Trade Liberalisation and Female Employment in Manufacturing: Evidence from India

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Abstract: Following the Indian trade reform in 1991, previously protected industries faced rapidly increasing import competition. This paper studies the effect of India's trade liberalisation on female labour force participation in the manufacturing sector. The paper uses two rounds of the Indian Employment and Unemployment Survey to evaluate the effect of rising manufacturing imports over the time period 1987 - 2000 and exploits heterogeneous concentrations of industries across Indian states to construct a measure of import exposure. In addition to the OLS estimations, an instrumental variable approach is used to control for potential endogeneity of imports. The paper finds that import exposure is positively related to higher employment levels for women in the manufacturing sector, especially in export-oriented industries which employ a large number of female workers. In the main specification, the average increase in import exposure over the time period corresponds to a 3 percentage point increase in female employment. The effect differs extensively depending on the level of education and is strongest for women with no or limited schooling. In the import competing manufacturing sectors, the effect of increased import competition is still positive, but smaller in magnitude and largest for women with secondary schooling or a graduate degree.

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1 Introduction

Over the past few decades, the world has experienced an unprecedented drive towards globalisation, both in developed and developing countries. As gender equality is increasingly being emphasised as an important development objective, the potentially differential impacts of trade reforms on women and men has gained attention (IANWGE 2011, World Bank 2011). One crucial aspect of improved gender equality is the creation of paid employment opportunities for women (World Bank 2011). Paid employment is an important way for women to obtain increased independence and higher bargaining power in the household, in addition, gender gaps in employment have been shown to slow down economic growth in developing countries (Klasen & Lamanna 2009; Duflo 2012). Female labour force participation (hereafter FLFP) is therefore an important issue in developing countries, both for gender equality and for economic development.

It is therefore imperative to understand the impact trade reforms have on women's prospects to obtain paid employment in order to understand the connection between trade liberalisation and gender equality. Although there is a substantial literature on the effect of trade liberalisation on FLFP in developing countries, only a few focuses on the case of India. The Indian context is interesting for several reasons. Firstly, in 1991 India experienced a severe balance of payment crisis which forced the country to implement wide-ranging economic reforms, among them extensive trade reforms. The reforms led to a liberalisation of Indias trade policies, in particular for the manufacturing sector, and with a reduction in the protection of domestic industries (Menon & van der Meulen Rodgers 2009; Banga & Das 2012). Secondly, after an increase in FLFP in India in the 1980s, the share of women participating the labour force fell to a rate that was lower compared to other emerging economies during the 1990s (Bhalla & Kaur 2011; Sorsa et al 2015). However, although aggregate FLFP in India declined in the 1990s, it might be possible to identify differences in the impact of trade reforms on FLFP between sectors or between women with different levels of education.

The aim of this paper is to evaluate the relationship between increased import competition and female employment in the manufacturing sector in India between 1987 and 2000. The findings indicate that there is a positive relationship between increased import exposure and FLFP in the manufacturing sector. The effect is strongest in export-oriented manufacturing industries which employ large number of female workers. In the main specification, the average increase in import exposure over the time period corresponds to a 3 percentage point increase in female employment. The effect differs extensively depending on the level of education and is strongest for women with no or limited schooling. In the import competing manufacturing industries which employ fewer women, the pattern is slightly different. The effect of increased import competition is still positive, but smaller in magnitude and largest for women with secondary schooling or a graduate degree. The results to a large extent corroborate the existing literature on international trade and FLFP. Previous studies (e.g. Wood 1991; Fontana 2009) have indeed shown that trade liberalisation in developing countries lead to increased employment levels for women in export-oriented industries. In addition, several studies have found increased imports to be correlated with higher FLFP in

developing countries (Bussman 2009; AlAzzawi 2014; Fatima & Khan 2019). The fact that rising imports increases female employment might still seem surprising, in particular in the import competing industries. In addition, it contradicts the empirical evidence from industrialised countries where females have been found to suffer disproportionally from increased import competition (Kucera & Milberg 2000; Kongar 2006). The paper explores two potential mechanisms for the positive relationship between imports and female employment in manufacturing; the effect of imports on wages and the role of increased access to intermediate inputs. Whereas it finds no empirical evidence for an effect of import competition on wages for women in the manufacturing sector, the relationship between intermediate imports and employment is an interesting area for future research. This study contributes to the existing literature on Indian FLFP and trade liberalisation in several ways. Firstly, it is to the best of my knowledge the first study to evaluate Indian FLFP in the manufacturing sector in the time period surrounding the trade reforms and to explicitly focus on the role of increased import competition. Secondly, in contrast to previous studies on the Indian trade reform and FLFP, I control for the potential endogeneity of imports. Finally, by using detailed household survey data, I am able to control for a range of individual and regional factors that are likely to have an impact on female employment in the manufacturing sector.

The empirical strategy is based on the methodology of Autor et al (2013) and Edmonds et al (2010). Following Autor et al (2013), I exploit heterogenous concentrations of manufacturing industries across Indian states to construct a measure of import exposure. The Indian trade reforms in 1991 were implemented during a short period of time and were primarily a result of external pressures to liberalise trade, which mitigates issues of endogeneity of trade policies (Topalova & Khandelwal 2010). However, there might be unobserved demand shocks to India's manufacturing industries that affect employment in these industries as well as the level of imports of manufactured goods (Autor et al 2013). To control for the potential endogeneity of import exposure, I instrument import exposure with manufacturing imports to other Asian economies. The instrument is however weak, which indicates that the results should be interpreted with caution. To mitigate this issue, I perform weak instrument robust inference following Andrews et al (2018). There are several caveats to the study. Firstly, the focus is on the manufacturing sector only, not FLFP in general. Increases in employment in the manufacturing sector might have been accompanied by job losses in other sectors, causing the net change in female employment to be zero or even negative (Fontana & Wood 2000). In addition, studying effects at the industry level does not provide any evidence regarding intra-industry changes due to trade liberalisation, e.g. workers switching from small to large firms (Ozler 2000). Lastly, the study focuses on the short to medium term, the findings can thus not be interpreted as showing the long-term effects of trade reforms on FLFP.

The paper is structured in the following way. Section 2 describes the background to the 1991 Indian trade reforms and reviews the literature on trade and FLFP in developing countries. Section 3 describes the data and section 4 outlines the empirical strategy. Section 5 presents the results and section 6 checks for robustness. Section 7 discusses the findings and potential mechanisms driving the results. Section 8 concludes.

2 Background

2.1 The 1991 Indian trade reform

During the 1980s, India ran an expansionary fiscal policy in order to induce higher growth rates (Panagariya 2004). The fiscal expansion was to a large extent financed by borrowing, which became unsustainable when India simultaneously faced a several adverse economic situations, among them the collapse of the Soviet Union (at the time India's largest trading partner), political instability and a sharp fall in remittances from abroad (Nagaraj 1997). The balance of payments crisis combined with high inflation forced the government to apply for loans from the IMF and, in return for the loan, implement a range of economic reforms (Menon & van der Meulen Rodgers 2009; Paudel 2016). An important part of the reform package was a liberalisation of India's trade policies (Menon & van der Meulen Rodgers 2009). In the decades leading up to the economic crisis, India had protected its domestic industries and removed foreign competition through import-substitution and import-licensing (Panagariya 2004; Paudel 2016). The balance of payment crisis and the subsequent reforms led India to adopt a more outward-oriented economy and to implement a series of policies aimed at liberalizing its trade policies (Panagariya 2004). A crucial part of the reforms was to reduce the high tariffs on imports. Between 1990 and 1992, the average tariff declined from 82% to 58% and weighted tariffs from 50% to 28% (Banga & Das 2012). In addition to the reduction in tariffs, the reforms aimed to remove other barriers to trade such as discretionary controls and to deregulate imports, although some restrictions on imports of consumer goods were in place until the end of decade (Banga & Das 2012; Banerjee & Veeramani 2017).

2.2 Trade and female labour force participation

There is a substantial literature on the effects of trade liberalisation on FLFP in developing countries but only a few focuses on the case of India. This section will briefly review the literature on trade liberalisation and employment for women in developing countries and subsequently describe the existing papers focusing on India. The effect of trade liberalisation on FLFP predominantly goes through two main channels; either through a reallocation of production factors across sectors or through cost reducing effects following increased import competition (Banjerjee & Veeramani 2017; Gaddis & Pieters 2017). The theoretical foundation for the former channel is based on the Heckscher-Ohlin model of trade. The Heckscher-Ohlin model states that under free trade and with identical technologies, countries will specialise in exports of the good that uses intensively the factor of production they are relatively abundant in, and import goods using factors of production they are relatively scarce in (Feenstra 2004). Developing countries are in general abundant in low-skilled labour and are therefore predicted to specialise in goods that use low-skilled labour intensively in its production (Banerjee & Veeramani 2017). As women in developing countries in general are paid a lower wage compared to men, a large share of the workforce in low-skilled labour-intensive industries has traditionally been women (Joekes 1995). Thus, as these industries expand following trade liberalization, FLFP can be expected to increase (Joekes 1995).

Several empirical studies have found a positive effect of trade liberalisation on employment for women in developing countries, especially in the manufacturing sector. In general, these studies emphasise the role of increased export-orientation following trade liberalisation. Wood (1991) finds that the share of females in the manufacturing sector in developing countries increased as a result of rising international trade between 1960 and 1985. He further argues that the degree of export-orientation of the economy and FLFP are positively correlated, and that an important reason for this relationship is that export-oriented manufacturing sectors often employ a large number of women. In addition, Fontana (2009) concludes that FLFP increased more following trade liberalisation in countries that experienced a larger increase in exports of traditionally female intensive industries and that the effect was particularly strong in countries which have a large share of production in labour-intensive manufacturing industries. Indeed, the World Bank (2011) suggests that the trade liberalisation reforms in the 1980s and 1990s were characterised by a shift of light manufacturing production to developing countries, especially to countries were unskilled labour was abundant, such as India and other Asian countries.

The effect of increased import competition following trade liberalisation on employment for women is more disputed. Studies of industrialised countries have shown that women suffer disproportionally from increased import competition, in particular in the manufacturing sector (Kucera & Milberg 2000; Kongar 2006). However, the evidence of increased import competition in developing countries is more ambiguous. Bussman (2009) finds a positive relationship between imports and FLFP in developing countries and especially in the industrial sector. In addition, Fatima and Khan (2019) find that both exports to and imports from developed countries enhance FLFP in developing countries. They argue that although imports from developed countries might be of higher quality, there will still be a demand for cheaper domestically produced goods, which increases the demand for cheap female labour among local producers. In a study of Egypt, AlAzzawi (2014) concludes that increased import competition led to higher female employment in heavily concentrated industries, whereas the opposite was true in more competitive industries. On the other hand, Nordas (2003) finds that increased imports reduce women's share in employment in developing countries, mainly due to that industries facing higher import competition tend to employ more men. In addition to the studies linking import volumes to employment, several papers evaluate the effect of a reduction in import tariffs. These studies have in general found that FLFP decreased as a result of tariff reductions (Gaddies & Pieters 2017; Cirera et al 2014).

Some authors suggest that increased import competition creates a higher demand for female workers as way to save costs. Women in developing countries are in general paid lower wages than men and are therefore a cheaper form of labour (Joekes 1995). In addition, Ghosh (2002) argues that women might be prepared to agree to worse working conditions compared to men and are often are offered less secure contracts, which makes female workers more flexible compared to male workers. Standing (1999) suggests that as a consequence of rising international trade, low labour costs have become increasingly importantly which in turn has forced employers to increase the use of alternative and more flexible forms of labour compared to regular full-time employees, which

has strengthened women's position in the labour market. The use of female labour as a way to reduce costs is confirmed by Seguino (1997), who in a study of South Korea found that increased international competition is related to lower wages for women relative to men as an attempt to reduce costs.

There are a few studies focusing on the effect of India's trade liberalisation in the 1990s on FLFP and other labour market outcomes for women. Banerjee and Veeramani (2017) find that between 1998 and 2011, decreases in tariff rates led to a rise in FLFP in the manufacturing sector. In addition, the authors find that the share of women in the workforce differs extensively across industries in India and that the industries with the highest share of female workers tend to be export-focused and use labour intensively in its production. Moreover, Prakash (2006) found that both rising exports and imports lead to an increase in FLFP, especially for unskilled workers. However, the study looks at employment as the ratio of total female to male working hours and can therefore not control for individual characteristics. Lastly, Menon and van der Meulen Rodgers (2009) evaluate the effect of trade liberalisation on wages in the manufacturing sector in India and find that increased import competition was one of the main reasons behind an increase in the gender wage gap in India in the 1990s.

This paper contributes to the literature in several ways. Firstly, it is to the best of my knowledge the first study to evaluate the effect of India's trade reform on changes in FLFP before and after the reforms and to explicitly focus on the role of increased import competition. In addition, none of the existing studies of FLFP in India control for the issue of endogeneity of international trade flows. Finally, it is to the best of my knowledge the first study of trade and FLFP in India use household survey data, which enables me to control for individual and regional characteristics.

3 Data

3.1 Data sources

The dataset used in the study is compiled from a range of sources. The data on employment status, demographic characteristics and household characteristics come from the NSS Employment and Unemployment Survey (NSSO 2018). Two rounds of the survey are used: the 1987/88 round, which covers the pre-reform period, and the 1999/2000 round for the post-reform period. When combined, the two rounds include data for more than 700,000 individuals aged 15–60. Individuals are classified as being in the labour force if they reported that they had some type of employment or paid work as their principal activity status during the week the survey was conducted, including self-employment. [1] Only working age women (15–60 years old) who are in the labour force are included in the sample used in the study. When the sample is restricted to this sub-group, the data

[1]The sample includes workers in both the formal and informal sector. In the 1987/88 round, no distinction is made between the formal and informal sector. This changed in the 1999/2000 round, when the survey was adapted in order to distinguish between informal and formal sector workers (ILO 2017). However, since there is no coherent approach to separate formal and informal sector workers across the two rounds, all individuals who report that they work in the manufacturing sector are included in the sample.

set includes over 90,000 observations. The survey uses the National Industry Classification (NIC) to classify industries. Industries in the sample are defined on the 2-digit level of NIC. Different versions of NIC are used in the two survey rounds and concordance between the versions is based on Government of India (1987) and Menon and van der Meulen Rodgers (2009). State-wise industry employment shares are calculated based on the Annual Survey of Industries (ASI) (NSSO 2019). The ASI data is available for 25 of India's states and covers registered firms. Population weighted means of the independent variables show that compared to all working age women, the average woman working in the manufacturing sector was in both time periods less likely to be married, less likely to be belong to a landowning household and belonged to a household with a lower monthly expenditure per capita. She was however more likely to be literate or to have completed primary school. The means are not reported due to limited space. The trade data is obtained from UN Comtrade (2020) and covers Indian imports from and exports to the rest of the world between 1988 and 2000. No data is available prior to 1988. A key part of the data compilation was to match the trade data to the employment data. The trade data is divided into product groups based on the Harmonized System (HS) nomenclature. To the best of my knowledge, no concordance between the NIC and HS codes exists. To circumvent this problem, I used the concordance table between NIC and the International Standard Industry Classification (ISIC) by Menon and van der Meulen Rodgers (2009). I subsequently matched this with the World Integration Trade Solutions' (WITS 2020) concordance between ISIC and 6-digit HS codes in order to construct a novel concordance mapping between NIC and HS 6-digit codes.

In contrast to previous studies of the effects of trade liberalisation (e.g. Edmonds et al 2010; Topalova 2011; Gaddis & Pieters 2017), this study uses annual growth rates of trade values rather than tariff rates as the measure of exposure to trade. The key reason for the use of growth in trade in place of tariffs rates is that the latter measure of trade exposure does not take non-tariff barriers into account. Although Goldberg et al (2010) found that lower tariffs correspond to an increase in import volumes, non-tariff barriers in the form of for example bureaucratic or legal constraints could still have a considerable effect on the amount of goods imported. Thus, realized trade values can be argued to provide a more accurate measure of the effect of trade liberalisation.

3.2 The Indian manufacturing sector

Table 1 shows the share of the Indian labour force working in the manufacturing sector in rural and urban areas. In 1987/88, 8% of the labour force in rural areas and 27% in urban areas worked in the manufacturing sector. In 1999/2000 the figure had fallen to 7% in rural areas and 22% in urban areas. Although the share of the labour force employed in the manufacturing sector is relatively similar for men and women, the distribution of men and women within the manufacturing sector differs extensively. Previous studies have shown that female employment in India is disproportionally high in five manufacturing industries: food and beverages, tobacco, textile, apparel and basic chemicals (Chattopadhyay et al 2013). These five industries will be referred to as female intensive industries whereas the remaining manufacturing industries will be

Table 1: Share of labour force in manufacturing

	Men		Women	
	1987/88	1999/2000	1987/88	1999/2000
Rural	0.080	0.074	0.082	0.072
Urban	0.262	0.224	0.270	0.223

Note: Figures are weighted to represent population means. Data is from NSSO (2018).

Table 2: Share of manufacturing workers in female intensive industries

	Men		Women	
	1987/88	1999/2000	1987/88	1999/2000
Rural	0.505	0.446	0.717	0.710
Urban	0.465	0.414	0.750	0.714

Note: Figures are weighted to represent population means. Data is from NSSO (2018).

labelled male intensive industries. [2]

Table 2 shows the share of manufacturing workers employed in the female intensive manufacturing industries. In 1987/88, 75% of all women working in manufacturing in urban areas and 71% in rural areas were employed in the female intensive industries. The corresponding figure for men was 51% in rural areas and 47% in urban areas. In 1999/2000 the figures had decreased slightly in both urban and rural areas.

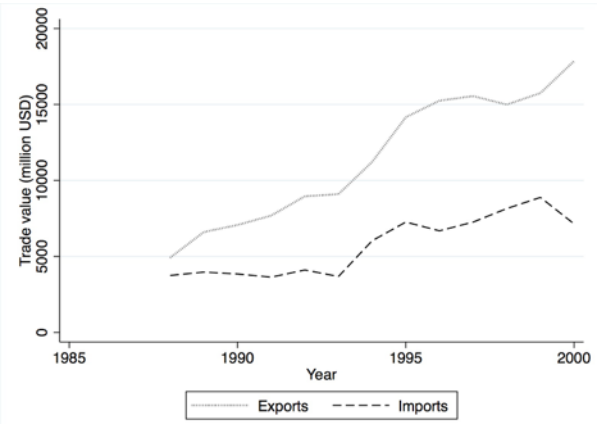
3.3 Trade in manufacturing products

Figure 1 shows Indian manufacturing imports and exports between 1988 and 2000. Panel A shows the female intensive industries. Imports were mostly stable prior to 1993 and increased subsequently. Exports increased continuously throughout the time period, with the exception of a drop in 1997. The female intensive industries were net export industries throughout the time period and the gap between exports and imports increased over time. Panel B of figure 1 shows the equivalent figures for the male intensive industries. Imports increased sharply after 1991. Exports increased as well but less rapidly, with the exception of a spike in the value of exports between 1998 and 2000. The male intensive industries were net import industries between 1988 and 2000.

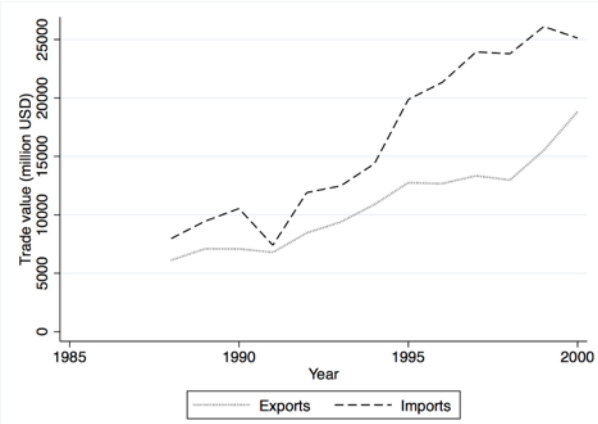
[2] The male intensive industries are: Leather, footwear, wood products, furniture, paper products, printing, industrial chemicals, petroleum/coal products, rubber products, plastic products, pottery, glass products, iron and steel, metals, machinery and scientific equipment.

Figure 1: Indian imports and exports of manufacturing goods (1988 - 2000)

(a) Female intensive industries



(b) Male intensive industries



Source: UN Comtrade (2020)

4 Empirical strategy

4.1 Measure of trade exposure

The empirical strategy exploits variations in industry concentration across Indian states to compute a measure of import exposure based on the methodology of Autor et al (2013)

$$Imports_{st} = \sum_{j} \frac{L_{sj,1987}}{L_{Ij,1987}} g_{Ijt} \tag{1}$$

where $L_{sj,1987}$ is the number of workers in industry j in state s in 1987, $L_{Ij,1987}$ is the total number of workers in industry j across India in 1987 and g_{Ijt} is the growth rate of Indian imports of industry j products in time period t. It is important to note that the measure is weighted by the share of national industry employment in the pre-reform period, 1987. The only source of variation in the measure of import exposure is therefore the growth rate of imports. Although figure 1

Table 3: Mean import exposure index scores

	Import index
1987/88	0.13
1999/2000	0.83

Note: Calculated according to equation 1.
Data is from UN Comtrade (2020) and NSSO (2019).

shows that total manufacturing imports increased over the time period, the annual growth rates for industries within the manufacturing sector fluctuated considerably. To obtain a more robust estimate of changes in import growth, g_{ijt} is the average annual growth rate in industry j in the pre-reform period (1988 – 1991) and post-reform period (1996 – 2000). In order to control for the effect of exports, I have constructed a measure of export exposure which follows equation 1 but where the growth rate of imports has been replaced by the growth rate of exports. However, the objective of the study is to evaluate the effect of rising import competition on female employment in the manufacturing sector. The main variable of interest is therefore the import exposure variable. Table 3 shows the mean values for the import exposure index for the two time periods studied. The average score in the import index was 0.13 in 1987/88 and increased to 0.83 in 1999/2000. As mentioned above, the index is weighted by pre-reform industry employment shares. The mean increase of 0.7 thus reflects an increase in import growth rates only.

4.2 Baseline specification

Equation 2 shows the baseline specification, based on the methodology of Edmonds et al (2010)

$$y_{ist} = \beta_0 + \beta_1 Import_{st} + \beta_2 Export_{st} + \beta_3 X_{it} + \beta_4 H_{it} + \tau + \alpha_s + \varepsilon_{ist} \tag{2}$$

where y_{ist} is a binary indicator for employment in the manufacturing sector for individual i in state s in period t. $Import_{st}$ and $Export_{st}$ are the measures of import and export exposure described in section 4.1. X_{it} is a vector of demographic control variables which are likely to have an impact on FLFP: a second order polynomial in age and dummy variables for marriage status and level of education. The literature on Indian FLFP has identified social and cultural factors as important determinants of womens participation in the labour market (Bhalla & Kaur 2011; Sorsa et al 2015). Thus, in addition to the demographic control variables, H_{it} is a vector of variables capturing household characteristics, including whether the household is in a rural area, log monthly household expenditure per capita as a proxy for wealth, social group and religion. τ is a dummy for the post-reform period (the 1999/2000 survey round) which captures the average change in manufacturing employment between the two survey rounds. α_s is a set of dummies capturing state fixed effects, i.e. state-specific factors that are constant over time. However, there might

also be unobserved time-variant effects that affect employment in manufacturing, which might be correlated with state-specific characteristics in the pre-reform time period (Edmonds et al 2010). In order to allow for the time effect to vary across states, an additional specification will include interaction variables between the post-reform dummy and state-specific characteristics in the pre-reform period, as in Edmonds et al (2010). These include the states share of the labour force in manufacturing and in agriculture and share of population belonging to a disadvantaged social group.

4.3 Endogeneity

It is possible that the import exposure variable is endogenous. As Autor et al (2013) emphasise, changes in import exposure might be correlated to unobserved industry specific changes in demand that might also affect employment in this industry. If changes in industry demand are correlated with changes in import exposure and this is not controlled for, the estimate of the coefficient on the import exposure variable will be biased (Autor et al 2013). In order to control for the potential endogeneity of the import exposure measure, I follow the instrumental variable approach in Autor et al (2013) and use an alternative import index as an instrument for import exposure.

$$Imports_{IV,st} = \sum_{j} \frac{L_{sj,1981}}{L_{Ij,1981}} g_{T,Kjt} \tag{3}$$

The instrument uses growth rates of manufacturing imports to other Asian economies in place for imports to India. Due to limited availability of comparable trade data for the entire period of study, data for South Korea (henceforth Korea) and Thailand are used. In addition, the instrument uses employment levels from 1981, ten years prior to the Indian tariff reforms, in order to avoid potential simultaneity bias caused by anticipation of increased trade (Autor et al 2013). By using growth rates of imports to other Asian economies as an instrument, it is possible to isolate the part of the increase in Indian imports that is due to increased supply of manufacturing products from the rest of the world. Thus, under the assumption that the demand shocks in the three countries differ from each other, the instrument will capture only the exogenous part of rising imports that is due to rising import competition (Autor et al 2013). The instrument will therefore control for the effect of unobserved demand shocks on employment in India's manufacturing sector and isolate the effect of rising imports following the Indian trade liberalisation (Autor et al 2013).

In order for imports to Korea and Thailand to be a suitable instrument for Indian imports, manufacturing imports to Korea and Thailand should be partly correlated with Indian manufacturing imports, whilst being uncorrelated to employment in the Indian manufacturing industries. As mentioned above, a fundamental assumption is that the domestic demand shocks in Thailand and Korea are not correlated with the demand shocks in India (Autor et al 2013). Under assumption that the type of demand shocks at least to some extent varies with the level of income, it is plausible to believe that demand shocks in the three countries are indeed uncorrelated. The income levels in India, Korea and Thailand varied significantly during the time period: Indian GDP per

capita was $580 (constant 2010 USD) in 1990, the equivalent figure in Thailand was $2,500 and $8,460 in Korea. In 2000, GDP per capita in India had risen to $820, $3,400 in Thailand and $15,100 in Korea (World Bank 2020).

There are several potential threats to the suitability of the instrument strategy. Firstly, both Korea and Thailand were heavily affected by the East Asian financial crisis in 1997/98 (Gupta 2000). The crisis forced the Thai and Korean economies into recessions, which is highly likely to have affected the growth of manufacturing imports. However, by 1999 real GDP growth was positive in both countries and amounted to 10.7% in Korea and 4.2% in Thailand (IMF 2000). In order to mitigate the impact of the crisis on the import growth rates, the annual growth rates for the 1988 – 1989 and 1999 – 2000 is used rather than the average growth rates in the pre- and post-reform period. Furthermore, for the validity condition of the instrument to be fulfilled, there should be no correlation between imports to Korea and Thailand and manufacturing employment in India once Indian imports are controlled for (Wooldridge 2016). This condition might be threatened since imports of manufacturing products from the world to Korea and Thailand also include imports from India. Thai and Korean imports are therefore correlated with Indian exports, which is likely to have an impact on manufacturing employment in India. The effect of Korean and Thai imports on Indian employment has the potential to be substantial if Korea and Thailand were major trade partners with India in the 1990s and if bilateral trade flows increased significantly over the time period. However, Thailand and Korea were not major Indian export markets in the 1980s and 1990s. In 1988, 0.9% of Indian world exports were for Thailand and Korea respectively. In 1999 the figures had increased to 1.2% for Thailand and 1.3% for Korea. Similarly, imports from India also constituted for a very small share of total Thai and Korean imports. In 1988 0.8% of Thai imports originated from India, in 1999 the figure had increased very moderately to 0.9%. The corresponding figures for Korea was 0.3% in 1988 and 0.6% in 1999. [3] Thus, although Thai and Korean imports are correlated with Indian exports, the low level of bilateral trade between the countries implies that Indian exports to Korea and Thailand were not a major driver of changes in Indian manufacturing exports.

5 Results

5.1 Main results

Table 4 shows the results from the OLS regressions. In columns 1 to 3, employment in female intensive sectors is used as the dependent variable. In column 1, where the export exposure is not controlled for, the coefficient on the import exposure variable is positive and statistically significant. Column 2 shows the result for the baseline specification, equation 2, where a control for exports has been included. The coefficient on import exposure has the same sign and significance level as in column 1 but is slightly larger in magnitude. Allowing for state-specific time-variant factors by including interaction variables between initial conditions and the post-reform indicator (column 3)

[3] Authors calculations based on data from UN Comtrade (2020)

Table 4: Dependent variable: Employment in manufacturing (OLS)

	Female intensive sectors			Male intensive sectors		
VARIABLES	(1)	(2)	(3)	(4)	(5)	(6)
Imports	0.0144***	0.0149***	0.0236***	-0.000634	-0.000598	0.00137
	(0.00421)	(0.00404)	(0.00250)	(0.00248)	(0.00252)	(0.00239)
Post-reform dummy	-0.0136***	-0.0155***	0.125**	-0.00311*	-0.00325*	0.00917
	(0.00464)	(0.00447)	(0.0478)	(0.00162)	(0.00191)	(0.0189)
Control for exports	No	Yes	Yes	No	Yes	Yes
Initial conditions x post	No	No	Yes	No	No	Yes
Observations	93,015	93,015	93,015	93,015	93,015	93,015
R^2	0.131	0.131	0.131	0.017	0.017	0.018

Robust standard errors clustered on state-year
*** p<0.01, ** p<0.05, * p<0.1

Note: All specifications include demographic controls, household controls and state indicators. Constant included but not reported.

increases the magnitude of coefficient on the import variable. As shown in table 3, the average increase in the import exposure index was 0.7 between 1987/88 and 1999/2000. The coefficient on the baseline specification in column 2 thus indicates that the average increase in import exposure corresponds to a 1 percentage point increase in employment in female intensive industries. In columns 4 to 6 female employment in male intensive industries is used as the dependent variable. Across all specifications, the coefficient on the import exposure variable is statistically insignificant, thus suggesting that there is no relationship between import exposure and FLFP in the male intensive manufacturing industries. In all specifications, the robust standard errors are clustered on state-year.

Table 5 shows the results from the instrumental variable regressions, where import exposure is instrumented by Korean and Thai imports. For employment in the female intensive sectors, the overall trends are similar to the OLS regressions, but the coefficients are larger in magnitude. The coefficient in column 1, the baseline specification, corresponds to a 3 percentage point increase in employment for women, based on the average increase in import exposure. For the male intensive industries, columns 3 and 4 indicate that the effect of imports exposure is positive and statistically significant for both specifications. However, the coefficients are smaller in magnitude compared to the female intensive industries: the baseline specification (column 3) indicates that the average increase in export exposure corresponds to a 0.6 percentage point increase in employment. The post-reform indicator is negative and statistically significant in columns 1 and 3. The negative sign corresponds to the figures in table 1, which show that the share of the labour force employed in the manufacturing sector declined between 1987/88 and 1999/2000. In the absence of growth

Table 5: Dependent variable: Employment in manufacturing (TSLS)

	Female intensive sectors		Male intensive sectors	
VARIABLES	(1)	(2)	(3)	(4)
Imports	0.0436***	0.0610**	0.00833**	0.0149*
	(0.0156)	(0.0264)	(0.00338)	(0.00763)
Post-reform dummy	-0.0345***	0.276**	-0.00916***	0.0638
	(0.00944)	(0.133)	(0.00171)	(0.0426)
Initial conditions x post	No	Yes	No	Yes
Observations	93,015	93,015	93,015	93,015
R^2	0.129	0.130	0.017	0.017
	TSLS First stage estimates			
Imports to Korea/Thailand	0.751**	0.566*	0.751**	0.566*
	(0.303)	(0.333)	(0.303)	(0.333)
R^2	0.751	0.872	0.751	0.872
Montiel-Pflueger effective F-stat	6.27	2.95	6.27	2.95

Robust standard errors clustered on state-year
*** p<0.01, ** p<0.05, * p<0.1

Note: All specifications include demographic controls, household controls and state indicators. Constant included but not reported.

in imports, employment for women in manufacturing would have decreased by approximately 3.5 percentage point in the female intensive sectors and by 1 percentage point in the male intensive sectors over the time period. However, when controlling for state-specific time trends (columns 2 and 4), the average change in manufacturing employment over the time period was positive and large in magnitude.

The lower part of table 5 shows the first stage results. The coefficient on the instrument is positive and statistically significant at the 5% level for the baseline specification in columns 1 and 3. However, for the specifications in columns 2 and 4, the magnitude of the coefficient decreases and is only statistically significant at the 10% level. The R^2 is high, the first stage regressions explain 75% to 87% of the variation in the import exposure variable. Across all specifications, the magnitude on the coefficient on import exposure is larger in the TSLS regressions compared to the OLS regressions. If all variables had been exogenous, the OLS and TSLS estimates should have been similar to each other (Wooldridge 2016). Thus, since we observe a difference between the two estimation methods, it is plausible to believe that the import exposure variable is indeed endogenous. A test for endogeneity, which tests whether the difference between the coefficients from the OLS and TSLS estimations is statistically significant (Wooldridge 2016), rejects the null hypothesis that the suspected endogenous regressor is in reality exogenous at the 5% level in all specifications. Thus, the test implies that an instrumental variable approach should be used. Across

all specifications the Montiel–Pflueger effective F-statistic is below 10, which is often used as the rule of thumb threshold for a weak instrument (Andrews et al 2018). If the instrument is weak, a small correlation between the instrumental variable and the error term could lead to a large bias (Wooldridge 2016). In addition, a weak instrument can lead to the true confidence interval being estimated less often than it should (Sun 2018). Andrews et al (2018) suggest that if the instrument is suspected to be weak, inference that is robust to weak instruments should be conducted. Table A1 in the appendix reports weak instrument robust Anderson-Rubin confidence intervals for the specifications in table 5. For all specifications, the confidence intervals for the endogenous regressor (import exposure) are larger under weak instrument robust inference and the lower bound is higher compared to the non-robust estimations. Thus, the weak instrument robust inference indicates that the estimates of the coefficients in table 4 underestimate the effect of imports on female employment in the manufacturing sector. The F–statistic is higher for the baseline specification (columns 1 and 3), which indicates that the instrument for this specification is relatively stronger compared to the specification in columns 2 and 4. For this reason, only the baseline specification will be used in the regressions in the subsequent sections.

5.2 Heterogeneous effects based on education

As mentioned in the literature review, increased international trade could lead to a rise in demand for low-skilled workers in developing countries. Thus, in order to test whether the relationship between import exposure and employment differ depending on skill-level, in table 6 the sample has been divided into sub-groups depending on the level of education. The import exposure variable is instrumented by imports to Korea and Thailand. Columns 1 and 2 indicate that there is a positive and highly statistically significant effect of import exposure on employment in female intensive industries for women with no schooling and for women who have completed primary or middle school. The effect of import exposure on employment is largest for the group who have completed primary or middle school. For this group, employment increased by approximately 5.2 percentage point over the time period, based on the average increase in import exposure. However, for women who have completed secondary or graduate schooling, there is no statistically significant effect of import exposure on employment. In the male intensive industries, the pattern is different. The effect of import exposure on employment is largest for women with secondary or graduate schooling, albeit only statistically significant at the 10% level. There is no statistically significant effect for women who have completed primary or middle school. However, the effect for women with no schooling is once again positive and statistically significant, although small in magnitude. As in the full-sample regressions, the Montiel-Pflueger effective F–statistic indicate that the instrument is weak. Confidence intervals that are robust to weak instruments are reported in table A2 in the appendix. The results confirm the findings in table 6.

Table 6: Dependent variable: Employment in manufacturing (TSLS)

	Female intensive industries			Male intensive industries		
	(1)	(2)	(3)	(4)	(5)	(6)
VARIABLES	No schooling	Primary/ middle	Secondary/ graduate	No schooling	Primary/ middle	Secondary/ graduate
Imports	0.0419***	0.0748***	0.0107	0.00770**	0.0124	0.0433*
	(0.0150)	(0.0237)	(0.0201)	(0.00365)	(0.0114)	(0.0249)
Post-reform dummy	-0.0343***	-0.0639***	-0.000507	-0.00744***	-0.0153***	-0.0326**
	(0.00929)	(0.0115)	(0.0126)	(0.00218)	(0.00528)	(0.0147)
Observations	70,396	12,815	9,804	70,396	12,815	9,804
R^2	0.125	0.154	0.077	0.016	0.033	0.017
			TSLS First stage estimates			
Imports to Korea/Thailand	0.768**	0.725**	0.794**	0.768**	0.725**	0.794**
	(0.314)	(0.280)	(0.351)	(0.314)	(0.280)	(0.351)
R^2	0.738	0.797	0.790	0.738	0.797	0.790
Montiel-Pflueger effective F-stat	6.12	6.83	5.22	6.12	6.83	5.22

Robust standard errors clustered on state-year
*** p<0.01, ** p<0.05, * p<0.1

Note: All specifications include demographic controls, household controls and state indicators. Constant included but not reported.

6 Robustness of results

6.1 Alternative measure of imports

The measure of import exposure used thus far is not the only possible measure of imports. To check for robustness of the main results, I therefore construct an alternative measure of imports, again based on the methodology of Autor et al (2013).

$$Imports_{st} = \sum_j \frac{L_{sj,1987}}{L_{Ij,1987}} \frac{Imports_{Ijt}}{L_{st}} \tag{4}$$

The main difference to the import exposure measure in equation 1 is that growth rate of imports has been replaced by the average annual value of imports in million USD in industry j in the pre- and post-reform period. Total imports are scaled by the size of the labour force. L_{st} is therefore the number of workers per 1000 population in state s in period t. I have also constructed a corresponding measure for exports and an instrument using imports to Korea and Thailand.

Table 7 shows the results when the alternative measure of imports is used. For the female

Table 7: Dependent variable: Employment in manufacturing

	Female intensive industries		Male intensive industries	
	(1)	(2)	(3)	(4)
VARIABLES	OLS	IV	OLS	IV
Imports (million USD/	0.0209***	0.0246***	-0.00449	-0.00990***
1000 workers)	(0.00611)	(0.00705)	(0.00318)	(0.00377)
Post-reform	-0.0186	-0.0287	0.0186	0.0333*
dummy	(0.0438)	(0.0447)	(0.0192)	(0.0197)
Observations	93,015	93,015	93,015	93,015
R^2	0.131	0.131	0.018	0.018
		TSLS First stage estimates		
Imports to Korea/Thailand	–	0.187***	–	0.187***
(million USD/1000 workers)	–	(0.0210)	–	(0.0210)
R^2	–	0.998	–	0.998
Montiel-Pflueger effective F-stat	–	81.3	–	81.3

Robust standard errors clustered on state-year
*** p<0.01, ** p<0.05, * p<0.1

Note: All specifications include demographic controls, household controls, state indicators and an interaction between initial conditions and the post-reform dummy. Constant included but not reported.

intensive industries, the same pattern emerges as in the previous analysis: there is a positive and statistically significant relationship between import exposure and employment for women. The coefficient from the TSLS estimations in column 2 suggests that a one million dollar increase in trade per thousand workers, or equivalently 1000 dollars per worker, increases employment in female intensive industries by 2.5 percentage point. However, for the male intensive sectors, the TSLS estimation indicate that increased import exposure decreased employment for women. The coefficient from the TSLS estimation is highly statistically significant but smaller in magnitude compared to the TSLS estimate for female intensive industries. The coefficient in column 4 indicates that a 1000 dollar increase in imports per worker decreases employment by 1 percentage point. Thus, the main findings are robust to changes of the import measure for female intensive industries, whereas the effect of import exposure on employment in the male intensive industries is more ambiguous.

7 Discussion

The results indicate that import exposure is positively related to female employment in the manufacturing sector, in particular in female-intensive industries. In the male intensive manufacturing

industries, the effect of import exposure on female employment is smaller in magnitude and not robust to a change in the measure of import exposure. Thus, increased import competition does not seem to have been a driver behind the decrease in female labour participation in India in the 1990s. In contrast, increased import competition led to higher female employment rates, in particular in industries which employ large number of female workers. The results to a large extent corroborate the findings in the existing literature. The female intensive industries are, as shown in figure 1, export-oriented industries. As shown in the literature review, previous studies (e.g. Wood 1991; Fontana 2009) have indeed indicated that trade liberalisation in developing countries lead to higher employment levels for women in export-oriented industries. In addition, several studies have found increased imports to be correlated with higher FLFP in developing countries (Bussman 2009; AlAzzawi 2014; Fatima & Khan 2019).

The results in the study adds further evidence to the conclusions from previous studies that openness to trade in general, both exports and imports, in developing countries improve FLFP and that this effect is particularly large in female intensive export sectors. One reason for the increase in female employment could be that as the manufacturing industries expanded following trade liberalisation, there were not enough male workers available which led to an increase in female employment. However, male employment in manufacturing declined over the time period, as shown in table 1. It is therefore not likely that it was a lack of male workers that drove the increase in female employment in manufacturing. It was beyond the scope of this study to also evaluate the effects of import competition on male employment levels, but it would be interesting for future research to study the effects of trade liberalisation on both genders to be able to compare the effects. Furthermore, the findings suggest that for the female intensive industries, the positive effect of import exposure on employment is largest for women with no or limited education. The review of the literature and theoretical background indicated that according to the Heckscher-Ohlin model of international trade, developing countries such as India that are abundant in low-skilled labour should see a surge in the demand for low-skilled labour. Indeed, in the female intensive industries, there is no statistically significant effect of increased import exposure on employment for women with a higher level of education.

The trade reform thus seems to have drawn women with little formal education into the manufacturing sector. However, a very small share of highly educated women was employed in manufacturing even prior to the trade reforms. Highly educated women might have other outside options, thus, there might be supply-side choices involved which this study has not looked at. The effect on different groups based on education in the male intensive industries show a different pattern. The effect is largest for the group with highest education, and statistically insignificant for women with primary or middle school education. The discrepancy between the findings in the male and female intensive industries could reflect a difference in the type of jobs offered in the different industries. According to the Heckscher-Ohlin model, India should import goods that use skilled labour intensively. The results in table 5 seems to confirm this. In the import-competing male-intensive sectors, the effect of increased import competition is indeed largest for women with a high level of

Table 8: Mean weekly salary in rupees

	Female intensive industries			**Male intensive industries**		
	Female	Male	Female/male ratio	Female	Male	Female/male ratio
1987/88	33	67	0.50	96	128	0.75
1999/2000	214	498	0.43	322	634	0.51

Source: NSS Employment and Unemployment Survey. Weighted to represent population means.

education. The fact that increased import competition increased female employment in the manufacturing industries might still seem surprising, in particular in the import competing sectors. In addition, it contradicts the findings from industrialised countries in which females suffer disproportionally from increased import competition. The following subsections will discuss two potential mechanisms driving the increase in employment; the effect of imports on wages and the role of increased access to intermediate inputs. The former mechanism is possible to test empirically due to available data; the latter will be discussed based on findings in the existing literature.

7.1 Wages

As mentioned in the literature review, one strand of the literature explains increased FLFP following increased import competition as a result of attempts to save costs by replacing male workers by cheaper female labour (e.g. Seguino 1997; Standing 1999). Alternatively, the Stolper-Samuelson theorem implies that if increased imports lead to a fall in the price of the imported good, the return to the factor used intensively in the production of this good would fall (Feenstra 2004). Hence, one possible scenario is that if wages decreased following trade liberalisation, male workers might have switched to other sectors which led to a rise of female employment in the manufacturing sectors. The development of wages for women in the manufacturing sector can provide evidence of the plausibility of these arguments. Table 8 shows that the ratio of female to male wages declined over the time period, especially in the male intensive industries. The data on wages is obtained from the Employment and Unemployment Survey (NSSO 2018). It is important to note that table 8 shows the unadjusted wage gap, i.e. the figures do not take into account for example differences in education and age.

However, although the descriptive statistics in table 8 show a correlation between the time period and an increase in the wage gap between men and women, it cannot be interpreted as a causal relationship between increased import exposure and the rising wage gap. In order to explore the relationship between imports and wage levels further, I replaced the dependent variable in equation 1 with log weekly wages in rupees. The results from the TSLS estimation can be found in table A3 in the appendix. The results indicate that there is no statistically significant effect of imports on wages for women employed in either the female or male intensive industries. Thus, although the gender wage gap increased during the 1990s, increased import competition does not

seem to have had any effect on wages for women in the manufacturing sector. The results in table A3 should however be interpreted with caution. Firstly, there are considerably fewer observations compared to the specifications using employment as the dependent variable. In addition, a large number of individuals report a salary of zero rupees, although they indicate that they are working. If the reason for the missing data is non-random, e.g. correlated with numeracy, the sample will no longer be representative of the population. Secondly, the survey does not differentiate between professions within manufacturing, e.g. factory workers or managers.

7.2 Intermediate inputs

Another potential mechanism behind the positive relationship between imports and FLFP could be increased access to a larger variety of intermediate goods of higher quality, which could increase productivity (Amiti & Konings 2007). There are several studies evaluating the role of increased access to intermediate inputs in the Indian manufacturing sector. Topalova and Khandelwal (2011) find that the tariff reforms had a beneficial impact on firm productivity in India. The results were driven by increased competition as well as improved access to intermediate inputs and the effect was especially pronounced in import-competing sectors (Topalova & Khandelwal 2011). Moreover, Goldberg et al (2010) document a large increase in imports of intermediate goods to India following the trade reforms in the early 1990s. Thus, part of the positive relationship between import exposure and employment could be caused by increased trade in intermediate goods. If import data could be further disaggregated into types of imports, future research could attempt to distinguish between the effect of increased imports of final goods and of intermediate inputs.

8 Conclusion

This paper has studied the effect of India's trade reforms in 1991 on employment for women in the manufacturing sector. By exploiting heterogenous concentrations of industries across Indian states, I construct a measure of import exposure and use imports to other Asian economies as an instrument. The results indicate that there is a positive relationship between increased import exposure and female employment in the manufacturing sector, in particular for lower educated women in the export-oriented female intensive industries. The results can be interpreted as evidence that in addition to the beneficial effects of increased export-orientation, which has been widely confirmed in the literature, increased import competition also has a positive effect on female employment in the manufacturing sector. The instrument is however weak, indicating that the results should be interpreted with caution. Finding an instrument that is to a higher extent correlated with Indian imports would lead to more precise estimates of the relationship between import exposure and employment and could be an area for future research. When studying the potential mechanisms driving the results, the paper finds that the female to male wage ratio fell during the time period, but it finds no statistically significant effect of import exposure on wages. The findings are however based on a small sample and should be interpreted with caution. A second potential mechanism is

an increase in intermediate imports, which could explain the positive relationship between imports and employment. Further research into the mechanisms behind the positive relationship between imports and employment would be necessary in order to better understand the effect of trade liberalisation on FLFP, both in India and for developing countries in general.

Appendix

Table A1: Weak instrument robust inference

	Model	Test	Conf. level	Conf. set
Female industries	Model 1	AR	95 %	0.0204, 0.138
	Model 2	AR	90 %	0.0348, 0.903
Male industries	Model 1	AR	95 %	0.000648, 0.0227
	Model 2	AR	90 %	0.0144, 0.239

Table A2: Weak instrument robust inference based on level of education

	Education	Test	Conf. level	Conf. set
Female industries	No schooling	AR	95 %	0.0167, 0.129
	Primary & middle	AR	95 %	0.0396, 0.204
	Secondary & graduate	AR	90 %	-0.0476, 0.0457
Male industries	No schooling	AR	90 %	0.000736, 0.0165
	Primary & middle	AR	90 %	-0.00378, 0.0476
	Secondary & graduate	AR	90 %	0.0205, 0.174

Table A3: Dependent variable: Log weekly wage in rupees (TSLS)

	Female intensive industries	Male intensive industries
VARIABLES	(1)	(2)
Imports	0.0118	-0.0586
	(0.0415)	(0.154)
Post-reform dummy	1.370***	1.247***
	(0.0248)	(0.127)
Observations	2,054	878
R^2	0.595	0.612
	TSLS First stage estimates	
Imports to Korea/Thailand	1.168***	0.810***
	(0.349)	(0.265)
R^2	0.829	0.812
Montiel-Pflueger effective F-stat	11.50	9.56

Robust standard errors clustered on state-year
*** p<0.01, ** p<0.05, * p<0.1

Note: All specifications include demographic controls, household controls and state indicators. Constant included but not reported.

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