauritius before and after India and Mauritius amended their bilateral tax treaty to plug the tax loophole that enabled multinational firms to avoid taxes in India.

In 2017, India and Mauritius implemented an amendment to their tax treaty requiring that profits on sales of Indian firms would be liable to capital gains tax in India and no longer in Mauritius. We present robust evidence to show that this led to a fall in investments to India through Mauritius relative to investments through other countries. The relative fall is large in magnitude: Investments from Mauritius fell by 47.4% relative to other non-haven countries after the policy change.

At least part of the adjustment of FDI flows following the policy change was to re-route investments into India through other tax havens, with investments from these countries

rising by 43.8% relative to investments from other countries. One of the countries to experience the largest rise was Singapore, where a similar loophole had already been plugged as far back as 2005. The total value of foreign investments received by Indian firms who had been recipients of Mauritian investments did not fall relative to firms that had not previously received investments from Mauritius. To sum up, there was no large reduction in total foreign investments and low tax havens that replaced Mauritius could not offer the capital gains tax loopholes that were previously available.

India is one of the largest recipients of foreign investments in the world. It also has one of lowest tax to GDP ratios among G20 nations. The tradeoff between attracting foreign capital and widening its tax base are therefore of first-order importance for economic welfare. The findings of this paper show that measures for plugging tax loopholes can move countries to superior outcomes of maintaining overall foreign investments while reducing the potential for tax avoidance.

One outstanding question is why investments routed through Mauritius did not drop to zero and in fact still remained reasonably high following the policy change. One possibility is that there are remaining tax advantages to investing in India through Mauritius, or that adjustment costs are high such that adaptation to the policy shift will take longer than the three year horizon considered in this paper. Another possibility is that Mauritius was able to generate a persistent comparative advantage through its tax policies, such as through localised agglomeration forces, human capital, or institutional frameworks.

Appendix

3.A The 1994 India-Singapore Treaty

The 1st protocol of the 1994 India Singapore Treaty contains provisions to reduce treaty shopping. Article 3 states:

> 1. A resident of a Contracting State shall not be entitled to the benefits of Article 1 of this Protocol if its affairs were arranged with the primary purpose to take advantage of the benefits in Article 1 of this Protocol.
>
> 2. A shell/conduit company that claims it is a resident of a Contracting State shall not be entitled to the benefits of Article 1 of this Protocol. A shell/conduit company is any legal entity falling within the definition of resident with negligible or nil business operations or with no real and continuous business activities carried out in that Contracting State.
>
> 3. A resident of a Contracting State is deemed to be a shell/conduit company if its total annual expenditure on operations in that Contracting State is less than S$200,000 or Indian Rs 50,00,000 in the respective Contracting State as the case may be, in the immediately preceding period of 24 months from the date the gains arise.
>
> 4. A resident of a Contracting State is deemed not to be a shell/conduit company if:

(a) it is listed on a recognised stock exchange of the Contracting State; or

(b) its total annual expenditure on operations in that Contracting State is equal to or more than S$200,000 or Indian Rs 50,00,000 in the respective Contracting State as the case may be, in the immediately preceding period of 24 months from the date the gains arise.

In the 3rd protocol, agreed in 2016, Article 3 is replaced with a similar Article 24A (Limitation of relief) which states:

1. A resident of a Contracting State shall not be entitled to the benefits of paragraph 4A or paragraph 4C of Article 13 of this Agreement if its affairs were arranged with the primary purpose to take advantage of the benefits in the said paragraph 4A or paragraph 4C of Article 13 of this Agreement, as the case may be.

2. A shell or conduit company that claims it is a resident of a Contracting State shall not be entitled to the benefits of paragraph 4A or paragraph 4C of Article 13 of this Agreement. A shell or conduit company is any legal entity falling within the definition of resident with negligible or nil business operations or with no real and continuous business activities carried out in that Contracting State.

3. A resident of a Contracting State is deemed to be a shell or conduit company if its annual expenditure on operations in that Contracting State is less than S$200,000 in Singapore or Indian Rs.5,000,000 in India, as the case may be:

(a) in the case of paragraph 4A of Article 13 of this Agreement, for each of the 12-month periods in the immediately preceding period of 24 months from the date on which the gains arise;

(b) in the case of paragraph 4C of Article 13 of this Agreement, for the immediately preceding period of 12 months from the date on which the gains arise.

4. A resident of a Contracting State is deemed not to be a shell or conduit company if:

(a) it is listed on a recognised stock exchange of the Contracting State; or

(b) its annual expenditure on operations in that Contracting State is equal to or more than S$200,000 in Singapore or Indian Rs.5,000,000 in India, as the case may be: (i) in the case of paragraph 4A of Article 13 of this Agreement, for each of the 12-month periods in the immediately preceding period of 24 months from the date on which the gains arise; (ii) in the case of paragraph 4C of Article 13 of this Agreement, for the immediately preceding period of 12 months from the date on which the gains arise.

5. For the purpose of paragraph 4(a) of this Article, a recognised stock exchange means:

(a) in the case of Singapore, the securities market operated by the Singapore Exchange Limited, Singapore Exchange Securities Trading Limited and The Central Depository (Pre) Limited; and

(b) in the case of India, a stock exchange recognised by the Securi-

ties and Exchange Board of India.

The agreement - and all subsequent protocols - have been modified by the Multilateral Convention to Implement Tax Treaty Related Measures to Prevent Base Erosion and Profit Shifting signed by India and Singapore on 7th June, 2017.

3.B Data

3.B.1 Firm name cleaning

We conduct numerous steps to clean the firm names in DIPP and Orbis. We remove all trailing spaces and double spaces, as well as any special characters, and capitalise all characters. For sequential standalone letters such as "I B M", we remove the intermediate spaces, but do not do this for numbers. For a set of manually identified spelling mistakes that appear often in the data, we correct the spelling - for example, there are 44 unique spellings of the word "technologies" in the raw data. For some words that are clearly missing spaces, we manually add spaces. Next, we remove some common suffixes from the ends of the firm names such as "PLC", "Private Limited", "Corp", "Inc" - we run this iteratively three times so that firms with multiple suffixes have each of them removed.

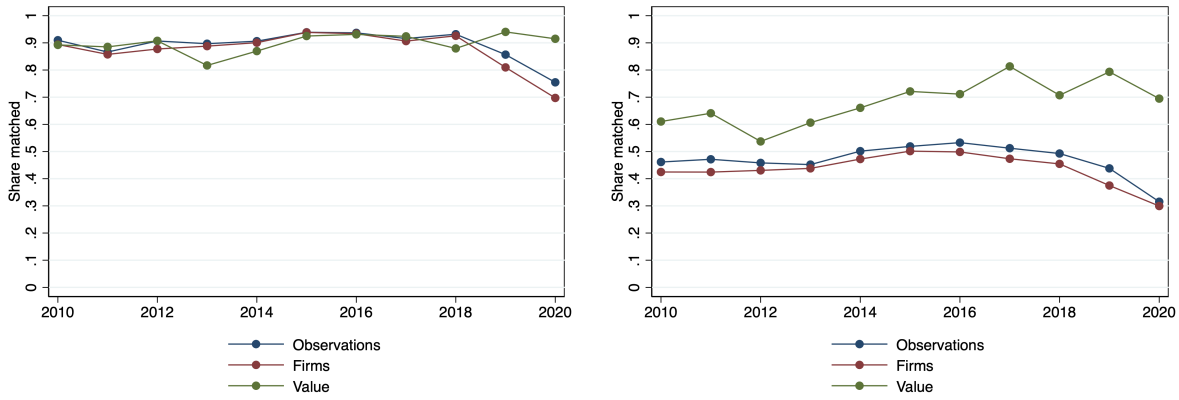
3.B.2 Firm name matching

The preliminary matching stage produces many-to-many pairs of potential matches. We then run various matching algorithms described in Section 3.3.3 to provide scores to each of the potential firm pairs. To identify a unique Orbis match for each firm name in the DIPP data, we apply a sequential decision rule as follows which confirms a unique firm match if the criteria is met and drops all other potential matches and otherwise

leaves the many-to-many matches to the next decision rule criteria. In order, the criteria are as follows: (1) accept any identical matches; (2) accept identical matches on strings with spaces removed; (3) For many-to-many matches with multiple identical strings without spaces, choose the one with the highest bigram score; (4) accept matches with a bigram score above a high threshold; (5) accept cases with a very high Levenshtein score; (6) accept cases with a very high Jaro-Winkler score; (7) accept cases with a high Jaro-Winkler score and meeting multiple criteria on the preliminary matching round; (8) accept cases above a threshold on a combination of bigram, Levenshtein, and Jaro-Winkler; (9) accept cases with a high phonetic score and the same first 15 characters; (10) accept cases with a high Jaro-Winkler and a high score on one of the other methods. For any firms that still do not meet any of these thresholds, we treat them as unmatched.

3.B.3 Matching descriptives

Figure 3.B.1: Indian Firm Matches over time

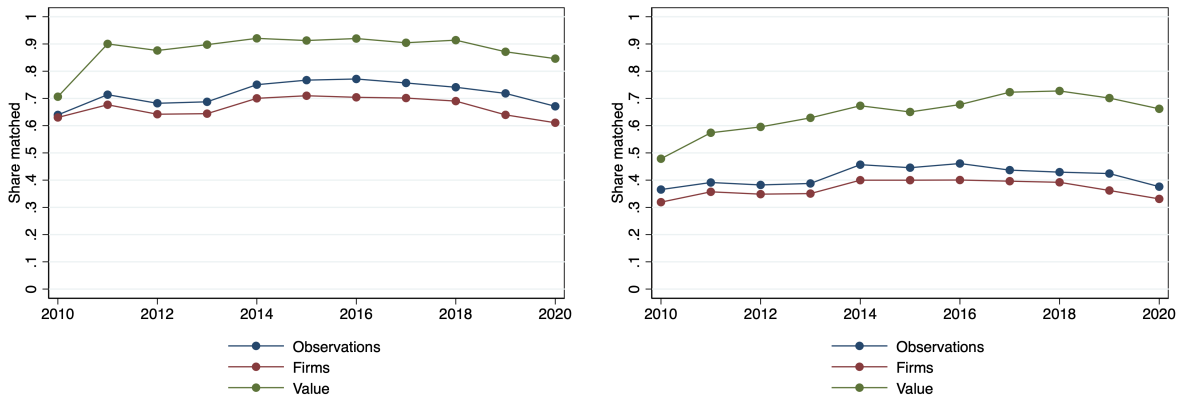


(a) Indian-Orbis

(b) Indian-GUO

Note: The figure plots the share of observations, firms, and the value of FDI by year for which the Indian firm can be matched to an Orbis firm (panel a) or the firm's GUO in Orbis (panel b).

Figure 3.B.2: Foreign Firm Matches over time



(a) Foreign-Orbis (b) Foreign-GUO

ote: The figure plots the share of observations, firms, and the value of FDI by year for which the foreign investor firm can be matched to an Orbis firm (panel a) or the firm's GUO in Orbis (panel b).

Table 3.B.1: Summary Statistics on Matches

	count	sum	mean	sd	min	p25	p50	p75	max
India to Orbis									
Matched	89340	1.97e+07	220	1968	0	0.3	5.0	46.0	154902
Unmatched	10792	2018115	187	1856	0	0.1	3.0	33.3	114071
India to GUO									
Matched	45999	1.54e+07	335	2412	0	0.5	10.5	93.0	131469
Unmatched	54139	6287741	116	1453	0	0.1	2.5	20.9	154902
Foreign to Orbis									
Matched	70351	1.93e+07	275	2249	0	0.7	9.8	73.5	154902
Unmatched	29745	2395157	81	941	0	0.1	1.0	7.5	67966
Foreign to GUO									
Matched	40309	1.45e+07	361	2793	0	1.0	13.7	100.0	154902
Unmatched	59829	7181512	120	1060	0	0.1	2.3	21.0	89562

Note: The table presents summary statistics on the value of FDI transactions comparing matched and unmatched observations. The level of observation is an investor-investee-country-year. We consider four matches and split the sample into matched and unmatched for each of the matches. The matches are: Indian firm to Orbis; Indian firm to Orbis GUO; foreign investor firm to Orbis; and foreign investor firm to Orbis GUO.

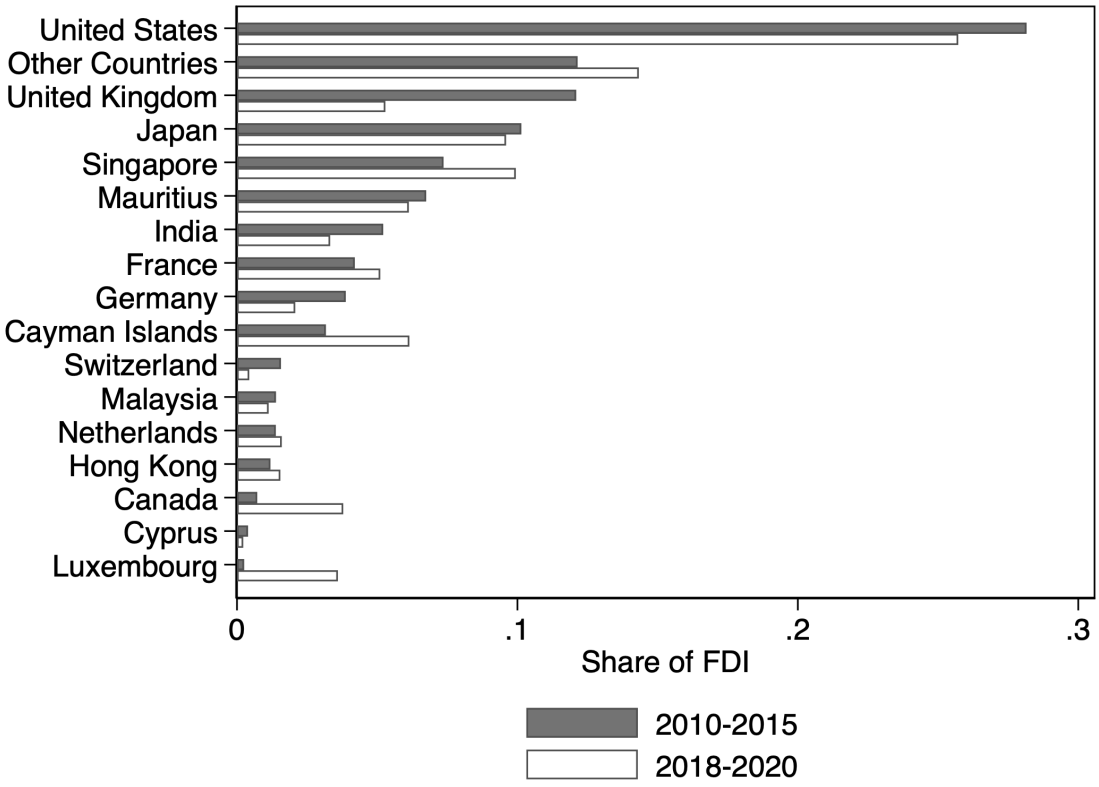
Table 3.B.2: Share of Value Matched by Source Country

	Value (bns RS)	India-Orbis	India-GUO	Foreign-Orbis	Foreign-GUO
Mauritius	5872	0.94	0.71	0.93	0.59
Singapore	5634	0.89	0.68	0.94	0.82
Netherlands	1867	0.89	0.80	0.96	0.84
Japan	1505	0.88	0.79	0.90	0.77
United States	1370	0.93	0.62	0.89	0.70
United Kingdom	803	0.81	0.68	0.96	0.78
Germany	552	0.93	0.84	0.93	0.62
France	429	0.87	0.44	0.95	0.65
Cyprus	399	0.96	0.64	0.87	0.38
Hong Kong	249	0.92	0.77	0.84	0.62
Switzerland	226	0.95	0.77	0.96	0.61
Malaysia	47	0.97	0.80	0.85	0.67
Other	2617	0.91	0.73	0.64	0.40
Unreported	144	0.88	0.60	0.00	0.29
Total	1551	0.91	0.71	0.83	0.62

Note: The table presents the total value of FDI received by each country and the share of firms matched for each partner country. There are four matches considered: Indian firm to Orbis; Indian firm to Orbis GUO; foreign investor firm to Orbis; and foreign investor firm to Orbis GUO.

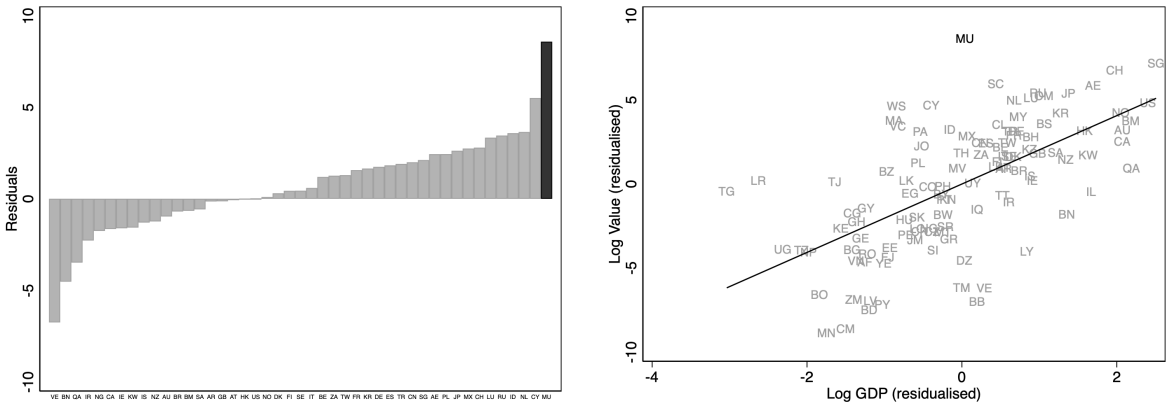
3.C Additional Empirical Analysis and Robustness Checks

Figure 3.C.1: FDI by home country



Note: The chart plots the share of FDI flows into India by country in the period 2010-2015 and 2018-2020. FDI data is from DIPP and the country of ultimate owner is from Orbis. Shares are calculated after dropping transactions by foreign investors that cannot be matched to a GUO.

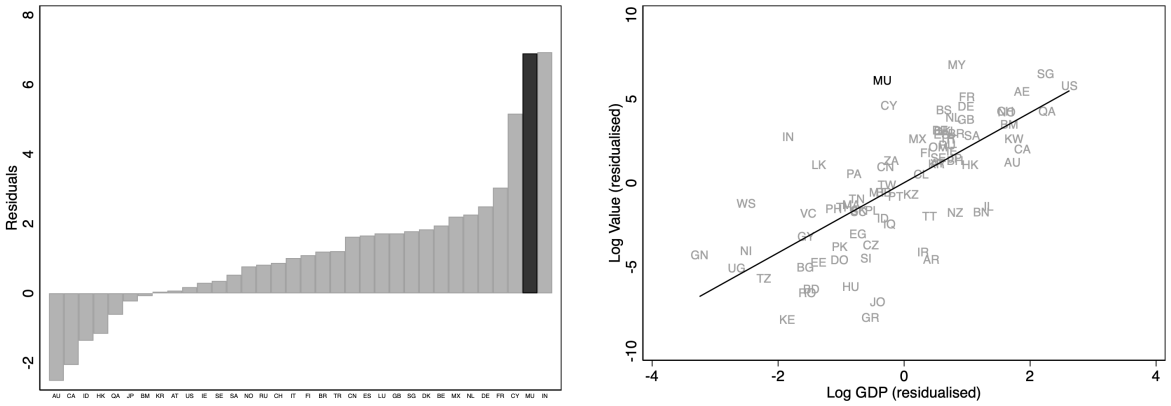
Figure 3.C.2: Country-level gravity estimate



(a) Error Terms (b) Log Value against Log GDP, residualised

Note: Panel (a) plots the country residuals from estimating cross-sectional gravity regressions on pooled data for 2010-2015. The plot includes selected countries based on their global rank of GDP, GDP per capita, and countries classified as tax havens. Panel (b) plots log value and log GDP, each residualised on other controls, and country error terms.

Figure 3.C.3: Home country-level gravity estimate



(a) Error Terms (b) Log Value against Log GDP, residualised

Note: Panel (a) plots the country residuals from estimating a cross-sectional gravity regression on pooled data for 2010-2015. The country is measured as the country of the investor firm's GUO. The sample is restricted to firms that can be matched to its GUO. The plot includes selected countries based on their global rank of GDP, GDP per capita, and countries classified as tax havens. Panel (b) plots log value and log GDP, each residualised on other controls, and country error terms. The methodology for estimating the gravity regressions and included controls is detailed in Section 3.4.1.

Table 3.C.1: Country-level gravity estimates

	(1)	(2)
	Log Value	Log Value
Log Distance	-1.211*	-1.319*
	(0.540)	(0.652)
Log Population	-1.163***	-1.139***
	(0.268)	(0.271)
Log GDP	2.033***	2.203***
	(0.260)	(0.425)
Log Common Religion Index	-0.0747	-0.0175
	(0.268)	(0.258)
Official Common Language=1	2.704**	2.689**
	(0.860)	(0.866)
Common Colonizer=1	0.738	0.809
	(0.934)	(0.960)
RTA=1	0.915	0.963
	(0.827)	(0.833)
EU=1	1.085	1.024
	(0.743)	(0.773)
WTO=1	0.797	0.937
	(1.059)	(1.108)
Log Trade Flow		-0.129
		(0.245)
Constant	-12.28*	-12.98*
	(5.555)	(5.409)
Observations	112	112
R^2	0.514	0.516

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents estimated coefficients from a country-level gravity regression using data aggregated over the period 2010-2015. Standard errors are robust to heteroskedasticity.

Table 3.C.2: Home country-level gravity estimates

	(1) Log Value	(2) Log Value
Log Distance	-0.761	-0.427
	(0.623)	(0.590)
Log Population	-1.401***	-1.533***
	(0.237)	(0.234)
Log GDP	2.150***	2.568***
	(0.224)	(0.314)
Log Common Religion Index	-0.442	-0.214
	(0.241)	(0.223)
Official Common Language=1	2.102**	1.938*
	(0.739)	(0.743)
Common Colonizer=1	0.204	0.485
	(1.029)	(0.968)
RTA=1	-0.179	0.266
	(0.902)	(0.924)
EU=1	-1.205	-1.166*
	(0.639)	(0.577)
WTO=1	-0.845	-0.580
	(0.941)	(0.848)
Log Trade Flow		-0.229
		(0.170)
Constant	-14.79*	-20.85***
	(6.649)	(5.819)
Observations	83	82
R^2	0.591	0.621

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents estimated coefficients from a country-level gravity regression using data aggregated over the period 2010-2015. The country is measured as the country of the investor firm's GUO. The sample is restricted to firms that can be matched to its GUO. Standard errors are robust to heteroskedasticity.

Table 3.C.3: Country-level regression results, estimated by OLS

	(1) asinh(Value Rs)	(2) asinh(Value mns)	(3) asinh(Value bns)	(4) asinh(# Indian Firms)	(5) asinh(# Foreign Firms)	(6) sinh(# Firm pairs)
Post × MU	-1.630***	-0.789***	-0.603***	-0.236***	-0.419***	-0.191***
	(0.388)	(0.0983)	(0.0252)	(0.0294)	(0.0293)	(0.0301)
Post × OtherHaven	-0.0481	0.791*	0.752**	0.221	0.152	0.238
	(0.545)	(0.393)	(0.270)	(0.203)	(0.187)	(0.215)
Observations	1694	1694	1694	1694	1694	1694
R-squared	0.746	0.876	0.908	0.956	0.957	0.955
Estimation	OLS	OLS	OLS	OLS	OLS	OLS
Country FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the country-year difference-in-differences regression estimates. The regressions are estimated by OLS. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. Standard errors are clustered by country.

Table 3.C.4: Regression results, dropping 2016 and 2017

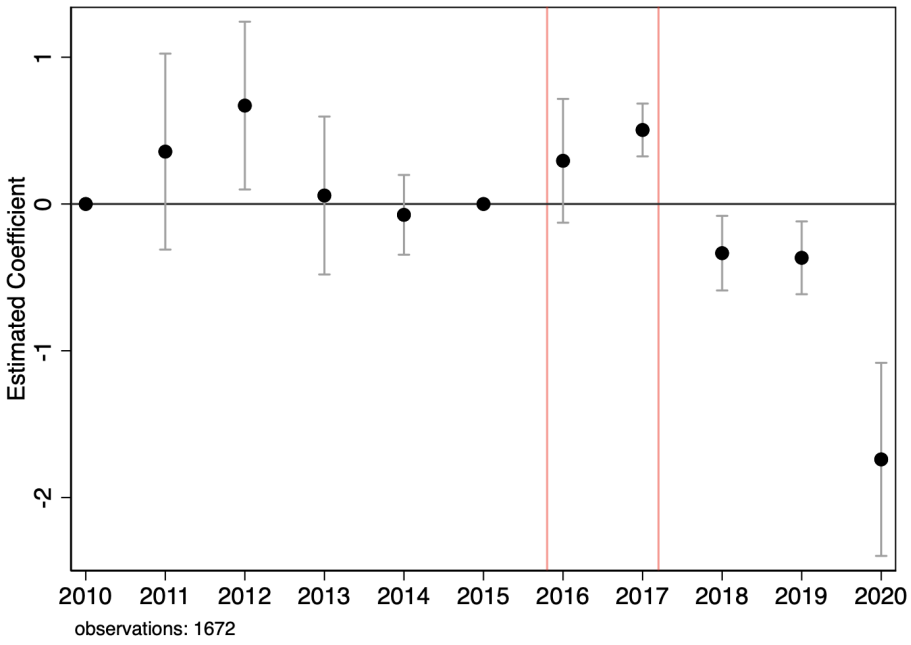
	(1) Value	(2) # Indian Firms	(3) # Foreign Firms	(4) # Firm pairs
Post × MU	-0.354**	-0.220**	-0.454***	-0.147*
	(0.129)	(0.0724)	(0.0703)	(0.0706)
Post × OtherHaven	0.469**	0.169	0.0843	0.174
	(0.166)	(0.147)	(0.137)	(0.151)
Observations	1332	927	927	927
Estimation	PPML	PPML	PPML	PPML
Country FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The years 2016 and 2017 are excluded from the sample. Standard errors are clustered by country.

Figure 3.C.4: Country-level event study



Note: The figure plots estimated coefficients and 99% confidence intervals on the interaction of the Mauritius dummy variable with year dummy variables. The sample period is 2010-2020, with the 2010 and 2015 interactions omitted. The regression includes country and year fixed effects. Standard errors are clustered by country. The regression is estimated by PPML.

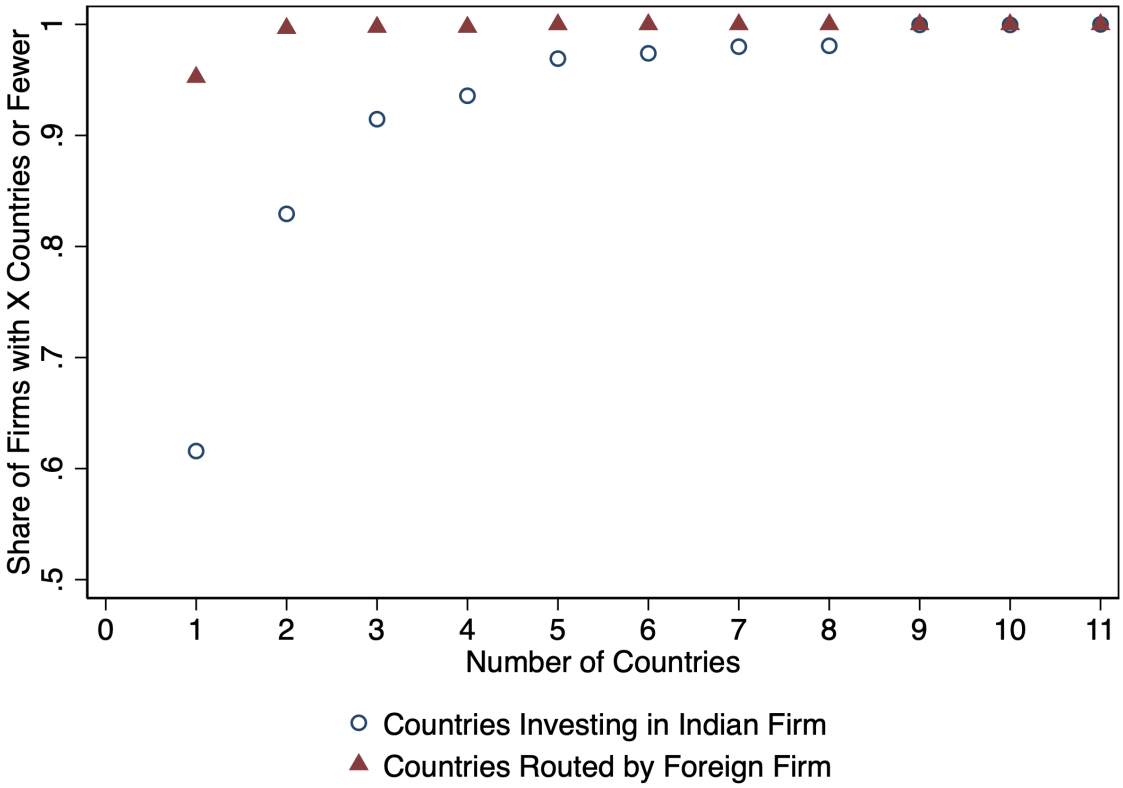
Table 3.C.5: Investor-level summary statistics

	mean	sd	min	p10	p25	p50	p75	p90	max
Value	649	5144	0.01	0.10	0.84	9.40	95.00	696.97	296457
# Transaction (firm*country*year)	3.05	6.38	1	1	1	1	3	6	260
# Countries	1.02	0.14	1	1	1	1	1	1	7
# Partner Firms	1.31	1.67	1	1	1	1	1	2	69
# Years	1.64	1.21	1	1	1	1	2	3	11
# US Transactions	0.60	2.13	0	0	0	0	1	2	147
# UK Transactions	0.19	1.09	0	0	0	0	0	0	35
# Mauritius Transactions	0.59	5.13	0	0	0	0	0	0	261
# Singapore Transactions	0.47	2.81	0	0	0	0	0	1	115
Observations	27042								

Sample: Full Sample

Note: The table presents summary statistics at the foreign investor level covering the period 2010-2020.

Figure 3.C.5: FDI value by number of countries



Note: the figure plots the cumulative value of FDI covered by firms with each number of countries with which the firm has an FDI transaction, following Kramarz et al. (2020). For Indian firms, this means the number of countries from which they receive investments from. For foreign firms, this means the number of countries through which they send investments.

Table 3.C.6: Difference-in-differences regression results estimated by OLS

	(1) asinh(Value Rs)	(2) asinh(Value mn)	(3) asinh(Value bn)
Post × MU	-1.825***	-0.442***	-0.0265***
	(0.147)	(0.0247)	(0.00109)
Post × OtherHaven	0.194	0.0672	0.0118**
	(0.316)	(0.0678)	(0.00439)
Observations	336963	336963	336963
R-squared	0.132	0.209	0.224
Estimation	OLS	OLS	OLS
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The regressions are estimated by OLS. Standard errors are clustered by firm and by country.

Table 3.C.7: Baseline difference-in-differences regression results, dropping 2016 and 2017

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.113***	-0.389***	-0.325*
	(0.0115)	(0.0725)	(0.141)
Post × OtherHaven	0.0181	-0.0606	0.359*
	(0.0249)	(0.111)	(0.158)
Observations	230625	18217	230625
R-squared	0.0939	0.761	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The years 2016 and 2017 are excluded from the sample. Standard errors are clustered by firm and by country.

Table 3.C.8: Baseline difference-in-differences regression results, dropping 2020

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.106***	-0.333***	-0.333**
	(0.00978)	(0.0455)	(0.112)
Post × OtherHaven	0.0125	-0.0627	0.314*
	(0.0208)	(0.0646)	(0.132)
Observations	297710	25665	297710
R-squared	0.104	0.753	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The year 2020 is excluded from the sample. Standard errors are clustered by firm and by country.

Table 3.C.9: Baseline difference-in-differences regression results, dropping 2010 to 2012

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.114***	-0.337***	-0.472***
	(0.0120)	(0.0486)	(0.101)
Post × OtherHaven	0.000343	-0.0739	0.205
	(0.0210)	(0.0708)	(0.112)
Observations	205072	20216	205072
R-squared	0.118	0.770	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The years 2010 to 2012 are excluded from the sample. Standard errors are clustered by firm and by country.

Table 3.C.10: Baseline difference-in-differences regression results - excluding top 10 phantom investor countries to Mauritius

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.0846***	-0.303***	-0.410**
	(0.0132)	(0.0629)	(0.139)
Post × OtherHaven	0.0259	0.0420	0.380*
	(0.0208)	(0.0841)	(0.149)
Observations	188287	18986	188287
R-squared	0.122	0.719	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The sample excludes the investments from United States, United Kingdom, South Africa, Malaysia, Thailand, United Arab Emirates, Democratic Republic of Congo, Australia, and Canada. Standard errors are clustered by firm and by country.

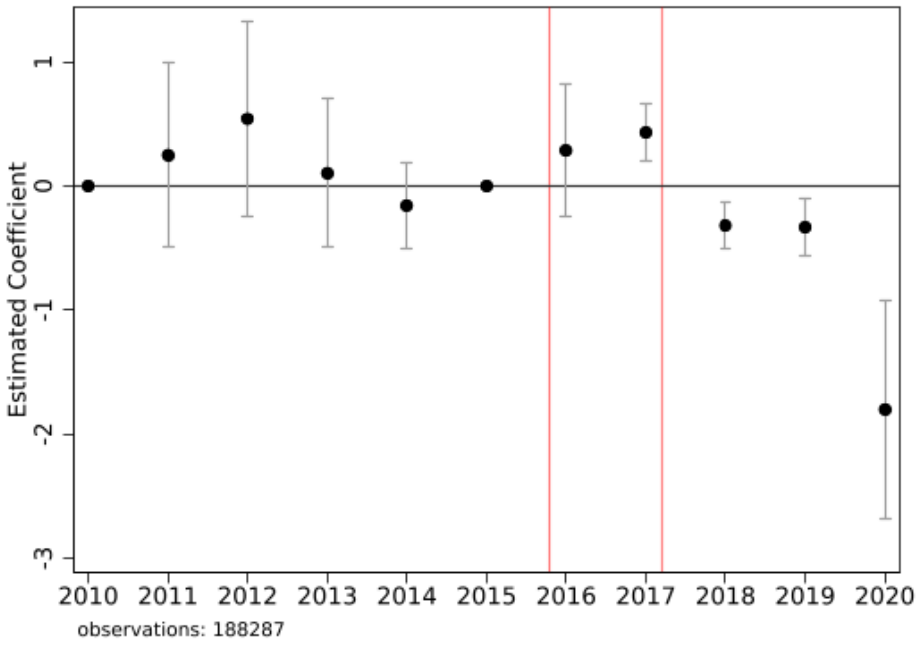
Table 3.C.11: Investor-level summary statistics for matched sample

	mean	sd	min	p10	p25	p50	p75	p90	max
Value	955	6836	0.01	0.10	1.09	16.30	160.71	1031.25	296457
# Transaction (firm*country*year)	3.41	6.90	1	1	1	2	3	7	260
# Countries	1.03	0.20	1	1	1	1	1	1	7
# Partner Firms	1.34	1.83	1	1	1	1	1	2	69
# Years	1.79	1.35	1	1	1	1	2	4	11
# US Transactions	0.53	2.26	0	0	0	0	0	1	147
# UK Transactions	0.23	1.24	0	0	0	0	0	0	35
# Mauritius Transactions	0.45	5.14	0	0	0	0	0	0	261
# Singapore Transactions	0.73	3.49	0	0	0	0	0	2	110
# Foreign Firm's GUO Affiliate Firms	342	3526	1	1	2	6	55	295	55410
# Foreign Firm's GUO Affiliate Countries	12.3	18.6	1	1	1	3	15	40	107
# Foreign Firm's GUO Affiliate Firm-Countries	346	3538	1	1	2	7	58	306	55602
# Foreign Firm's GUO Affiliates in MU	293	3537	0	0	0	0	0	6	55602
# Foreign Firm's GUO Affiliates in SG	336	3539	0	0	0	0	30	275	55602
# Foreign Firm's GUO Affiliates in Havens	343	3539	0	0	0	2	54	306	55602
Observations	13881								

Sample: Matched to Foreign GUO sample

Note: The table presents summary statistics at the foreign investor level covering the period 2010-2020. The sample is restricted to investor firms that can be matched to their GUO.

Figure 3.C.6: Event study estimates - excluding top 10 phantom investor countries to Mauritius



Note: The figure plots estimated coefficients and 99% confidence intervals on the interaction of the Mauritius dummy variable with year dummy variables. The sample period is 2010 to 2020, with 2010 and 2015 interactions omitted. The regression includes firm, country, and year fixed effects. Standard errors are clustered by firm and country.The regression is estimated by PPML. The sample excludes the investments from United States, United Kingdom, South Africa, Malaysia, Thailand, United Arab Emirates, Democratic Republic of Congo, Australia, and Canada.

Table 3.C.12: Baseline difference-in-differences regression results with matched sample

	(1) $\mathbb{1}\{Value > 0\}$	(2) Log(Value)	(3) Value
Post × MU	-0.114***	-0.200**	-0.432***
	(0.00665)	(0.0646)	(0.107)
Post × OtherHaven	0.0247*	-0.0418	0.447***
	(0.0114)	(0.0832)	(0.117)
Observations	172073	16743	172073
R-squared	0.121	0.724	
Estimation	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes
Country FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Controls	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents results for the investor-country-year difference-in-differences regression estimates. The sample is restricted to foreign investors that can be matched to their GUO. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. Standard errors are clustered by firm and by country.

Table 3.C.13: Investee-level summary statistics

	mean	sd	min	p10	p25	p50	p75	p90	max
Value	743	6914	0.01	0.10	1.31	17.49	167.01	913.60	635148
# Transaction (firm*country*year)	3.49	6.48	1	1	1	2	4	7	560
# Countries	1.19	0.55	1	1	1	1	1	2	14
# Partner Firms	1.57	3.10	1	1	1	1	2	2	346
# Years	1.69	1.18	1	1	1	1	2	3	11
# US Transactions	0.70	3.88	0	0	0	0	1	2	453
# UK Transactions	0.23	1.42	0	0	0	0	0	0	89
# Mauritius Transactions	0.68	3.03	0	0	0	0	0	2	118
# Singapore Transactions	0.54	2.11	0	0	0	0	0	1	50
Observations	23634								

Sample: Full Sample

Note: The table contains summary statistics at the level of the Indian investee firm over the period 2010-2020.

Table 3.C.14: Baseline investee difference-in-differences regression results estimated by OLS

	(1)	(2)	(3)	(4)
	asinh(Value)	asinh(Value non-MU)	asinh(Value)	asinh(Value non-MU)
Post x Treated	-0.0163***	0.0196***	-0.0146***	0.0186***
	(0.00485)	(0.00393)	(0.00436)	(0.00354)
LDV(1)			0.0684***	0.0817***
			(0.0127)	(0.0155)
LDV(2)			-0.0151	-0.0137
			(0.0107)	(0.0134)
LDV(3)			-0.0469***	-0.0433***
			(0.00968)	(0.0116)
Observations	248809	248809	248809	248809
R-squared	0.228	0.230	0.234	0.236
Estimation	OLS	OLS	OLS	OLS
Firm FE	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes
Controls	None	None	LDV(3)	LDV(3)

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents estimates for the difference-in-differences regressions at the firm-year level. The sample is restricted to firms that received some FDI in the pre period. The treatment variable is equal to 1 if the firm received FDI from Mauritius in the pre period and 0 otherwise. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. Standard errors are clustered by firm.

Table 3.C.15: Baseline investee difference-in-differences regression results - GUO level

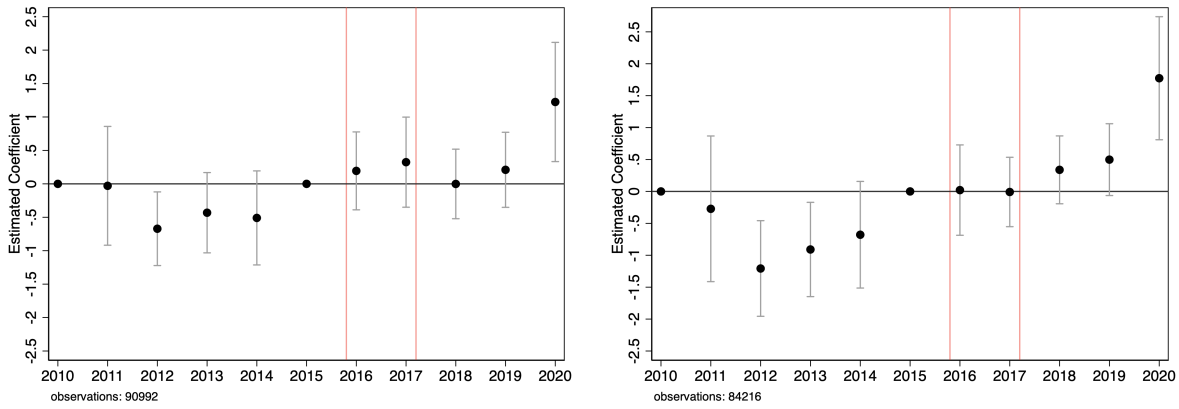
	(1)	(2)	(3)	(4)	(5)	(6)
	$\mathbb{1}\{Value > 0\}$	Log Value	Value	$\mathbb{1}\{Value(non-MU)\}$	Log Value (non-MU)	Value (non-MU)
Post x Treated	0.000628	-0.0627	0.243	0.0959***	0.535***	0.809***
	(0.00841)	(0.115)	(0.184)	(0.00716)	(0.162)	(0.188)
Observations	90992	15783	90992	90992	13606	84216
R-squared	0.191	0.640		0.194	0.649	
Estimation	OLS	OLS	PPML	OLS	OLS	PPML
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
Controls	None	None	None	None	None	None

Standard errors in parentheses

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The table presents estimates for the difference-in-differences regressions at the GUO-year level. The sample is restricted to GUOs that received some FDI in the pre period. The sample period is 2010-2020 and post equals 1 from 2018 onwards and 0 otherwise. The treatment variable is equal to 1 if the GUO received FDI from Mauritius in the pre period and 0 otherwise. Standard errors are clustered by GUO.

Figure 3.C.7: Investee event studies - GUO level



(a) Total value

(b) Non-Mauritius value

Note: The figure plots estimated coefficients and 95% confidence intervals on the interaction of the treatment dummy variable with year dummy variables. Panel (a) has the total value of FDI as the dependent variable while Panel (b) has the value of FDI from countries other than Mauritius. The sample period is 2010 to 2020, with 2010 and 2015 interactions omitted. The regression includes firm and year fixed effects. Standard errors are clustered by GUO.The regression is estimated by PPML.

Conclusions

This thesis studies the effects of increased international trade on labour markets, and the effect of international tax policy on cross-border investment flows. Each chapter of the thesis examines a different aspect of globalisation; international trade in goods, international trade in services, and FDI, respectively.

Chapter One studies the outcomes of workers and firms in the UK in response to the sharp increase in Chinese exports of manufactured goods that followed China's accession to the World Trade Organisation (WTO) in 2001. Individuals initially employed in sectors more exposed to growth of imports from China experienced lower income growth and remained out of employment for longer than workers initially in sectors less exposed to subsequent import competition. The effects are heterogeneous, with initially lower-paid workers suffering more in terms of employment and earnings than those initially better-paid, and female workers experiencing a greater relative fall in total earnings than males, mostly through reduced years of employment.

Chapter One also shows that plants in industries more affected by Chinese import penetration exhibited lower employment growth and lower probability of survival, the effects being stronger for larger plants. Studying worker and firm outcomes together shows that the effects on employment and earnings were, at least in part, driven by a contraction of labour demand at both the firm and industry level. The results show that adjustments to import competition for both workers and firms are costly in the short and medium term.

Chapter Two studies the effects of a rise in imports of services on labour market outcomes in the UK. Exploiting variation across local labour markets, total employment increases with imports of services while average wages decrease, driven by redistribution of employment across firms and industries. A rise in imports of services causes a fall in average wages of high skilled non-routine cognitive occupations, and a decline in wages in the top half of the wage distribution.

The result that high wage workers or workers in non-routine cognitive occupations experience relative wage declines in response to services importing is in contrast to the distributional impacts of many other economic phenomena. It is typically lower wage workers who are found to suffer relatively more in response to import competition of goods, offshoring of goods, and skill or routine-biased technological change. The impacts of importing services appear more similar to the predicted impacts of artificial intelligence on the wage distribution.

The first two chapters show that increasing exposure to import competition, either for final goods or for intermediate service inputs to production, impacts domestic labour markets. They highlight that the nature of the effects, particularly how different types of workers are impacted, varies according to the nature of the trade shock as demonstrated by comparing the findings of Chapter One and Chapter Two. Policies that support labour market adjustment to trade, such as the European Globalisation Adjustment Fund or US Trade Adjustment Assistance, should therefore be flexible in their implementation. Furthermore, given the complexity of globalisation shocks, it may be difficult for policies to identify those affected by globalisation and non-targeted implementations could be preferable. The evidence of this thesis will help inform policymakers about the likely labour market effects of future shifts in globalisation.

While Chapters One and Two both show that international trade generates winners and

losers, they cannot speak to the aggregate impacts of openness to trade. Firstly, they consider only the effects of changes in importing whereas increases in exporting may benefit workers through increased demand for their outputs. Secondly, both analyses are partial equilibrium and therefore omit the benefits of a decline in consumer and input prices.

The third chapter documents the role that international tax treaties play in directing the flows of FDI. It shows that a huge share of India's FDI receipts came through Mauritius before 2016. These flows cannot be explained by the socio-economic characteristics of Mauritius. Instead, they indicate that the bilateral tax treaty between India and Mauritius, which provided firms with a low-cost way of avoiding capital gains tax on profits made on equity sales, was causing FDI flows to be routed through Mauritius.

Following an amendment to the treaty that removed this loophole, the value of FDI that was routed to India through Mauritius fell sharply. At the same time, there was an increase in the value of FDI that was routed to India through other havens. The total value of foreign investments received by Indian firms which had previously been recipients of Mauritian investments did not fall relative to firms that had not previously received investments from Mauritius.

India is one of the largest recipients of foreign investments in the world. It also has one of lowest tax to GDP ratios among G20 nations. The trade-off between attracting foreign capital and widening its tax base are therefore of first-order importance for economic welfare. The findings of this paper show that measures for plugging tax loopholes can move countries to superior outcomes of maintaining overall foreign investments while reducing the potential for tax avoidance.

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