CENTRE FOR THE STUDY OF AFRICAN ECONOMIES

CSAE Working Paper WPS/2019-08

Microenterprises and the Lure of Wage Work: Theory and Evidence from Mexican Export Manufacturing

Michael Koelle*

March 2019

Abstract

This paper provides a model and empirical evidence on how job prospects for entrepreneurs limit the growth of owner-operated firms. When job opportunities are uncertain and liquidation is costly, a forward-looking entrepreneur will reduce the size of their firm below its potential if they anticipate a chance of receiving an attractive job offer and switching occupations. I formalise this mechanism with a model where productive decisions and occupational choices are mutually dependent. With a detailed, representative and comprehensive dataset on almost one million microenterprises in Mexico and administrative records on export-dependent jobs that are plausibly exogenous to local market conditions, I test the mechanism empirically. I find evidence in support of the model predictions. Entrepreneurs take up wage jobs when export manufacturing expands, and their firms grow less in anticipation of this. Tracing news on automotive plant expansions, I show that entrepreneurs react to future job creation only once it becomes public knowledge. The theoretical results and empirical findings provide a new mechanism to explain small firm performance. They imply a role for policy to target a long-term comparative advantage in entrepreneurship.

Keywords: Occupational choice, entrepreneurship, search frictions, irreversibility, firm size
JEL Codes: J24, J64, L26, O17.

*Address: Pembroke College and Centre for the Study of African Economies, University of Oxford, St Aldates, Oxford OX1 1DW, e-mail: *michael.koelle@economics.ox.ac.uk*. This paper is based on part of my PhD dissertation at the University of Oxford. I would like to thank Orazio Attanasio, Abhijit Banerjee, Ian Crawford, Elwyn Davies, Esther Duflo, Marcel Fafchamps, Paolo Falco, James Fenske, Markus Goldstein, Doug Gollin, Juan Carlos Hallak, Leander Heldring, Lukas Hensel, Clément Imbert, Michael Keane, Kalina Manova, Costas Meghir, Peter Neary, Simon Quinn, Chris Roth, Marlon Seror, Raúl Sánchez de la Sierra, Daniela Scur, Margaret Stevens, Gabriel Ulyssea, Chris Woodruff, the members of the Firms and Development Student Research Group at Oxford, and audiences at various conferences and seminars for helpful discussion and comments at various stages of this project. I thank Pavel Luengas-Sierra for help with some of the data. Financial support from the ESRC through doctoral studentship 1368986 is gratefully acknowledged.

1 Introduction

Most firms in the economy are small, and more so in poorer countries.[1] A classic view implies that this is because many entrepreneurs operating in countries with a low level of income have low managerial ability (Lucas, 1978). Other views see small firms as constrained from reaching their optimal size, given ability. A range of explanations for such constraints have been suggested, such as constraints to capital (de Mel, McKenzie, and Woodruff, 2008), size-dependent distortions from informality (Ulyssea, 2018) or weak property rights (Goldstein and Udry, 2008).

In this paper, I suggest a new explanation for why entrepreneurs with the same managerial ability keep their firms at smaller size than what would be optimal in absence of constraints. Entrepreneurs face disincentives for growing their firms from the uncertainty about firm survival. Key to this is the uncertainty about the opportunity cost of running a firm, for instance in terms of income foregone from wage employment. This is potentially very relevant, given the high rates at which small firms across developing countries die (McKenzie and Paffhausen, 2018). In Mexico where I place the empirical analysis of this paper, taking up a wage job is the most important destination of small-scale entrepreneurs whose business has died. A long literature examines the disincentives of uncertainty for investment when such investment carries a sunk cost, but it has mostly restricted attention to uncertainty about firm-level fundamentals (Bernanke, 1983; Bloom, Bond, and Van Reenen, 2007). By contrast, this paper considers uncertainty arising through the labour supply of entrepreneurs.

I analyse the mechanism which gives rise to this explanation both empirically and theoretically. I combine a simple model of (partially) irreversible investment in small firms with a standard labour market search model with indivisible labour. The presence of search frictions and a wage offer distribution generates uncertainty about the value of the alternative occupation, wage employment. In such a world, agents cannot perfectly sort into occupations based on their comparative advantage. Rather, each entrepreneur faces the possibility that potentially attractive wage offers would entice them to shut down their firm. The prospect of leaving to a wage job reduces then the optimal firm size that entrepreneurs choose to start with. This model has very different implications to existing work on the nexus of entrepreneurship and alternative employment opportunities (Gottlieb, Townsend, and Xu, 2016;

[1]In Mexico, the empirical setting of this paper, small firms (with less than 10 employees) account for 94% of all firms and employ 55% of all workers, about half as self-employed business owners and half employed in a wage job in small firms (INEGI data). For comparison, in the US, they constitute 76% of all firms, and 20% of all employment, including self-employment (BDS data). Figure E.1 in the Appendix shows for a wider set of developing countries that a large share of the urban, non-agricultural workforce are self-employed. Gollin (2008), Table 1, provides an earlier cross-country comparison of non-agricultural self-employment.

Hombert, Schoar, Sraer, and Thesmar, 2014; Bianchi and Bobba, 2013; Vereshchagina and Hopenhayn, 2009). In that work, the outside income – wages or welfare benefits – is fixed and acts as a complement to entrepreneurship by providing insurance, encouraging entrepreneurial risk-taking and investment. By contrast, in my model, the outside option of wage work is uncertain. In such a world, wage-employment acts as a substitute for entrepreneurship.

The model unites and nests two different viewpoints of small businesses that are often seen as opposing each other. On the one hand, it allows microenterprises to be firms that make meaningful production decisions. On the other hand, it conceptualises the entrepreneur as a self-employed worker who evaluates his current occupation against the alternative of a wage job. In a world of labour market frictions and implicit exit costs on firm-specific investments, these two viewpoints are linked: firm size and occupational choices are mutually dependent decisions. That is, an entrepreneur might find it optimal to run a relatively small firm and plan to leave to a wage job with high probability. Anticipating that a costly firm shutdown is likely, it then makes sense that the entrepreneur limits their investment. Alternatively, they might run a relatively larger and more profitable firm, leaving fewer potential wage offers attractive, which in turn justifies a larger investment. Thus, there exist multiple local firm size optima, each with an associated occupational choice strategy. If the resulting probability of switching occupations is positive, then firms will be smaller compared to a counterfactual where firm size is determined only by productivity and other business fundamentals.

Empirically, I assess the relevance of this mechanism by testing two primary predictions from the model.[2] First, occupational choices should respond to the incentives posed by job opportunities, and more entrepreneurs should leave self-employment when attractive wage jobs are created. The second prediction encapsulates the mechanism in this paper: better job opportunities should reduce the firm size that entrepreneurs choose. Since the key driver of this mechanism is the *anticipated* likelihood of leaving self-employment, the decrease in firm size should precede eventual occupational choices.

Several challenges arise in empirically testing these predictions. First, data typically come either as a firm survey on the microenterprise, or as a labour force survey on the self-employed microentrepreneur; but few span both domains. Second, systematic data at high frequency on wage employment at the level of individual labour markets are very rare, especially in developing countries. Third, local factors that drive changes in wage employment will often affect not only job opportunities for entrepreneurs, but also fundamentals for the profitability

[2] In addition to generating these testable predictions, the model is also consistent with a number of stylised facts from recent empirical literature on microenterprises: (i) high ex-post returns to capital; (ii) heterogeneous returns to microfinance; (iii) effects of large start-up grants. I discuss how the model relates to each of these in Online Appendix 2.5.

of their firms (such as demand, prices, or costs).

I overcome the first two challenges by assembling a very detailed, high-quality, and representative dataset on almost one million microenterprises from Mexico. To do so, I link detailed administrative data on job opportunities (from the universe of social security records) with labour force panel data on microentrepreneurs. Mexico is an ideal testing ground for my model: an emerging economy characterised both by a large and modern export-oriented manufacturing sector offering formal and permanent wage jobs to a wide range of the population, and by the millions of small businesses and self-employed workers that are typical to any developing country.[3] I show that my model is a good approximation of the empirical reality that Mexican microenterprises face. I address the third challenge by isolating variation in local job creation that is due to factors that are plausibly exogenous to local markets. In particular, I predict job creation with changes in aggregate exports of the internationally integrated manufacturing industries, and the initial industry composition of a local market. This adapts a now very common approach in the literature of labour market effects of trade to my specific empirical question and context (see, for example, Autor, Dorn, and Hanson (2013) and Dix-Carneiro and Kovak (2017)).

I present two main pieces of empirical evidence that correspond to the two primary model predictions. First, I find that job creation in the local municipality increases the propensity of entrepreneurs to leave self-employment, especially to wage employment. This confirms that entrepreneurs respond to the opportunities posed by formal, stable, and relatively well-paying jobs in export manufacturing establishments. Second, I find that between four and one quarters *before* job creation, small firms shrink in size. This is true whether we look at firm size in terms of hired labour, household labour, or capital. The effects are driven by the group of firms that have at least one worker other than the entrepreneur. Transitions by entrepreneurs out of self-employment, on the other hand, follow a different time pattern: they only occur around the quarter when jobs are created. These findings, both in sign and in timing, are as predicted by the model: entrepreneurs switch to wage jobs when job opportunities arise, and reduce their firm size in anticipation.

This interpretation of the empirical findings in light of the model implicitly assumes that entrepreneurs can *anticipate* job creation in their local market. I provide evidence for this linking piece with an event study for the largest export manufacturing industry, automotive manufacturing. Information on larger investment projects by car manufacturers is revealed centrally by the global headquarters of these public, multinational companies. Announce-

[3] As I will detail in Section 3 below, these two groups of firms – export manufacturing establishments and entrepreneur-run small businesses – have almost no overlap.

ments are directed at global markets and competitors and are picked up by the financial and special interest press. Using the universe of announcements on major expansions and new openings of Mexican auto plants, I show that small firms strongly reduce their size in the two quarters after an expansion has been publicly announced, but not during times of industry job growth before the announcement.

Following these tests of the main predictions, I test for additional implications along several dimensions suggested by theory. Not all of these dimensions are immediately reflected in the data, and I employ machine learning techniques to predict the missing quantities of interest. Consistent with theory, I find that effects are larger for entrepreneurs with a higher inclination for wage employment, a higher degree of capital irreversibility, and for those facing a lower baseline degree of labour market uncertainty.

I consider four leading potential alternative explanations for my findings: (i) labour market spillovers and wage competition for workers; (ii) local demand effects and product market spillovers; (iii) changes in the structure of linkages of small firms to export manufacturing establishments; (iv) an insurance effect from wage employment opportunities. I test for the presence of these mechanism and find support for some of them in particular industries and subsets of firms. However, these alternative explanations alone cannot explain my empirical findings. If anything, the results provide even stronger empirical support in line with the model for firms – the majority of all firms in the sample – for which there is no evidence that alternative mechanisms are at play.

The main contribution of this paper is to the literature on entrepreneurship and occupational choice, which goes back to the early work on occupational choice and selection into entrepreneurship (Jovanovic, 1982; Kihlstrom and Laffont, 1979; Evans and Jovanovic, 1989). To the best of my knowledge, this paper is the first to address the question how job opportunities for entrepreneurs can explain low firm size and performance, and to provide empirical evidence as a test for this mechanism.[4] By contrast, when wage work or welfare benefits provide a *safe* outside option, entrepreneurs are more likely to engage in risky business ventures (Vereshchagina and Hopenhayn, 2009). Empirically, Bianchi and Bobba (2013) show how elegibility for the conditional cash transfer programme *Progresa* in Mexico increased entrepreneurship by providing implicit insurance. Gottlieb, Townsend, and Xu (2016) and Hombert, Schoar, Sraer, and Thesmar (2014) report similar evidence from welfare programmes in Canada and France.

[4] In related and parallel work, Humphries (2017) develops a life-cycle model of self-employment where capital entry and adjustment costs create a link between investment and the expected length of a self-employment spell. He structurally estimates his model using data from Sweden, and finds that it can replicate the different patterns of self-employment he observes in the data.

Second, this paper relates to a growing literature that examines the labour market effects of trade at the micro level (Autor, Dorn, and Hanson, 2013; Adão, 2015; Atkin, 2016; Dix-Carneiro and Kovak, 2017; McCaig and Pavcnik, 2018). I show how factory jobs in the export sector change incentives for occupation-specific investments by entrepreneurs. This mirrors findings that in the early stages of a manufacturing boom, factory job opportunities reduce investment into further schooling (Atkin, 2016; Heath and Mobarak, 2015). My model also provides a new mechanism to explain occupational reallocations following an opening to trade, as for example documented by McCaig and Pavcnik (2018) in Vietnam. The prospect of wage work pushes entrepreneurs out of small firms, and reduces their demand for hired labour. Both of these adjustments shift employment from small to large firms.

Third, this paper provides a link between the literatures on self-employment in developing countries (e.g. Maloney (1999), Günther and Launov (2012), Haywood and Falco (2016)) and on constraints to growth of microenterprises (e.g. de Mel, McKenzie, and Woodruff (2008, 2018), Bruhn, Karlan, and Schoar (2018), Banerjee, Duflo, Glennerster, and Kinnan (2015)).[5] In my model, occupational choice strategies of the self-employed and firm size are two endogenous, non-separable choices. In this regard, my paper connects to a longstanding literature in development economics on the non-separability of production and other domains of choice when markets are missing (Benjamin, 1992; LaFave and Thomas, 2016).

This paper proceeds as follows. Section 2 presents and discusses the model, and ends with testable predictions. Section 3 introduces the empirical context and strategy, and validates the model's assumptions. The main empirical evidence is presented in Section 4. Section 5 presents evidence on the role of expectations from an event study in the Mexican auto industry. Section 6 concludes with a brief discussion.

2 Model

In this section I develop a model of an entrepreneur who participates in a frictional labour market. The novelty of this model is that I combine a standard neoclassical model of firm production with the basic two-sector labour market search model (building on Mortensen (1970) and subsequent literature). The setup of the model is kept deliberately simple. This simplicity allows me to isolate the key assumptions that the mechanism relies upon, and which I validate in both conceptually and empirically. In the following, I characterise and

[5] Among the few studies that look at the labour supply effects of policies directed at easing firm-level constraints, Crépon, Devoto, Duflo, and Parienté (2015) find that microcredit in Morocco lead to a rise in investment, but to a reduction in wage labour. This is consistent with a continuous-hours version of my model.

solve the model, establish the comparative statics that the empirical test will build on, and provide intuition for the economic mechanisms at play. I then introduce a number of extensions that bring the model closer to the empirical reality: production with multiple inputs; risk aversion and credit constraints; and heterogeneous entrepreneurial ability.

2.1 A model of entrepreneurship and job prospects

There are two occupations: self-employment and wage-employment. The agent is initially self-employed as the owner of a business (an entrepreneur) with access to a production technology $\pi(k)$. The sequencing of choices is as following. The entrepreneur rents capital k on a perfectly competitive market at rental rate r. After contracting capital, and before production is realised, a wage offer is drawn from a compound lottery. There is a probability λ that the agent receives a wage offer. This allows for the presence of search frictions. If an offer is made, it is itself drawn from a continuous distribution $F(w)$. The stochastic distributions are known to the agent. The agent decides to accept or to reject the wage offer. Production, wage payments, and consumption are realised, and contracted capital is repaid.

The market environment constrains the entrepreneur's choices. There are four features of the market environment that jointly are critical for creating a link between occupational choices and firm outcomes. These are summarised in Assumption 1:

Assumption 1. ***Market environment***

1a. DISCRETE OCCUPATIONAL CHOICE: *An individual can either be self-employed or wage-employed at a given point in time.*

1b. MISSING MARKET FOR MANAGERIAL LABOUR: *Production in a firm only takes place when the firm owner is self-employed.*

1c. FIRM-SPECIFIC CAPITAL: *Capital invested in the firm cannot be liquidated until the end of period.*

1d. SEARCH FRICTIONS AND WAGE DISPERSION: *A wage offer arrives with probability* $0 \leq \lambda < 1$. $F(w;a)$ *is the continous distribution function of wage offers* w *parameterised by* a *that admits first order stochastic dominance in* a*:*

$$\begin{aligned} F(w,a) &= \int_{-\infty}^{w} f(x,a)\,dx \quad \textit{with} \quad \int_{-\infty}^{+\infty} f(x,a)\,dx = 1; \\ F_a(w,a) &= \frac{\partial F(w,a)}{\partial a} \quad \leq \ 0. \end{aligned}$$

These constituent parts of Assumption 1 resonate with a number of stylised facts on small firms, as well as with our understanding of some fairly broad economic mechanisms. In the empirical section, I further provide extensive descriptive evidence that the specific context for my empirical test – entrepreneurs embedded in urban labour markets in Mexico – is approximated well by these assumptions.

Here I discuss the assumptions' economic basis. To start with, almost all small firms anywhere in the world are owned and operated by a single individual or family. At such a scale, ownership and control of a firm are non-separable, since the agency costs of separation outweigh the benefits (Fama and Jensen, 1983).[6] The assumptions of missing market for managerial labour and discreteness of occupational choices together embody this notion. The market for used capital suffers from the asymmetric information problems pervasive in durable goods markets (Akerlof, 1970). This renders investment at least partly irreversible for the firm.[7] I make a fairly mild assumption on the degree of irreversibility. Intuitively, in my model, agents cannot instantly liquidiate their invested capital to purchase an alternative interest-bearing asset. They therefore pay the opportunitity cost of capital given by the rental payment (but face no loss on the principal). The model's qualititave implications continue to hold for stronger versions of the assumption. Finally, I model uncertainty about the arrival and value of wage-employment opportunities with a job search model along the lines of Mortensen (1970) and subsequent literature. As is standard in this class of model, search is characterised by a background probability that a job offer is made. Here, I consider 'on-the-job search' of the self-employed, who can expect periodic access to an opportunity for a wage job. Search frictions imply that the opportunity cost of the entrepreneur's indivisible labour is uncertain, and given by a distribution rather than a single wage.

Whereas the market environment is characterised by a number of constraints and frictions, technology and preferences are neoclassical.

[6] Fama and Jensen (1983) in their seminal essay "Separation of ownership and control" formulate this as following (p. 307):

> [C]ombining decision and risk-bearing functions is efficient in small noncomplex organizations because the benefits of unrestricted risk sharing and specialization of decision functions are less than the costs that would be incurred to control the resulting agency problems. The proprietorships, partnerships, and closed corporations observed in small scale production and service activities are the best examples of classical entrepreneurial firms in which the major decision makers are also the major residual risk bearers.

[7] Irreversibility is a particularly well-studied in the macro literature on how uncertainty affects investment. The seminal theoretical paper is Bernanke (1983) who traces the concept of 'irreversibility' back to Marschak (1949). Empirically Bloom, Bond, and Van Reenen (2007) and Bloom (2009) show how business cycle and geopolitical uncertainty, respectively, disincentivise investment. More recently, Lanteri (2018) endogenises irreversibility in an equilibrium model where supply and hence the price of used capital varies over the business cycle.

Assumption 2. ***Neoclassical production function:***
The production function $\pi(k)$ is twice continuously differentiable and obeys the Inada conditions:

$$\begin{aligned} \pi(0) &= 0; & \lim_{k\to 0} \pi'(k) &= \infty; \\ \pi'(k) &> 0; & \lim_{k\to\infty} \pi'(k) &= 0; \\ \pi''(k) &< 0. \end{aligned}$$

Assumption 3. ***Preferences***
RISK NEUTRALITY: *The agent's utility function over consumption is given by $u(c) = c$.*

The assumption of risk neutrality serves several purposes. First, it isolates the profit motives for investment from other motives such as consumption smoothing. Second, it simplifies the model. Third, it serves to show that risk aversion is not a necessary assumption for the mechanism.[8] Even risk-neutral entrepreneurs are discouraged to invest by the prospect of a wage job. I allow for risk aversion later in a model extension that I discuss in Section B.1 and more fully in Appendix B. The theoretical results become stronger once risk aversion is allowed for.

Under risk neutrality, expected utility equals expected income. At the stage when capital is chosen, expected utility is given by:

$$EU(k) = (1-\lambda) \cdot [\pi(k) - rk] + \lambda \cdot \big(E \max(w, \pi(k)) - rk\big), \tag{1}$$

where the expectation is taken over the wage distribution. Given that w is monotonic as we integrate along its distribution, there will be a unique reservation wage $z = \pi(k)$ above which all wage offers are accepted. We can rewrite the problem (1) as:

$$EU(k) = \pi(k) \cdot \big[1 - \lambda(1 - F(\pi(k))\big] + \lambda \int_{\pi(k)} w \cdot f(w)\, dw - rk. \tag{2}$$

In this representation, a single choice variable, capital, determines both firm size and occupational choice, given technology and the economic environment. The cost of capital has to be borne in all states of the world (since default on interest payments is not allowed) whereas returns are only realised when the agent is self-employed.

In the baseline model, I define firm size to be synonymous with the capital stock of a firm. Given the assumptions, there exists a deterministic one-to-one mapping between capital

[8] Business risk and risk premia are themselves an important determinant of productive decisions in microenterprises, and one reason why entrepreneurs require high expected returns (Samphantharak and Townsend, 2018).

stock (the only input) and output. In an extension, I show that the predictions from the basic model hold for both capital and labour in a multi-input production function.

2.2 Solution and characterisation

A solution to the choice problem (and thereby firm size) is guaranteed to exist, but need not be unique. There may be multiple local optima in firm size. I characterise the responses of firm size to an improvement in the option value of wage employment. Given the potential multiplicity of local optima and the possibility of jumps between them, local comparative statics are not a sufficient characterisation of the model. We need to also consider equilibrium selection and global comparative statics. I show that even under multiple local equilibria, the model gives a clear global prediction.

2.2.1 Optimal firm size

The necessary first-order condition for expected utility-maximising capital choice is given by:

$$EU_k = \pi'(k) \cdot \big[1 - \lambda(1 - F(\pi(k)))\big] - r = 0. \tag{3}$$

The first-order condition states that the returns to capital are multiplied by the probability of staying in self-employment, which I denote $\delta(k)$:

$$\delta(k) = 1 - \lambda(1 - F(\pi(k))). \tag{4}$$

If this probability $\delta(k)$ is less then one – i.e. if entrepreneurs take up a wage job with a positive probability – then the firm chooses an optimal size where ex-post, returns to capital are higher than the rental rate of capital r. The probability of leaving the firm drives a wedge between the returns to capital in the firm, and the rental rate of capital.

2.2.2 Existence and uniqueness

The following proposition summarises the results on existence and uniqueness of solutions to the entrepreneur's problem.

Proposition 1. *(Existence and uniqueness) There exists at least one solution to the first-order condition (3). There may exist more than one solution. If there is exactly one solution, it is a local maximum. If there is more than one solution, at least one of those solutions is a local maximum, and there may be multiple local maxima.*

To prove existence, first note the limits of the marginal product of capital and of the probability of staying in entrepreneurship, which are given by:

$$\begin{aligned} \lim_{k\to 0} \pi'_k &= \infty; & \lim_{k\to 0} \delta(k) &= 1-\lambda; \\ \lim_{k\to\infty} \pi'_k &= 0; & \lim_{k\to\infty} \delta(k) &= 1. \end{aligned}$$

Together, this implies that EU_k approaches infinity as capital reaches zero, and that it approaches a negative bound $(-r)$ for very large values of capital. By continuity, there must be a crossing point where $EU_k = 0$. This establishes existence of a solution to (3). Given that expected utility increases in the lower limit and decreases in the upper limit, there must be a solution which is a maximum.

To consider uniqueness, note that although the marginal utility in (3) needs to eventually turn negative somewhere in order to satisfy the limit conditions, it does not need to decrease for every level of capital. This follows from the sign of the second order condition:

$$EU_{kk} = \pi''(k) \cdot \delta(k) + \pi'(k) \cdot \delta'(k), \tag{5}$$

which is in general ambiguous. If it is possible that marginal utility increases locally, expected utility is not necessarily globally concave. Therefore, multiple solutions to the first-order condition (3) may exist. Together with what we established about the slope of expected utility in the limit, this means that if there are multiple solutions to the first-order condition, there will in general be multiple local maxima. The global optimum is the local optimum which yields the highest expected utility.

2.2.3 Comparative statics

The possibility of multiple local optima requires us to examine local as well as global comparative statics. The model yields a clear predictions about global comparative statics: changes in the availability or attractiveness of wage employment move local optima, as well as selection amongst local optima, in the same direction:

Proposition 2. *(Global comparative statics) (i) An improvement in the wage offer distribution and (ii) an increase in the offer probability reduces optimal firm size, if it changes the probability of staying in self-employment $\delta(k)$.*

Appendix A.1 contains the proof. To give an intuition for the proof, note that there is no general analytical way to express a ranking of local solutions. We would need to know all the primitives of the model in order to numerically evaluate expected utility. However, we can use comparative statics on the expected utility function to analytically establish the direction and relative magnitude in which expected utility, and therefore the relative comparison of local maxima, are being shifted. We do not need to evaluate expected utility, or evaluate the number of local optima, to be able to establish this intermediate result. The other intermediate step, comparative statics analysis of a local optimum, is straightforward. Together, these results prove the proposition.

2.3 Intuition and illustration

In Figure 1, I illustrate the model solution and characterisation.[9] The left-hand figure graphs marginal utility EU_k against capital k in blue dash-dotted curves. There are three crossing points with the x-axis, marked with thinly dotted vertical lines and labelled A, B and C. These are the three solutions to the first-order conditions. The right-hand side graphs expected utility as a function of capital. As we can read from the graph, the odd crossing points (A and C) are local maxima, while the crossing point in the middle B is a local minimum. If there are multiple local maxima, only one of these will be a global optimum which satisfies utility maximisation. In this example, C is the global maximum. The thin, dotted horizontal line marks the maximum expected utility in this baseline case, for reference.

[**Figure 1 about here.**]

Consider what happens after an increase in the wage distribution (graphed in red solid curves). Marginal utility shifts by a small amount. As a result, both local maxima shift downward (although only the downward shift of C is visible to the bare eye, with the new solution marked by a thin dashed line). These local shifts in firm size are a function of the shifts in the anticipated probability of staying $\delta(k)$. At point A, most wage offers are already accepted at baseline. Under such circumstances, the wage improvement does little to alter $\delta(k)$, the probability of staying. On the other hand, at C a relatively larger share of jobs now suddenly become attractive, leading to a larger effect on the probability of staying and on firm size. This discussion illustrates the local comparative statics result within Proposition 2.

[9] The graphs are drawn with a standard parametric form for the functions π and f. I use a Cobb-Douglas production function, and a lognormal wage distribution

The shift in expected utility, shown in the right-hand side of Figure 1, is more pronounced than the shift of local optima. The increase in expected utility that results from better wages is larger for smaller values of capital. As a result, the new solution close to C no longer is a global optimum. The change in the environment has lead the entrepreneur to jump to a much smaller firm size A. The probability of her staying self-employed has likewise decreased by a large amount. This illustrates the global comparative statics within Proposition 2.

Figure 2 provides additional intuition for the model. We can express the first-order condition (3) as: $\pi'(k) = \frac{r}{\delta(k)}$. In this representation, the rate of return in the firm equals the effective cost of capital at the optimum. The rental rate r is discounted by the probability of staying self-employed $\delta(k)$. The right-hand side of Figure 2 graphs these two curves. At low levels of capital, the marginal rate of return is high. The probability of leaving self-employment is high, too. This is because at low levels of capital, profits and thereby the reservation wage are relatively low, such as z_A in the left-hand side of Figure 2, which is the reservation wage associated with point A. Therefore, a large mass of wages in the market are attractive to the entrepreneur, and the probability that she accepts an offer is high. This combination of factors turns running a very small firm into a potentially optimal solution, even for an entrepreneur who would be capable to successfully manage a larger business.

[**Figure 2 about here.**]

More generally, the optimal capital choice is driven by the relative steepness of the returns to capital and the occupational choice probability. As we move up to higher levels of capital, two forces are at play. The rate of return decreases, but at the same time the probability of staying (and thereby the opportunity to enjoy returns) increases. Which of these two forces dominates depends on the model's parameters, as well as the relative shape of various functions. For instance, if the wage distribution is bell-shaped with the largest mass of wages in the middle of the distribution, $\delta(k)$ increases steeply at first, and then more slowly as we move up in the distribution. As illustrated in the graph, under such circumstances the occupational choice effect dominates at lower levels of capital (pushing optimal firm size locally towards A) whereas the rate-of-return choice effect dominates for higher levels of capital (pushing optimal firm size towards C).[10]

Finally, note that in all of these situations, firms are smaller than they would be if their size was independent of occupational choice, but driven by technological and other firm-level con-

[10]The second channel always dominates whenever $\pi'(k)\delta(k)$ decreases in k. This is equivalent to $\delta^{-1}(k)/\pi'(k)$ satisfying the monotone likelihood ratio property. If expected returns are monotonic, then only one solution to the return to capital satisfies the optimality conditions.

straints alone. This is due to the uncertainty about occupational choices that entrepreneurs face. When entrepreneurs have certainty about their future in self-employment, the model reduces to the simple textbook case of a neoclassical firm. For instance, this happens when $\delta = 1$; i.e. when the entrepreneur continues in self-employment with certainty. Within the environment considered by the model, this case occurs if $\lambda = 0$ – if there are no offers of wage employment – or if profits strictly dominate all wages and hence no wage offer is attractive. Similarly, when $\delta = 0$, entrepreneurs can be sure they will *not* stay in their business and therefore will not continue to make any investments at all.

2.4 Extension: Multiple inputs into production

The basic model assumes that firms that use a single input, capital; that investment decisions are static and entrepreneurs are risk neutral; and implicitly it assumes a single, homogeneous agent. In order to bring the model closer to the empirical reality, I extend the model to relax these assumptions in turn. I discuss the first extension which allows for multiple inputs into production here in the main text. The extensions to a dynamic model under risk aversion, and to a model which allows for heterogeneity in ability, are discussed in Appendix B.

In addition to physical capital, firms also use labour and intermediate inputs in production. These inputs are often thought of as flexible – they can be adjusted freely, and need not be contracted in advance of production taking place. Important for empirical applications of the model, data on labour and material inputs is more likely to be directly available than data on stocks of physical capital.

To deal with multiple inputs, I extend the previous assumption about the production function as follows:

Assumption 4. ***Production function with multiple inputs***

a) The production function $\pi(k, L)$ is twice continuously differentiable and concave:

$$\begin{array}{llllll} \pi'_K & > & 0; & \pi'_L & > & 0; \\ \pi''_{KK} & < & 0; & \pi''_{LL} & < & 0; \end{array} \qquad \pi''_{KK}\pi''_{LL} - \pi''_{KL}\pi''_{LK} > 0;$$

b) Capital and labour are complements in production:

$$\pi''_{LK} > 0; \qquad \pi''_{KL} > 0;$$

c) The production function fulfils the Inada conditions:

$$\begin{aligned}\lim_{k\to 0}\pi'_k(k,L) &= \infty; & \lim_{k\to\infty}\pi'_k(k,L) &= 0;\\ \lim_{L\to 0}\pi'_L(k,L) &= \infty; & \lim_{L\to\infty}\pi'_L(k,L) &= 0;\end{aligned}$$

This naturally extends Assumption 2 of a neoclassical production function to two inputs, capital and labour. Whereas capital is predetermined with respect to the revelation of information about the entrepreneur's wage employment prospects, labour is a flexible input, only chosen if and when production is realised.[11] The one substantive additional assumption I make here is that capital and labour are complements in production. While a very natural assumption, it is critical for the following result to obtain:

Proposition 3. *(Comparative statics on labour) (i) An improvement in the wage offer distribution and (ii) an increase in the offer probability reduces optimal firm size expressed in terms of capital and in terms of labour, if it changes the probability of staying in self-employment* $\delta(k, L)$*.*

Appendix A.2 proves that, as long as capital and labour are complements, a change to probability of self-employment (and thereby to the effective cost of capital r/δ) increases the *relative* labour intensity of production, but decreases the *absolute* amount of both capital and labour that are used in production. Therefore, the prediction that we obtained in the basic model about firm size is maintained regardless of whether we express firm size in terms of labour or in terms of capital.

2.5 Consistency with stylised facts

Before proceeding to the empirical test of the model, I discuss a number of stylised facts from recent literature on microentrepreneurship that the model is able to replicate.

1. **High returns to capital:** The model is consistent with a strand of literature that documents high returns to capital in microenterprises (McKenzie and Woodruff (2008), de Mel, McKenzie, and Woodruff (2008) and Fafchamps, McKenzie, Quinn, and Woodruff (2014)) in contexts where firms are discontinued at a high rate (McKenzie and Paffhausen (2018)). The model rationalises this finding with an agent who considers

[11]This assumption is more common in the literature than the alternative, assuming that labour is predetermined. It also better suits the empirical context. Labour in small firms is often informal, hence adjustment costs due to institutional constraints are negligible. In any case, Proposition 3 holds for either of these two assumptions on labour input.

their expected returns to capital in the firm and the interest rate, given by the possibility of leaving self-employment and losing some returns from investment. For surviving firms, this will result in a wedge between the *ex post* rate of return to pre-determined capital, and the fixed interest rate.

2. **Microfinance and firm growth:** Large and positive effects of access to microfinance on business outcomes tend to come from the ex ante more successful microenterprises (Angelucci, Karlan, and Zinman (2015), Banerjee, Duflo, Glennerster, and Kinnan (2015), Banerjee, Breza, Duflo, and Kinnan (2015), Fafchamps, McKenzie, Quinn, and Woodruff (2014)). This stylised fact is consistent with this model of multiple local optima. When relaxing a credit constraint allows a firm to expand, such an expansion might not be optimal for the entrepreneur in my model if it renders too many wage employment opportunities unattractive. This type of entrepreneur in the lower part of the distribution would not borrow for productive investments. On the other hand, microentrepreneurs that already operate at a larger size would be happy to borrow and increase their size and profits. As a result, microfinance will only have an effect for the firms that were already relatively large before its introduction.

3. **Capital grants and size of new entrants:** This is a corollary of the microfinance case. Potential entrepreneurs that are given a large start-up grant can immediately jump to a high equilibrium. Entrepreneurs with a small start-up grant will start small and remain small, absent any further large shock to access to finance. This matches evidence from start-up grants in several countries (Fafchamps and Quinn (2016), McKenzie (2017)).

3 Empirical strategy and data

To test the model, we need to observe entrepreneurs who are exposed to changing opportunities in wage-employment. A natural starting point is to compare the trajectories of entrepreneurs across different markets for jobs that are available to a wide range of the local population. Self-employed, small-scale entrepreneurs in Mexico and their exposure to export manufacturing jobs provide an ideal testing ground for the theory. To implement this empirical approach, I build a large and nationally representative panel dataset of Mexican entrepreneurs, covering many different local labour market constellations. Using administrative data, I isolate variation in wage employment opportunities that is exogeneous to local conditions.

3.1 Data

I build a dataset linking representative, individual survey data on the Mexican working population (including small-scale entrepreneurs) to administrative records covering the universe of formal employment in all Mexican local labour markets. I link the different sources by municipality and quarter, using the 2005 Census municipality boundaries.[12]

Labour lorce survey: Outcome variables come mainly from 40 quarterly waves of the ENOE labour force survey that span the years 2005 to 2014. The survey, conduced by the national statistical institute INEGI, follows 120,000 households every quarter, and for up to five waves in a rotating design. This allows me to build panel datasets of employment rates, transitions, earnings, and firm dynamics for about one million microenterprises in Mexico, which operate in 41,484 unique local labour market constellations.

Firm survey: A detailed firm survey on microenterprises, ENAMIN, is available in 2008, 2010 and 2012. Three waves can be linked back perfectly to the ENOE, which serves as a screening device for the microenterprises selected into the ENAMIN. Given the sample selection and measurement issues related to this screening that I discuss in Appendix C.5, I mostly use this data for descriptive purposes.

Social security records: I observe the precise number of jobs in each municipality, by industry, from social security administrative records. Social security records come from IMSS, a government institution tasked both with administering the public social insurance scheme, and with providing services to its affiliates. Enrolment with IMSS is mandatory for all workers, thus by definition the set of all IMSS-affiliated workers is equivalent to the universe of formal employment in Mexico.

Auto plants: I assemble a roster of all Mexican auto plants. By the end of 2014, Mexico had 18 automotive manufacturing plants. Most of these were final assembly plants for cars and light trucks; a few establishments were dedicated to intermediate processes such as transmissions production, engine assembly, or stamping. I construct a database on announcements of large plant expansions by hand-coding articles from the leading special interest publication for the automotive industry, *Automotive News*.

Additional data sources: I supplement the main data sources with additional administrative and census data: the 2005 and 2010 Population Census, industry-level monthly data on Mexican-US trade from the US Census bureau, and municipality-level monthly population predictions from CONAPO, the Mexican national population council. I also make use

[12] Municipalities constitute my definition of local labour markets for the main analysis. I report results using commuting zones as an alternative definition for local labour markets in Appendix D.

of several waves of the Mexican Family Life Survey (MxFLS).

I summarise the key aspects of the data for the purpose of testing the model in the main text. Section C of the online appendix gives further details on dataset construction and provides additional contextual descriptives.

3.2 Microenterprises in Mexico: an ideal testing ground

Around 11 million Mexicans – about a quarter of all individuals who hold a main occupation that earns them an income – were self-employed in the period under consideration, on average. Most firms owned by self-employed entrepreneurs are very small, as Appendix Table E.1 attests. Most of these firms would also be classified as belonging to the informal sector by various standards: only one in four firms is registered with local authorities, and one in 20 with national authorities; only 17 percent issue any kind of sales receipt; and virtually none of the business owners is affiliated with an occupational health insurance scheme such as IMSS.

Notwithstanding that 80 percent of the firms have no workers (aside from the owner-operator), as a group they are responsible for creating around 40 percent of all wage jobs (and around a quarter of aggregate employment) in Mexico. Three out of four jobs in small firms are informal; that is, the worker is not registered with IMSS, as would be legally required. Even among Mexican SME that are formally registered for taxation, a substantial proportion fail to register their workers for payroll taxes and other legal benefits (Bruhn, Karlan, and Schoar (2018)). Similar findings have been reported from other countries (e.g. Ulyssea (2018)). Informal workers are not subject to regulatory costs or restrictions on hiring and firing.

These small and informal firms operate within an economy with a large internationally integrated and modern industrial sector. Mexico has seen a boom in export-oriented industrialisation in recent decades, in particular since the creation of NAFTA, the free-trade zone between Mexico, the US, and Canada, in 1994. Sharing a 2000 mile land border with the largest economy in the world unsurprisingly implies that the lion's share of Mexican exports (more than 80 percent) goes to the US. While the initial phases of export manufacturing were characterised by a prevalence of low-skilled jobs, many of which were held by young women (Atkin (2016)), by 2005 employment in this sector was roughly equally distributed between industries in the garment trade with tasks on the lower end of the skill spectrum, and high-skill intensive industries in electrical and machinery manufacturing, including automotive.[13]

Here and for the rest of the paper, I define export manufacturing employment as formal, IMSS-affiliated jobs in ten 3-digit NAICS industries where the majority of production was exported to the US (see Appendix C.3 for details and descriptives).[14] The single largest industry by employment and export volume is transportation equipment manufacturing: the automotive sector accounts for 25 percent of all export manufacturing jobs, and 37 percent of exports. On a whole, export manufacturing provided for an average of two million jobs during 2005-2014; equivalent to 5.7 percent of all paid employment and about 8 percent of wage employment in Mexico. The vast majority of export manufacturing jobs – 85 percent – are blue-collar jobs that require full-time employment.

Sample selection

I apply various criteria to obtain a sample of small firms for which the model is potentially applicable. First, I restrict attention to the 99 percent of entrepreneurs with up to nine workers. I further restrict the sample to firms outside the agricultural sector, and to entrepreneurs of working-age population (15-64 years inclusive) who I observe for at least two consecutive periods. While each individual in the sample runs a firm in the first period, they may have made a transition to a different employment state in the second period. For the main analysis, I do not impose any further restrictions and obtain a sample of around 918,000 individuals observed over two periods. I will restrict attention to particular subsets of firms and workers when focusing on disentangling mechanisms.

[Table E.2 about here.]

Table E.2 compares the characteristics of small business owners with those of workers in export manufacturing and in other industries. Around 70 percent of workers in export manufacturing hold either an upper or lower secondary degree (which corresponds to 9-12 years of schooling), and they are on average younger than the general working-age population. There are no significant differences on gender or whether the worker is a migrant. Exporting plants in Mexico pay significant wage premia (Frías, Kaplan, and Verhoogen (2009)). Almost

[13]See Verhoogen (2008) on how in the mid-1990s Mexican manufacturing plants responded to negative trade shocks with quality upgrading.

[14]This definition is in spirit similar to the way Atkin (2016) defines export manufacturing industries. However, I work with the 3-digit NAICS classification system that is applied in both Mexican and US national statistics, whereas Atkin harmonises to the international ISIC classification. I also focus on export industries after 2005, while Atkin looks at the 1985-2000 period.

all (92 percent) of export manufacturing employment is in incorporated enterprises. These firms are much larger than the average Mexican employer: four out of five jobs are in large firms with more than 50 employees, and 95 percent in firms with more than 10 employees. As a point of comparison, close to 50 percent of all wage jobs in Mexico are in firms with 10 workers or fewer. Thus, export manufacturers and small firms run by entrepreneurs are two almost completely disjoint sub-sets of Mexican firms.

3.3 Validating the key model assumptions

Before proceeding to an empirical test of its comparative statics, I validate the assumptions on which the model rests. The available descriptive evidence suggests that the context in which small firms in Mexico operate is well approximated by the four constituent parts of Assumption 1:

1. **Discrete occupational choice:** Secondary activities are rare for Mexican entrepreneurs and workers. Only 6 percent of those who are self-employed in their main occupation, and 5 percent of those who are wage employed, report having a secondary job in addition to their primary occupation. Rather, workers seem to perform different economic activities sequentially, frequently switching between running a business and other employment states (see Appendix Table C.2 for the full transition matrix). Each quarter, only 70 percent of the self-employed stay in their occupation. Of those who leave, half do so to take up a wage job. Therefore, in this context, occupational choice is best described by a discrete choice model.[15]

2. **Missing market for managerial labour:** Since it is not possible to trace microenterprises independently of their owners, we rely on less precise but arguably conservative proxies to assess whether small firms can be passed on to other managers. 88 percent of all small-scale entrepreneurs surveyed in the ENAMIN state that they are the founder of their firm. Similarly, for 88 percent of all *former* entrepreneurs in the ENOE, we do not find a firm in the same two-digit NAICS industry run either by another household member, or as a secondary activity of the former entrepreneur. Therefore, for the vast majority of small firms in Mexico, the available empirical evidence suggests that firms do not continue to operate once their owner leaves self-employment.

[15] The alternative would be a model of continuous hours choice across different occupations held simultaneously. In some contexts such as in rural Uganda, multiple occupations are more common (e.g. Blattman, Fiala, and Martinez (2014)). Not so in urban Mexico. These differences in context are plausibly explained by the fact that I restrict attention to non-farm enterprises, as well as the higher level of income of Mexico.

3. **Firm-specific capital:** The most closely related evidence comes from microenterprises in India surveyed by Field, Pande, Papp, and Rigol (2013) that expect to retrieve only 37 percent of the total value of business capital if it needed to be sold within a day.[16] For proxy evidence from Mexico, we can turn to three waves of the Mexican family life survey (MxFLS). The MxFLS is the only panel survey to capture income from liquidation of productive assets (such as land, machinery, equipment or lifestock); without distinguishing between personal and business assets. Only 1-2 percent of households (whether they have a business or not) report any income from asset sales. Even among those households who report that they closed a business within the last 12 months, only 3 percent have positive asset sales income. While these figures probably understate the degree to which some assets (such as inventories) can be liquidated, they suggest significant capital irreversibility for Mexican microenterprises.

4. **Search frictions and wage dispersion:** I assess wage dispersion in Mexico with data from the ENOE, following the approach that Autor, Katz, and Kearney (2008) take for the US. For raw hourly wages, the 90/10 earnings gap is around 1.3-1.5 log points for men and 1.4-1.6 for women. Translated into pesos, hourly wages at the 90th percentile are about 5 times higher than at the 10th percentile. Even within very narrowly defined occupations (e.g. lawyers, industrial production supervisors, car mechanics, printing machine operators) the residual 90/10 ratio, estimated separately by gender, still averages 1.15. Regression evidence at the municipality level (see Appendix D) suggests that in the short term, employment and transition rates do respond to export job creation, but wages in the local export manufacturing sector do not. This is suggestive that in the short run, export job creation increases the job offer probability (λ in the notation of my search model) but not necessarily the wage offer distribution in large firms.

3.4 Empirical specification and identification

I test the predictions of Propositions 2 and 3 with a linear regression model in first differences. We are interested in how changes in firm size, and in the propensity of leaving self-employment, are affected by changes in local export manufacturing employment (which

[16] I am not aware of any survey (whether in Mexico or elsewhere) that would elicit a direct measurement of small firms' exit and liquidation. Scarcity of evidence surrounding exit and liquidation is not restricted to small firms. A singular exception using data on three aerospace plant closings in the US is Ramey and Shapiro (2001) who estimate discounts of 42-84 percent for used capital, relative to replacement values. Lanteri (2018) calibrates a macroeconomic model where irreversibility of capital is endogenous to the state of the economy, since the price for used capital depends in equilibrium on how many firms want to disinvest their capital stock at the same time.

I call 'export job creation', which is allowed to be negative). There are two principal concerns about identifying a causal effect of job prospects on outccomes if we used observed export job creation. First and foremost, omitted factors common to a local labour market could drive both the growth in wage employment opportunities, and the growth of small firms. Second, a reverse causal effect from increases in small firm employment to export job creation could be at play if small firms themselves are exporters. Both of these concerns should cause biases in the opposite direction of what the model predicts. A positive correlation between employment in small firms and in export manufacturing establishments would introduce an upward bias in the effect of export job creation on firm size. Likewise, a growing business would likely reduce entrepreneurs' desire to leave their firm, and thus cause a downward bias in the effect of job creation on leaving self-employment.

To address these potential issues, I isolate variation in export job creation that occurs for reasons external to the local market. Specifically, I construct a measure of local export job creation that is due to differential exposure of markets to foreign demand, given specialisation in different industries during an initial period. This measure of exposure has a straightforward interpretation as predicted job creation in export manufacturing, per thousand working-age population, in local labour market m and quarter t:

$$\left(\frac{\Delta \widehat{XME}}{WAP}\right)_{m,t} = \sum_{g\in\{XM\}} \frac{E_{m,0,g}}{WAP_{m,t-1}} \cdot \frac{\Delta x_{t,g}}{x_{0,g}}. \tag{6}$$

I create the predicted number of jobs per industry g as the interaction of initial local employment in this industry $E_{m,0,g}$ with the change of aggregate Mexican exports of goods produced by this industry, $\frac{\Delta x_{t,g}}{x_{0,g}}$. Recent empirical work has used similar approaches to allocate trade shocks to local labour markets (e.g. Dix-Carneiro and Kovak (2017), Adão (2015), Autor, Dorn, and Hanson (2013), Topalova (2010)). I use the variation in bilateral exports to the US, by far the biggest export market. The approach is valid as long as changes to aggregate exports at the 3-digit NAICS level are not driven by supply shocks in any individual municipality.[17] I normalise everything by the lagged working-age population (in thousand) and sum up over all export manufacturing industries in a municipality. My predicted measure of job creation correlates has strong predictive power for observed job creation (see Appendix

[17]Note that the research question in this paper only requires employment variation that is exogenous to local factors. It does not presuppose a particular reason for such employment variation. Even if Mexican-US trade is not only driven by US demand but also by other factors such as export competition with China (e.g. Iacovone, Rauch, and Winters (2013)) or factors at the aggregate level of the Mexican economy such as exchange rate shocks, this will still constitute a change in local export manufacturing demand that is exogenous to factors at the local labour market level. In robustness checks, I show that results are not driven by geographically concentrated industries, for which local supply shocks could be a bigger concern.

C.4).

I estimate the following regression model for entrepreneur i in municipality m. Time is indexed by t, and I adopt the convention that $\Delta x_t = x_{t+1} - x_t$:

$$\Delta y_{i,m,t} = \alpha + \beta \left(\frac{\Delta \widehat{XME}}{WAP} \right)_{m,t-s} + \boldsymbol{x'_{m,t}}\, \beta_{\mathbf{1}} + \boldsymbol{x'_{i,m,t}}\, \beta_{\mathbf{2}} + \Delta \epsilon_{i,m,t} \tag{7}$$

Specifying the regression model in first differences removes any time-invariant heterogeneity at the level of the individual as well as the level of the municipality. The control variables therefore pick up any differences in *trends*. I always control for the municipality-level components $x_{m,t}$ of predicted job creation: quarter fixed effects to pick up any aggregate time effects that move together with the time series of exports; the municipality's initial export manufacturing employment share to capture differential trends by initial industrial structure; and state fixed effects to avoid spurious correlation due to differential trends across regions with more or less export manufacturing. In my preferred specification, I also include control for differential trends by individual entrepreneur characteristics $x_{i,m,t}$: demographics (education, experience, gender), firm characteristics (industry,lagged employment and lagged profitability), and the size of the locality of residence in the vector. Specification (7) allows for shifting job creation by s quarters into the future or the past. This picks up anticipation of, and adjustment to, changing job opportunities.

My approach effectively compares two observationally equivalent entrepreneurs that face different circumstances in their respective labour market, given by the degree to which job opportunities are created in export manufacturing. Differences in job creation in turn are due to differences in aggregate exports, and to the fact that large export establishments in their municipality specialised in different industries in 2005. This research design enables me to identify the reduced-form effect of export job creation on entrepreneur behaviour. This effect has a causal interpretation under the assumption that predicted job creation is uncorrelated with unobserved shocks that are correlated with entrepreneur behaviour, conditional on the specified controls. While I cannot directly test this assumption, I can rule out the two most likely cases that it is violated: neither are small firms themselves exporters (which would introduce reverse causality) nor are my findings driven by particularly concentrated industries (where local shocks might transmit into aggregate exports; see Section 4.4).

4 Empirical evidence

In this section I document the empirical evidence for a link between wage employment opportunities and the size of entrepreneur-run firms. First I show how occupational choices of entrepreneurs respond to the creation of jobs in export manufacturing. Next I show the effect of export manufacturing opportunities on entrepreneurial choices. I subsequently explore the model's implications for heterogeneity in responses to export manufacturing jobs, and consider alternative explanations.

4.1 Job creation and occupational choice

A driving force of the model is the premise that entrepreneurs' anticipated occupational choices respond to the incentives that wage employment opportunities provide. Descriptively, we have seen high rates of turnover between self-employment and wage employment. Here I provide direct evidence on how export manufacturing employment opportunities affect occupational choices of entrepreneurs. While a finding of an effect on observed occupational transitions is consistent with a change in beliefs about wage employment opportunities and the probability of shutting down the firm, it is by no means a direct estimate of the change in beliefs. A literature on job search in developed and developing countries suggests that many individuals are over-optimistic about their job finding rate (e.g. Abebe, Caria, and Ortiz-Ospina (2018); Spinnewijn (2015)).[18]

In Table 1, I report the effect of export job creation on the propensity of entrepreneurs to leave self-employment, using the regression model (7). Job transitions are expressed quarterly. Export job creation is given by the predicted change in export manufacturing jobs over the same quarter, constructed according to (6). Following the model, my preferred variable of occupational choice is the transition from self-employment to wage employment. While we would not expect a priori that export jobs would affect the choice between self-employment and non-employment, I define a second outcome variable that captures this margin. The base specification in columns (1) and (3) includes the standard municipality-level controls: quarter fixed effects, initial export manufacturing employment share, and state fixed effects. In my preferred specification in columns (2) and (4), I individual-level controls as defined in Section 3.

[Table 1 about here.]

[18]Alternatively, entrepreneurs might not be aware that job creation will change their likelihood of leaving self-employment. The next section, which tests for effects of job creation on firm size choices, implicitly addresses this possibility. If agents do not change their beliefs, we should see no effect on firm growth.

For ease of readability, I scale the independent variable here and in what follows such that coefficients can be interpreted as percentage point increases.[19] The coefficient estimate in column (4) implies that an additional export manufacturing wage job per thousand working-age population in the local municipality – a 0.1 percent increase in jobs per adult– raises the probability that an individual leaves self-employment by 0.13 percent. There is virtually no difference in the point estimate when we look at leaving to any sector (column (2)) versus leaving only to wage employment (column (4)), suggesting that in the overall population, the choice to leave to non-employment is orthogonal to opportunities in export manufacturing. In Appendix Table E.3, I further disaggregate transitions into leaving 'permanently' (defined as not observing a return to self-employment while the individual remains in the survey) and leaving temporarily, with an observed return to self-employment. Export manufacturing employment opportunities only matter for transitions into a permanent wage job. In fact, they slightly reduce the probability of taking a temporary job.

In a next step, I re-run the preferred specification from column (2) in Table 1, but successively shift job creation to the past and to the future, respectively. That is, I run separate regressions of model (7), each for a different value of s. How occupational choice reacts to future job creation tells us about how individuals respond to changes in expectations; and how choices react to past job creation is informative about the speed of labour market adjustments. In Figure 3a, I report the results from these individual regressions. The coefficient at zero on the horizontal axis corresponds the estimate in column (4) of Table 1. To its left are coefficients for the effects of future changes to job opportunities ($s < 0$), and to its right for past changes ($s > 0$). The figure shows that entrepreneurs start to leave self-employment at higher-than-usual rates only once jobs are being created according to my predicted measure.

Taken together, the results from this section show that entrepreneurs are more likely to shut down their businesses at the time when job opportunities in export manufacturing arrive – but not before. This adjustment of occupational choice continues for up to a year.

[Figure 3 about here.]

4.2 Job creation and entrepreneurial choice

My preferred measure of firm size (and thereby of entrepreneurial choices) is is the change in employment in small firms, normalised relative to initial firm size. The variable can be interpreted as firm growth. I use two variants of this measure. The first and preferred

[19] That is, a coefficient of -0.5 means half a percentage point decrease; not 50 percentage points.

one refers to employment of paid workers who are not members of the same household, excluding the entrepreneur. This variable is by definition restricted to firms with at least one paid worker. The second variant includes employment of unpaid household members.

In the model, firm growth responds to anticipated *future* wage employment opportunities. My explanatory variable in the regressions reported in columns (5)–(8) of Table 1 is therefore export job creation in the *next* quarter. The effect of future employment opportunities on both measures of firm growth is negative and statistically significant. My preferred estimate in column (8) implies that an that an additional export manufacturing wage job per thousand working-age population in the local municipality in the next quarter reduces firm size by about 1 percent on average.

The observation that *future* but not past export employment opportunities affect small firm growth holds more generally when we again examine the effects of different lags and leads of employment opportunities. I document this pattern in Figure 3b. Changes in employment opportunities up to a year into the *future* have a significant and negative effect on small firms job growth. Past job creation, however, does not appear to have any effect. This is in contrast to the finding on occupational choice, which is primarily affected by job creation of the recent *past*.

Capital and investment

While firm size expressed by the number of workers is available in all 40 quarterly waves of the ENOE, a direct measure of fixed capital investment is only available in 3 waves when the supplemental ENAMIN microenterprise module was administered. Besides limiting variation across markets, the measurement of capital and investment in the ENAMIN is subject to several caveats.[20] Nevertheless, the data may provide suggestive evidence on the effect of wage employment opportunities on firm size measured in terms of capital. In Figure 3c, I repeat the regressions on firm size, replacing labour by capital as the measure of firm size. The outcome variable is again defined as relative firm growth, given by the rate of annual investment as a fraction of capital stock. The overall pattern is similar to that reported in Figure 3b. The individual coefficients, however, are not statistically significant (lowest $p = 0.153$). Overall, this suggestive evidence is consistent with the prediction from Proposition 3: no matter whether it is measured in terms of capital or in terms of labour,

[20] The ENAMIN was in principle applied to the firms of all self-employed individuals that were indentified in the ENOE in the fourth quarter of 2008, 2010 and 2012. However, a sudden drop in self-employment for the survey waves in which the ENAMIN was applied suggests potential misclassification and non-random sample selection. Further, investment is only measured as a recall question with reference to the last year, and the measurement tool changes between ENAMIN waves. Appendix C.5 provides details.

firm size reduces with improved wage employment opportunities.

4.3 Heterogeneous effects

After documenting these main effects that are consistent with the model predictions, I consider three kinds of heterogeneous effects along dimensions that are directly implied by theory. Not all of these dimensions are variables that are observed in the data, and I use various machine-learning methods to predict these quantities.

Heterogeneity by inclination for wage employment

The model assumes that entrepreneurs wishing to leaving to wage employment is the key driver for uncertainty about firm survival. The data, however, will likely contain a mix of very different types of entrepreneurs – the type envisaged by the model, but also entrepreneurs who see their long-term comparative advantage in business, amongst others. To separate out these types of entrepreneurs, I train a probabilistic generative model for predicting which type of entrepreneur is likely to become a wage worker. This classification exercise is similar in spirit to De Mel, McKenzie, and Woodruff (2010). Whether or not they actually leave self-employment, these entrepreneurs should place a higher likelihood on giving up their business for when export jobs are created, and therefore face stronger disincentives for firm growth.

I estimate this model on a randomly selected subsample of 100,000 observations that I hold out from the main estimation sample. I then predict the probability of leaving to wage-employment for the remaining observations. I choose a logit specification as the model's functional form.[21] In the top panel of Table 2, I split this sample at the median predicted probability of becoming a wage worker. I find that both coefficients are about twice as large for the entrepreneurs with a high predicted probability of leaving their business. This suggests that type of entrepreneurs who are most susceptible to wage offers are also the ones that respond in a much stronger way to changes in export employment opportunities, as we would expect.

[Table 2 about here.]

[21] The choice of logit over alternative classes of machine learning models such as LASSO or regression tree classification models has the advantage that it comes with a natural probabilistic interpretation (Bishop, 2006). The variables included in the model are age brackets, education levels, marital status, whether the entrepreneur works full time, the number of children, and a detailled classification of business types (e.g. corner shop with family helpers; construction firm with employees; sole professional working from home); all interacted with gender.

Heterogeneity by degree of sunk costs

The degree of irreversible capital investments should play a moderating role on the effect of job creation on firm size. The elasticity of firm size with respect to uncertainty should be higher for firms that face higher sunk costs for any given expansion in firm size. In absence of a direct measure of irreversibility, I proxy the degree of sunk costs by the firms' capital-labour ratio. The ideas is that use more capital per hour worked, conditional on industry and various other characteristics, have higher sunk costs.

Since capital and total hours of labour input are only observed for subset of around 40,000 firms that can be linked to the ENAMIN firm survey, I train a random forest algorithm to predict the capital-labour-ratio. This algorithm first fits a regression tree, which slices the data using recursive binary splits, and then uses the average outcome in each cell (or leaf) as a class prediction. Two hyper-parameters govern the algorithm: the depth of the tree, and the minimum number of observation per leaf. A random forest then fits many trees on bootstrap samples of the data, and further decorrelates the trees by randomly selecting a subset of possible feature splits. To guard against overfitting, I empirically tune the hyper-parameters on a separate hold-out sample that I randomly divided from the training data. I choose the hyper-parameters which maximise the goodness of fit on the hold-out sample. Appendix Table **??** documents this process of empirical tuning. Using the fitted model, I then predict the capital-labour ration for all the 718,000 firms in my ENOE sample that have complete data for the main predictors.

To test for heterogeneity by the degree of sunk costs, I split the sample by the median predicted capital-labour-ratio. I report results in the middle panel of Table 2. I find that both groups of entrepreneurs are similarly likely to take up a wage job upon export job creation. But entrepreneurs with a high capital-labour-ratio have a more than two times higher elasticity of firm growth with respect to job creation. This suggests that firm growth of entrepreneurs with larger sunk costs is more responsive to outside job opportunities, for a given change in the likelihood of leaving the firm; just as the model would predict.

Heterogeneity by degree of market uncertainty

Finally, I explore differences in the degree to which job creation implies uncertainty about firm survival. In volatile labour markets where export jobs come and go, the same degree of job creation might cause much less uncertainty than in relatively stable labour markets, where job creation causes an unusual shift in the opportunity cost of running a firm.

To test this implication of the model, I split the sample by the median volatility in the market, where volatility is defined as the standard deviation of quarterly changes export employment over the past year. I find that firm growth responds almost twice as strongly to a unit increase in job creation in stable markets (with below median volatility) than in more volatile markets; although this difference is not statistically significant. Occupational transitions, on the other hand, are somewhat more elastic in volatile markets, which would be expected if entrepreneurs are more prepared for the possibility that opportunities can change. However, the estimate for stable markets is noisy and again the difference not significant. In sum, this third test provides some more suggestive evidence in line with the model.

4.4 Alternative Explanations

I consider various alternative explanations for these results. Alternative explanations would pose a challenge for interpreting the empirical evidence in light of the model if they operate through links between job creation and entrepreneur behaviour other than the anticipated likelihood of leaving the firm. Viewed through the lens of my model, alternative explanations would have a direct effect on profits $\pi(k)$ which in turn would affect firm size decisions. Given that job creation constitutes a shock a the local market level, alternative explanations that operate through local general equilibrium (GE) effects are of particular concern. I also consider the leading alternative theory on the relation between entrepreneurship and wage work.

Labour market competition

First, local export manufacturing shocks could affect the equilibrium of the local labour market, for example through their effects on local wages.[22] This potential alternative mechanism is an important concern because it implies predictions that go in the same way as my model. Labour market competition would be expected to affect small firms with close linkages to export manufacturers, such as small manufacturing firms with workers that are arguably most easily employable in large manufacturing establishments

[Table 3 about here.]

In principle, labour market spillovers should be detectable in wage adjustments. From wage data, there is indeed some suggestive evidence that this concern applies, but only for partic-

[22] This is the mechanism how shocks to the exporting sector transmit to small domestic firms in the economy in the standard trade model with heterogeneous firms (Melitz (2003)).

ular industries. I present this evidence in Table 3 and in Panel A of Figure 4. I find that a unit increase of local export manufacturing jobs bids up wages paid by small manufacturers to their workers. The increase is economically small (0.2 percent), but it is sustained over several quarters starting from about six months before predicted job creation. Wages paid by small construction firms are affected too, but in a less sustained manner. However, wages paid by small firms in other sectors (such as transport, trade and services) are not affected at all, with point estimates of virtually zero at any moment.

While these results suggest that labour market spillovers are limited to the construction and manufacturing sectors, not all spillovers might manifest themselves in prices, especially in the short term. I therefore also look for potential spillovers on quantities, expressed by worker transitions from small to large firms. We find evidence that the reduction of firm size in small construction firms goes hand in hand with increased transitions of these kinds of workers to large firms, which might be indicative of worker poaching. I find that transitions of workers in other industries (including manufacturing) are not affected by job creation.

In sum, I encounter indicators of labour market spillovers on manufacturing firms (through increased wages) and on construction firms (through increased worker out-transitions). The estimate of a spillover effect on firms in other sectors is a fairly precisely estimated zero. Given this evidence, I drop firms in construction and manufacturing from the analysis (Figure 4g and 4i). I find the same pattern as before; if anything quantitatively slightly stronger. This suggests that labour market spillovers alone cannot account for my results.

[**Figure 4 about here.**]

Product demand effects

A second possibility is that job creation leads to local demand spillovers, through supply chain linkages, goods market competition, or Keynesian multiplier effects. Positive spillovers work in the opposite direction to my model: positive demand effects increase the incentives for small firm growth, whereas employment opportunities decrease them. Negative spillovers work in the same direction. Spillovers in the product market are harder to detect with my data than spillovers in the labour market. I find no evidence of an effect on overall local prices (Column 10 of Table 3). We would expect negative spillovers especially for small manufacturing firms. The patterns reported in Figure 4 for those firms is consistent with negative demand spillovers, but we cannot disentangle them from negative labour market spillovers. On the other hand, construction, service and retail firms would likely benefit through increased demand; which would if anything attenuate our results. In sum, local demand spillovers are not a likely alternative explanation behind our findings.

Contract structure effects

Third, a positive shock to export manufacturers might change the contract structure in upstream sectors. Export manufacturers might seek larger and formal partners, whether in the construction phase or as suppliers. Thus, the construction sector (and to a lesser degree local manufacturing) may experience this kind of spillovers. There is some evidence for this in the results. Employment in construction seems to shift away from small informal firms to large establishments in the lead-up to export job creation. But the evidence is not quite as clear-cut, as construction business owners are significantly less likely to give up their firm. Contract structure effects should not be expected in small service and retail businesses, which are hardly directly linked to export manufacturers.

Wage jobs as a complement

The final alternative explanation I consider arises from the model where wage work and entrepreneurship are complements (Vereshchagina and Hopenhayn, 2009; Bianchi and Bobba, 2013). The prospect of wage work could be perceived by entrepreneurs as an insurance against business failure, which might encourage them to invest into riskier projects. This would imply that more job creation would lead to higher growth in surviving firms; with ambiguous predictions for the likelihood of transiting from self-employment to a wage job. However, this is not what I find – to the contrary, job creation has a negative effect on firm growth.

Other robustness checks

I relegate other robustness checks to Appendix D, where I discuss them in some detail. Among other checks, I document robustness of my findings to to (i) my definition of local labour markets, (ii) my definition of export manufacturing jobs, and (iii) strongly agglomerated industries which could introduce reverse causality.

5 The role of expectations

5.1 Event study design

In order to have any effect on their behaviour, future local export manufacturing employment opportunities must be anticipated by entrepreneurs. So far, the results have been consistent with such anticipation effects, but we were not able to observe either the expections or the information set of entrepreneurs. This section addresses this remaining gap in the empirical evidence.

For major investment projects of publicly listed multinational companies, the revelation of information is well documented. New projects are announced by the company's foreign headquarters, reported in the global financial and special interest industry press, and are picked up by local media in the geographical area of the production site. Exploiting such central revelation of information on major plant expansions, I conduct an event study for the universe of Mexican car manufacturing plants. Transport equipment manufacturing (NAICS sub-sector 336) is the largest among Mexican export manufacturing industries in terms of employment and export volume; and the one with the fastest growth rate (see Appendix C.3.)[23]

In total, I identify 56 public announcements of major plant expansions in the 18 auto plants that existed in the relevant period: introductions of new product lines, capacity expansions, installation of major first tier suppliers, and two greenfield plant openings. Within each local labour market indexed by z, I assign dummy variables $e_{z,q}$ for each quarter since the announcement in period t, which itself is assigned to event time $q = 0$.[24] I also assign dummies for quarters before the announcement. I corrobate these dates with municipality-level time-series of transport equipment manufacturing employment constructed from IMSS records.

My basic event study specification is the regression model

$$\Delta y_{i,z,t} = \alpha + \sum_{q=-4}^{8} \gamma_q \cdot e_{z,q} + \boldsymbol{x'_{z,t}}\beta_{\mathbf{1}} + \boldsymbol{x'_{i,z,t}}\beta_{\mathbf{2}} + \Delta\epsilon_{i,z,t} \tag{8}$$

where control variables are defined as before, and where quarterly event dummies capture a non-parametric trend of arbitrary shape. I additionally estimate a parametric form of this trend. That is, I place restrictions of a particular parametric shape on the post-event time

[23] Jobs in the Mexican auto industry are very salient and sought after, even more than the direct employment numbers would suggest. For example, in January 2016, nine months before the eventual start of production at its new plant in Puebla, Audi announced that it had received around 200,000 applications for 2,000 jobs to date; or 100 applications per job (Press release by Audi México from 21 January 2016, accessed on 02/03/2019 at http://www.audi.com.mx/dam/nemo/mx/compania/media-center/noticias/pdf/160122_audi-mexico-empleado-2000.pdf.) Note that this plant opening falls outside the period covered by my data.

[24] In the case of greenfield assembly plants – which tend to exhibit a lag of around 3 years between the first public announcement and the start of production – I work backward from the start of production. The first quarter generally seems to coincide with the start of major hiring. I allocate four quarters ($q = 0$ through $q = 3$) exclusively to a single expansion. That is, I allow for subsequent expansion announcements in $q > 3$.

dummies.[25] For instance, in the case of restricting the shape to a third-order polynomial, I estimate equation (8) subject to:

$$\gamma_{z,q} = \begin{cases} 0 & \text{if} \quad q < 0 \\ \phi_0 + \phi_1 \cdot q + \phi_2 \cdot q^2 + \phi_3 \cdot q^3 & \text{if} \quad q > 0 \end{cases} \tag{9}$$

Most auto plants are located in suburbs of mid-sized metropolitan areas. Many such suburbs constitute their own municipality. In order to adequately capture the exposure area for major plant expansions, I define commuting zones (CZ) as the relevant local labour market for the purpose of this event study.[26]

5.2 Findings from the event study

I first describe the evolution of auto jobs before and after an announcement by estimating model (8) at the level of CZ, without controls. Figure 5 plots the quarterly change in CZ auto jobs before and after an announcement, relative to other time periods in these commuting zones. I also plot a quadratic trend estimate of the post-announcement change in auto jobs. Auto job creation rises strongly following an announcement. It peaks a year after the annoucement. During the first post-announcement year, on average 2,200 additional auto jobs are created in the local commuting zone. Expansion announcements do not occur entirely randomly; rather there is previous uptick in auto jobs in the CZ. There are at least two possibilities for this pattern. First, the auto plant starts its expansion already before the public announcement. Second, this job creation is driven by local suppliers, many of which are covered by the same NAICS industry code.. In order to distinguish between these two explanations, I additionally report the evolution of auto jobs only for the municipality where the auto plant is located. There is no pre-announcement trend within the municipality itself. This suggests that this pre-announcement growth occurs in suppliers located elsewhere in the CZ; consistent with anecdotal evidence that local supply chains are a major determinant of plant location choices.

[Figure 5 about here.]

[25] This follows the estimation of trajectories of treatment effects for randomised control trials (Abebe, Caria, Fafchamps, Falco, Franklin, and Quinn (2016)).

[26] I use two pieces of information to aggregate municipalities up to commuting zones. First, I use the 2005 definition of *Zonas Metropolitanas* maintained by a working group of Mexican public agencies, and published by INEGI. Second, I apply a further aggregation from Atkin (2016) based on cross-municipality commuting patterns in the 2000 Census. These aggregation steps seem sufficient to properly delineate the urban area around an auto plant.

[**Figure 6 about here.**]

Figure 6 graphically reports the main event study: how does small firm growth respond to plant expansion announcements? First, note that, unlike for auto jobs, there is no pre-announcement trend in the growth of small firms, conditional on controls. Even though expansion announcements are not random, the absence of any pre-announcement trend provides some confidence that any subsequent changes in small firm growth will be a result of the announcement. Second, small firm growth dimishes strongly in the first and second quarter after the announcement. These short-term effects are economically large. The coefficient at Q2 implies a 50 percent reduction in firm growth relative to the mean. Third, small firm growth reverts back to normal a year after the announcement. Firm size increases in the post-expansion phase, once the expanded plant is established. At this stage, alternative channels (such as local demand spillovers) might be driving small firm growth.

In sum, the event study from the Mexican auto industry suggests that it is the available information (and/or salience) of export manufacturing jobs which link it to small firm growth. Over the course of two to three quarters, small firm growth is reduced when a major auto plant expansion adds local jobs.

6 Conclusion

In this paper, I propose that job prospects in local labour markets impact the behaviour of entrepreneurs who operate in these same markets. I provide a theoretical framework that maps search frictions in the wage labour market into entrepreneurs' uncertainty about returns to forward-looking investment which is to some degree irreversible. As a result, the opportunities for wage work and entrepreneurial investments into firms are substitutes. The prospect of wage work provides incentives for entrepreneurs to hold back on investments into firm size. I find evidence that supports this hypothesized mechanism among a large and representative sample of microenterprises in Mexico that are exposed to varying job opportunities in export-intensive industries.

These theoretical and empirical findings provide two leads for future research and policy, one direct and one more indirect. The direct implication is that policies aimed at supporting microenterprises should pay attention to entrepreneurs' outside employment option. Whereas much previous work tends to treat exit mostly as a sample attrition problem, my findings suggest that small firm death and survival are substantial variables of interest (see also McKenzie and Paffhausen (2018)). Exit of entrepreneurs to wage work could be both a target that policy might seek to affect, or an important moderator for other policies such as provision of credit. My findings lend support to policies which aim to target individuals whose long-term comparative advantage lies in entrepreneurship.

More indirectly, my findings raise the question whether policy should strive to encourage survival and growth of microenterprises, or whether it should instead encourage the transition into wage work in existing large and productive firms. This paper is deliberately focused on working out the implications of the prospect of wage work for performance and exit of entrepreneurs. The market frictions that give rise to the mechanism, however, also have implications for selection into entrepreneurship, and for the general equilibrium of an economy where entrepreneurs manage firms, create jobs, and compete in markets. For instance, distorted firm choices under uncertainty as well as search frictions which prevent individuals from pursuing their comparative advantage can be a source of misallocations (David, Hopenhayn, and Venkateswaran, 2016; Hsieh and Klenow, 2009). While this paper points to some of the effects and trade-offs involved, future work and perhaps more structure will be needed to address the full implications of this behavioural channel for the economy.

References

Abebe, G., S. Caria, M. Fafchamps, P. Falco, S. Franklin, and S. Quinn (2016): "Curse of Anonymity or Tyranny of Distance? The Impacts of Job-Search Support in Urban Ethiopia," Working Paper 22409, National Bureau of Economic Research.

Abebe, G., S. Caria, and E. Ortiz-Ospina (2018): "The Selection of Talent: Experimental and Structural Evidence from Ethiopia," Mimeo.

Adão, R. (2015): "Worker Heterogeneity, Wage Inequality, and International Trade: Theory and Evidence from Brazil," Discussion paper, mimeo.

Advani, A. (2018): "Insurance Networks and Poverty Traps," Mimeo.

Akerlof, G. (1970): "The market for lemons: Quality uncertainty and the market mechanism," *Quarterly Journal of Economics*, 84(3), 488–500.

Angelucci, M., D. Karlan, and J. Zinman (2015): "Microcredit Impacts: Evidence from a Randomized Microcredit Program Placement Experiment by Compartamos Banco," *American Economic Journal: Applied Economics*, 7(1), 151–82.

Atkin, D. (2016): "Endogenous Skill Acquisition and Export Manufacturing in Mexico," *American Economic Review*, 106(8), 2046–85.

Autor, D., D. Dorn, and G. H. Hanson (2013): "The China syndrome: Local labor market effects of import competition in the United States," *The American Economic Review*, 103(6), 2121–2168.

Autor, D. H., L. F. Katz, and M. S. Kearney (2008): "Trends in US wage inequality: Revising the revisionists," *The Review of Economics and Statistics*, 90(2), 300–323.

Banerjee, A., E. Breza, E. Duflo, and C. Kinnan (2015): "Do credit constraints limit entrepreneurship? Heterogeneity in the returns to microfinance," Mimeo.

Banerjee, A., E. Duflo, R. Glennerster, and C. Kinnan (2015): "The Miracle of Microfinance? Evidence from a Randomized Evaluation," *American Economic Journal: Applied Economics*, 7(1), 22–53.

Benjamin, D. (1992): "Household composition, labor markets, and labor demand: testing for separation in agricultural household models," *Econometrica: Journal of the Econometric Society*, pp. 287–322.

Bernanke, B. S. (1983): "Irreversibility, uncertainty, and cyclical investment," *The Quarterly Journal of Economics*, 98(1), 85–106.

Bianchi, M., and M. Bobba (2013): "Liquidity, risk, and occupational choices," *The Review of Economic Studies*, 80(2), 491–511.

Bishop, C. M. (2006): *Pattern recognition and machine learning*. Springer.

Blattman, C., N. Fiala, and S. Martinez (2014): "Generating Skilled Self-Employment in Developing Countries: Experimental Evidence from Uganda," *Quarterly Journal of Economics*, 129(2).

Bloom, N. (2009): "The impact of uncertainty shocks," *Econometrica*, 77(3), 623–685.

Bloom, N., S. Bond, and J. Van Reenen (2007): "Uncertainty and investment dynamics," *The Review of Economic Studies*, 74(2), 391–415.

Bruhn, M., D. Karlan, and A. Schoar (2018): "The impact of consulting services on small and medium enterprises: Evidence from a randomized trial in mexico," *Journal of Political Economy*, 126(2), 635–687.

Crépon, B., F. Devoto, E. Duflo, and W. Parienté (2015): "Estimating the impact of microcredit on those who take it up: Evidence from a randomized experiment in Morocco," *American Economic Journal: Applied Economics*, 7(1), 123–50.

David, J. M., H. A. Hopenhayn, and V. Venkateswaran (2016): "Information, Misallocation and Aggregate Productivity," *The Quarterly Journal of Economics*, 131(2), 943–1005.

de Mel, S., D. McKenzie, and C. Woodruff (2008): "Returns to capital in microenterprises: Evidence from a field experiment," *The Quarterly Journal of Economics*, 123(4), 1329–1372.

De Mel, S., D. McKenzie, and C. Woodruff (2010): "Who are the microenterprise owners? Evidence from Sri Lanka on Tokman v. de Soto," in *International Differences in Entrepreneurship*, ed. by J. Lerner, and A. Schoar, pp. 63–87. University of Chicago Press.

de Mel, S., D. McKenzie, and C. Woodruff (2018): "Labor Drops: Experimental Evidence on the Return to Additional Labor in Microenterprises," *American Economic Journal: Applied Economics*, forthcoming.

Dix-Carneiro, R., and B. K. Kovak (2017): "Trade liberalization and regional dynamics," *American Economic Review*, 107(10), 2908–46.

Evans, D., and B. Jovanovic (1989): "An Estimated Model of Entrepreneurial Choice under Liquidity Constraints," *Journal of Political Economy*, 97(4), 808–827.

Fafchamps, M., D. McKenzie, S. Quinn, and C. Woodruff (2014): "Microenterprise Growth and the Flypaper Effect: Evidence from a Randomized Experiment in Ghana," *Journal of Development Economics*, 116, 211–226.

Fafchamps, M., and S. Quinn (2016): "Aspire," *Journal of Development Studies*, 54(10), 1–19.

Fama, E. F., and M. C. Jensen (1983): "Separation of ownership and control," *The journal of Law and Economics*, 26(2), 301–325.

Field, E., R. Pande, J. Papp, and N. Rigol (2013): "Does the Classic Microfinance Model Discourage Entrepreneurship Among the Poor? Experimental Evidence from India," *American Economic Review*, 103(6), 2196–2226.

Frías, J. A., D. S. Kaplan, and E. A. Verhoogen (2009): "Exports and Wage Premia: Evidence from Mexican Employer-Employee Data," Mimeo.

Goldstein, M., and C. Udry (2008): "The profits of power: Land rights and agricultural investment in Ghana," *Journal of Political Economy*, 116(6), 981–1022.

Gollin, D. (2008): "Nobody's business but my own: Self-employment and small enterprise in economic development," *Journal of Monetary Economics*, 55(2008), 219–233.

Gottlieb, J. D., R. R. Townsend, and T. Xu (2016): "Experimenting with entrepreneurship: the effect of job-protected leave," Working Paper 22446, National Bureau of Economic Research.

Günther, I., and A. Launov (2012): "Informal Employment in Developing Countries: Opportunity or Last Resort?," *Journal of Development Economics*, 97(1), 88–98.

Haywood, L., and P. Falco (2016): "Entrepreneurship vs Joblessness: Explaining the Rise in Self-Employment," *Journal of Development Economics*, 118, 245–265.

Heath, R., and A. M. Mobarak (2015): "Manufacturing growth and the lives of Bangladeshi women," *Journal of Development Economics*, 115, 1–15.

Hombert, J., A. Schoar, D. Sraer, and D. Thesmar (2014): "Can Unemployment Insurance Spur Entrepreneurial Activity?," Working Paper 20717, National Bureau of Economic Research.

Hsieh, C.-T., and P. J. Klenow (2009): "Misallocation and Manufacturing TFP in China and India," *The Quarterly Journal of Economics*, 124(4), 1403–1448.

Humphries, J. E. (2017): "The Causes and Consequences of Self-Employment over the Life Cycle," Job Market Paper, University of Chicago.

Iacovone, L., F. Rauch, and L. A. Winters (2013): "Trade as an engine of creative destruction: Mexican experience with Chinese competition," *Journal of International Economics*, 89(2), 379–392.

Jovanovic, B. (1982): "Selection and the Evolution of Industry," *Econometrica*, 50(3), 649–670.

Kihlstrom, R., and J.-J. Laffont (1979): "A General Equilibrium Entrepreneurial Theory of Firm Formation Based on Risk Aversion," *Journal of Political Economy*, 87(4), 719–748.

Kraay, A., and D. McKenzie (2014): "Do Poverty Traps Exist? Assessing the Evidence," *Journal of Economic Perspectives*, 28(3), 127–148.

LaFave, D., and D. Thomas (2016): "Farms, Families, and Markets: New Evidence on Completeness of Markets in Agricultural Settings," *Econometrica*, 84(5), 1917–1960.

Lanteri, A. (2018): "The Market for Used Capital: Endogenous Irreversibility and Reallocation over the Business Cycle," *American Economic Review*, forthcoming.

Lucas, R. (1978): "On the Size Distribution of Business Firms," *The Bell Journal of Economics*, 9(2), 508–523.

Maloney, W. F. (1999): "Does informality imply segmentation in urban labor markets? Evidence from sectoral transitions in Mexico," *The World Bank Economic Review*, 13(2), 275–302.

Marschak, J. (1949): "Role of liquidity under complete and incomplete information," *The American Economic Review*, pp. 182–195.

McCaig, B., and N. Pavcnik (2018): "Export markets and labor allocation in a low-income country," *American Economic Review*, forthcoming.

McKenzie, D. (2017): "Identifying and Spurring High-Growth Entrepreneurship: Experimental Evidence from a Business Plan Competition," *American Economic Review*, 107(8), 2278–2307.

McKenzie, D., and A. L. Paffhausen (2018): "Small Firm Death in Developing Countries," *Review of Economics and Statistics*, forthcoming.

McKenzie, D., and C. Woodruff (2008): "Experimental evidence on returns to capital and access to finance in Mexico," *The World Bank Economic Review*, 22(3), 457–482.

Melitz, M. (2003): "The Impact of Trade on Intra-Industry Reallocations and Aggregate Industry Productivity," *Econometrica*, 71, 1695–1725.

Mortensen, D. (1970): "Job search, the Duration of Unemployment, and the Phillips Curve," *American Economic Review*, 60(5), 847–862.

Ramey, V. A., and M. D. Shapiro (2001): "Displaced capital: A study of aerospace plant closings," *Journal of Political Economy*, 109(5), 958–992.

Ramsey, F. (1928): "A Mathematical Theory of Saving," *The Economic Journal*, 38, 543–559.

Samphantharak, K., and R. M. Townsend (2018): "Risk and return in village economies," *American Economic Journal: Microeconomics*, 10(1), 1–40.

Spinnewijn, J. (2015): "Unemployed but optimistic: Optimal insurance design with biased beliefs," *Journal of the European Economic Association*, 13(1), 130–167.

Topalova, P. (2010): "Factor Immobility and Regional Impacts of Trade Liberalization: Evidence on Poverty from India," *American Economic Journal: Applied Economics*, 2(4), 1–41.

Ulyssea, G. (2018): "Firms, informality, and development: Theory and evidence from Brazil," *American Economic Review*, 108(8), 2015–47.

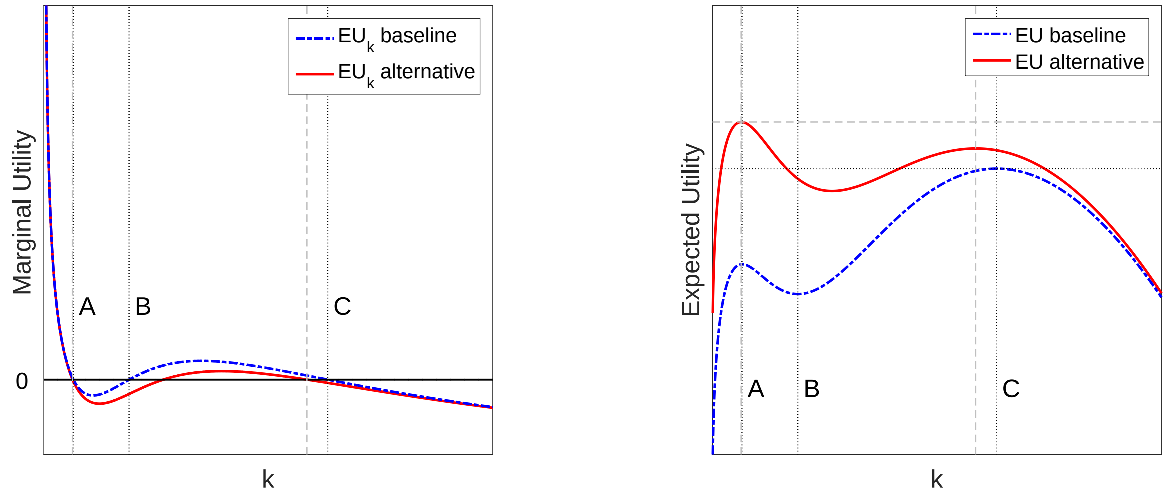
Vereshchagina, G., and H. A. Hopenhayn (2009): "Risk taking by entrepreneurs," *The American Economic Review*, 99(5), 1808–1830.

Verhoogen, E. A. (2008): "Trade, Quality Upgrading, and Wage Inequality in the Mexican Manufacturing Sector," *The Quarterly Journal of Economics*, 123(2), 489–530.

Main Text Tables and Figures

FIGURE 1

Multiple solutions, local and global comparative statics



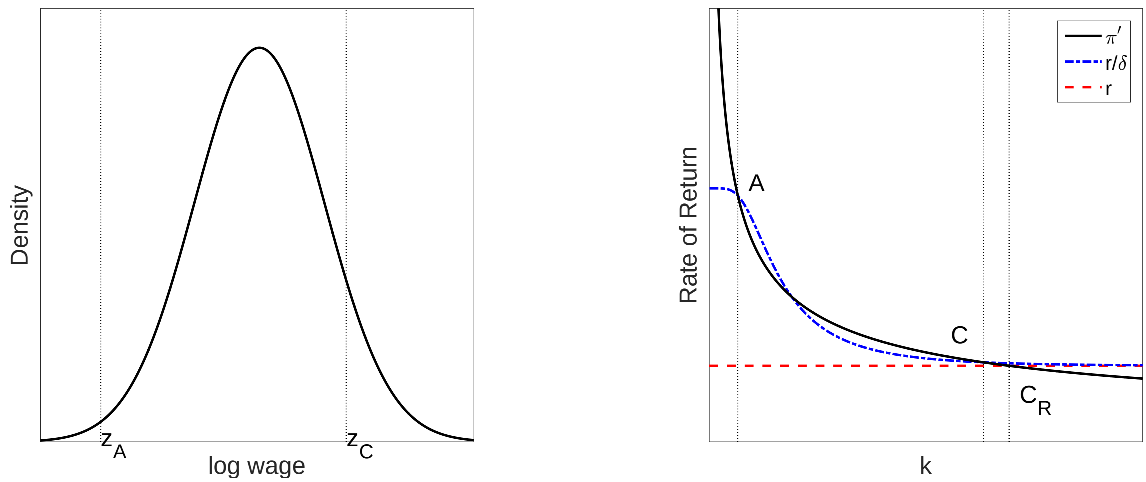
(a) Marginal utility and the FOC

(b) Expected utility, local and global optima

Notes: This figure graphs the model in expected utility (right) and marginal utility (left) space against the amount of capital invested. It graphs a baseline case (blue dotted) and the comparative statics with a higher job offer rate λ (red solid). Expected utility is non-monotonic in capital. Crossing points A and C of marginal utility are local optima; C is the global optimum. As the outside option of a wage job increases, A and C locally shift downward and the global comparison shifts toward the lower equilibrium A. Firm size k unambiguously decreases.

FIGURE 2

Intuition: Firm size and the probability of staying



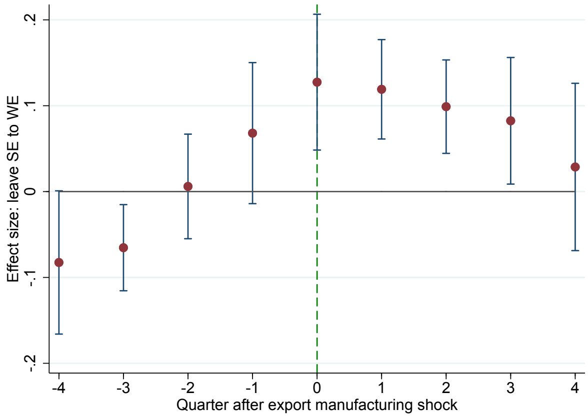
(a) Wage offer distribution and reservation wages

(b) Rates of return representation

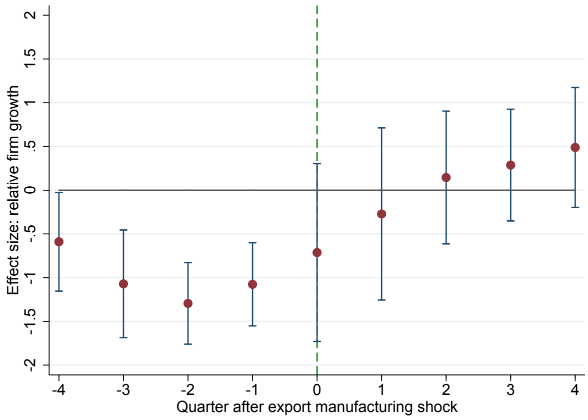
Notes: This figure graphs the model in rates of return space (right) and the quantiles of the wage offer distribution associated with local optima A and C (left). The relative slope and curvature of the effective discount factor δ and the marginal product of capital π' determine the existence of multiple optima.

FIGURE 3

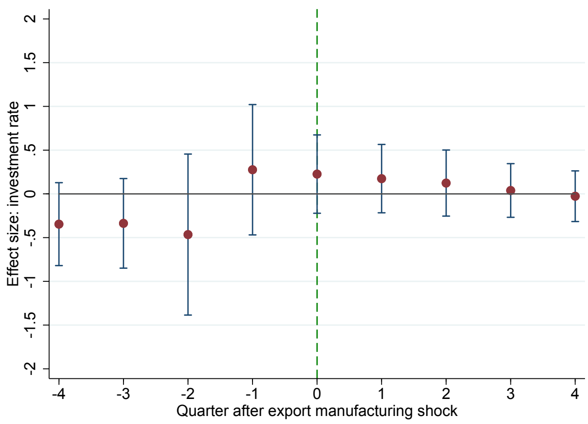
Timing of entrepreneur's responses to job creation



(a) Occupational choice: leave to WE



(b) Entrepreneurial choice: firm growth in terms of hired workers



(c) Entrepreneurial choice: firm growth in terms of capital

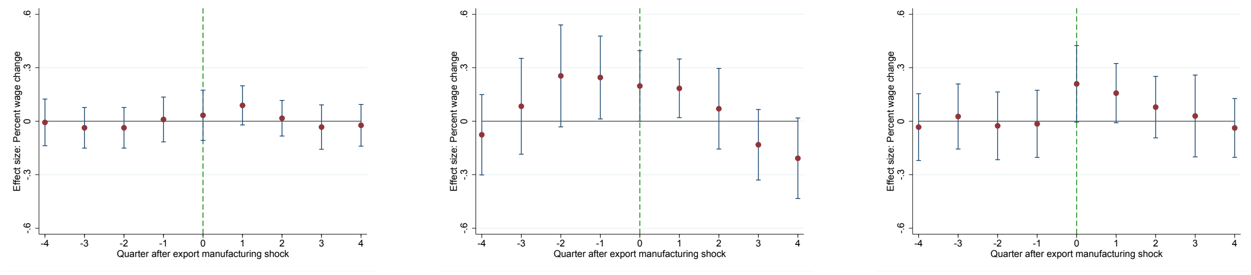
Source: Results from regression of model (7), using the specification reported in Column (4) of Table 1 (left) and Table 4 (right). Horizontal axis documents the number of quarters s that the dependent variable has been shifted. Each coefficient corresponds to a separate regression. Reported 95 % confidence intervals use two-way clustered standard errors by municipality and quarter.

FIGURE 4

Testing for alternative mechanisms

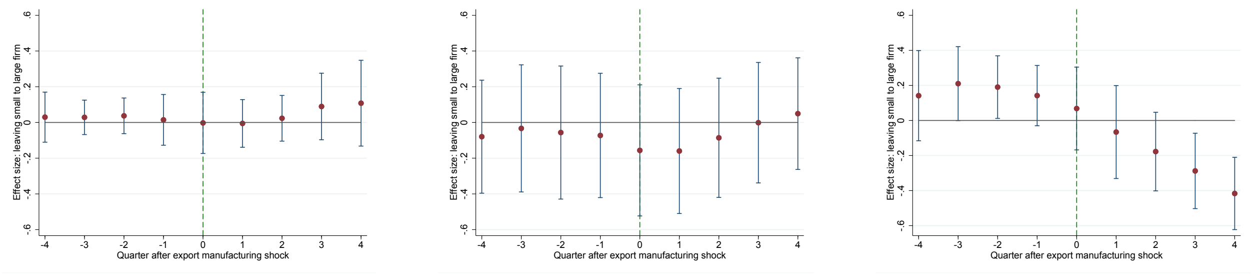
Other industries | **Manufacturing** | **Construction**

A. Wage increases in small firms



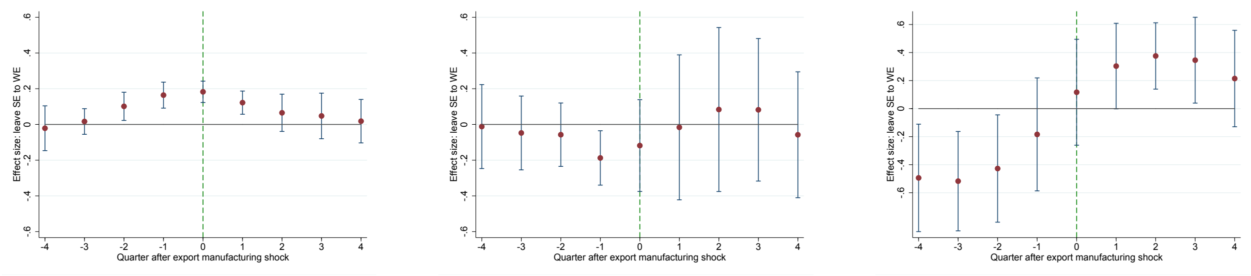
(a) (b) (c)

B. Small firm workers leaving to large firms



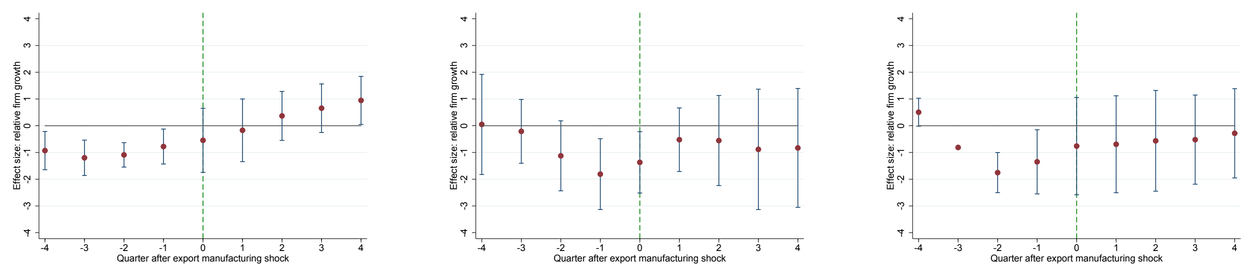
(d) (e) (f)

C. Entrepreneurs leaving to WE



(g) (h) (i)

D. Firm growth in small businesses

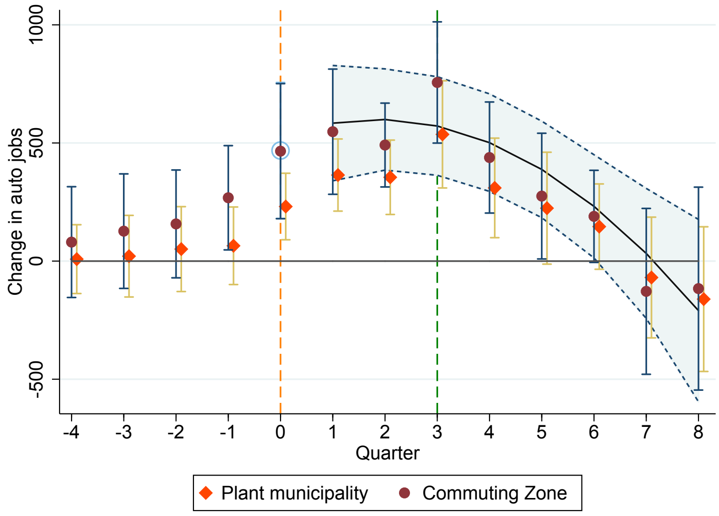


(j) (k) (l)

Source: This table documents the extent of spillovers from export manufacturing job creation. Each column corresponds to a different industry, each row/panel corresponds to a different outcome. The units of analysis are: (Panel A) Individual workers in small firms, (Panel B) Municipality-average wages of workers in small firms, (Panel C and D) Individual entrepreneurs with small firms. Horizontal axis documents the number of quarters s that the dependent variable has been shifted. Each coefficient corresponds to a separate regression. Reported 95 % confidence intervals use two-way clustered standard errors by municipality and quarter.

FIGURE 5

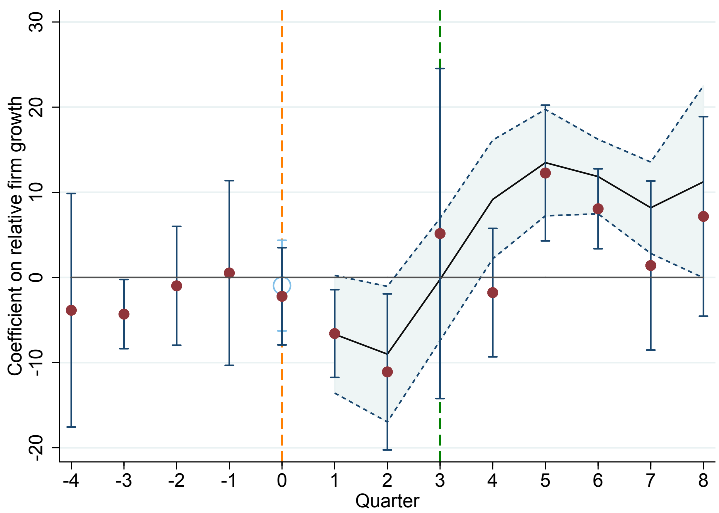
Automotive case study: large plant expansions and job creation



Source: The graph shows the coefficients from a regression of labour-market level changes in auto jobs on quarterly dummies indicating the time from the announcement of a major plant expansion. Confidence intervals at 95 percent. The quadratic trend corresponds to a constrained CZ-level regression.

FIGURE 6

Automotive case study: large plant expansions and small firm growth



Source: The dots plot the coefficients of an estimation of model (8) together with their 95 percent confidence intervals. The line shows a cubic trend, imposing the additional restriction (9) on the regression model, with 95 percent confidence intervals. The hollow circle shows the coefficient on the announcement period from the constrained model.

TABLE 1

EFFECT OF JOB CREATION ON ENTREPRENEUR BEHAVIOUR

	Leave self-employment				**Firm growth**			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Dependent Variable:	To all	To all	To WE	To WE	Paid workers	Paid workers	All workers	All workers
Δ Pred. XME/WAP	0.0973***	0.116	0.111***	0.127***				
	(0.0337)	(0.0703)	(0.0386)	(0.0409)				
F.Δ Pred. XME/WAP					-0.582*	-1.076***	-0.375**	-0.564***
					(0.304)	(0.246)	(0.151)	(0.169)
Municipality controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Individual controls	No	Yes	No	Yes	No	Yes	No	Yes
Dep. var. mean	33.46	33.57	17.68	17.41	-18.73	-22.71	-16.07	-18.90
# distinct LLM	25,789	25,436	25,375	24,900	16,213	14,707	20,718	19,406
# municipalities	1,491	1,490	1,479	1,477	1,272	1,255	1,412	1,401
# quarters	39	39	39	39	38	38	38	38
Observations	918,160	727,539	747,411	590,176	132,998	97,524	224,298	171,768

Notes. This table reports the test of the model predictions. It shows the effect of export job creation (defined in equation 7) on entrepreneur behaviour. Dependent variables are a dummy variable whether entrepreneur leaves self-employment (to any alternative or specifically to a wage job) and firm growth (in terms of number paid workers or household workers). Firm growth is only defined for microenterprises wiht at least one worker in the category. Control variable sets are defined in the main text. Each regression uses ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE 2

Heterogeneous effects

	(1)	(2)	(3)	(4)
Subsample	**Low Pr(Leave)**		**High Pr(Leave)**	
Dependent Variable:	Leave to WE	Firm Growth paid workers	Leave to WE	Firm Growth paid workers
Δ Pred. XME/WAP	0.0894*		0.150**	
	(0.0488)		(0.0700)	
F.Δ Pred. XME/WAP		-0.767		-2.007***
		(0.527)		(0.455)
Dep. var. mean	8.95	-23.42	25.40	-22.29
Observations	236,919	40,588	264,812	42,327
Subsample	**Low K/L ratio**		**High K/L ratio**	
Dependent Variable:	Leave to WE	Firm Growth paid workers	Leave to WE	Firm Growth paid workers
Δ Pred. XME/WAP	0.135*		0.121***	
	(0.0771)		(0.0292)	
F.Δ Pred. XME/WAP		-0.616**		-1.439**
		(0.297)		(0.584)
Dep. var. mean	18.23	-33.83	16.47	-9.72
Observations	295,084	48,664	295,092	48,860
Subsample	**Stable markets**		**Volatile markets**	
Dependent Variable:	Leave to WE	Firm Growth paid workers	Leave to WE	Firm Growth paid workers
Δ Pred. XME/WAP	0.121		0.169***	
	(0.0972)		(0.0589)	
F.Δ Pred. XME/WAP		-1.427**		-0.890*
		(0.618)		(0.506)
Dep. var. mean	17.59	-21.24	18.15	-22.49
Observations	245,906	42,712	245,123	42,705

Notes. This table reports heterogeneous effects of job creation on entrepreneur behaviour. In each panel the sample is split at the median of the respective moderating variable. Pr(Leave) is the predicted baseline probability, independent of export job creation, of leaving to a wage job. K/L ratio is the imputed capital labour ratio of the business, predicted using a cross-validated random forest machine learning model on the subsample of entrepreneurs that can be linked to the ENAMIN firm survey. Volatility scales job creation by the standard deviation of municipal export job creation in four quarters preceding an observation. Each regression includes the full set of controls and uses ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3: Effects on incomes and prices

	Dependent Variable: $100 \times \Delta$ log(average income)									
Sector:	Manufacturing			Construction			Other industries			Prices
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Type of income:	Profits	Small firm wages	Large firm wages	Profits	Small firm wages	Large firm wages	Profits	Small firm wages	Large firm wages	All
Δ Pred. XME/WAP	-0.178	0.198*	-0.0567	0.121	0.210*	0.0472	0.112	0.0334	0.0884**	0.0288
	(0.210)	(0.101)	(0.0646)	(0.118)	(0.109)	(0.205)	(0.0941)	(0.0719)	(0.0438)	(0.0259)
Dep. var. mean	-0.35	-0.12	-0.11	-0.08	-0.21	0.00	-0.72	-0.20	-0.16	4.04
# municipalities	1,322	1,172	1,026	1,140	1,333	816	1,457	1,456	1,353	45
Observations	21,753	19,437	20,183	15,198	24,122	9,781	34,750	34,482	30,273	1,740

Notes. This table reports local price, profit and wage effects of export job creation. Each outcome is the sampling-weighted municipality average of the respective variable. Profits are defined for small firms with up to 10 workers; the same employment threshold separates small from large firms. Control variables are standard municipality controls and municipal averages of education, experience, gender, industry shares, urban population, and firm size distribution. Observations are weighted by the municipality's working age population, and standard errors (in parentheses) are clustered by municipality.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

For Online Publication

A Appendix: Proofs of propositions

A.1 Proof of Proposition 2

To prove Propostion 2, I first establish how local optima change with changes in the economic environment. Assumption (1d) lets us conveniently model a stochastically-dominant shift in the wage distribution by an increase in the parameter a. I obtain the partial derivative

$$\frac{dk}{da} = -\frac{EU_{ka}}{EU_{kk}} = -\frac{\lambda \cdot \frac{\partial F(\pi(k);a)}{\partial a} \cdot \pi'(k)}{EU_{kk}} \leq 0. \tag{A.1}$$

Since $EU_{kk} < 0$ at a local maximum, the sign of (A.1) is negative. A stochastic improvement in the wage offer distribution reduces optimal firm size.[27] A shock to the wage distribution will transmit into a shock to $\delta(k)$. For a given reservation wage, it is now more likely that a wage offer is accepted. This brings down the optimal capital investments and in turn the reservation wage, until a new optimum is reached.

The same qualitative result obtains when the offer probablity λ is hit with a shock, instead of the wage distribution, since:

$$\frac{dk}{d\lambda} = \frac{(1 - F(\pi(k);a)) \cdot \pi'(k)}{EU_{kk}} \leq 0. \tag{A.2}$$

I summarise these local comparative statics in Lemma 1:

Lemma 1. *(Local comparative statics) (i) An improvement in the wage offer distribution or (ii) an increase in the offer probability reduces firm size in the neighbourhood of a local maximum, if it changes the probability of staying in self-employment $\delta(k)$.*

As a second step, I establish how an increase in a and an increase in λ shift expected utility at different points in the capital distribution. If these shifts are monotonic in capital – eg., if expected utility increases more steeply for a given shock the smaller a firm – then shifts in expected utility are directly information about the latent evaluation of local optima at different levels of capital.

The effect of increases in a and *lambda* on the expected utility of a given level of capital, at the optimum, is giben by

$$EU_a(k) = -\lambda \cdot \int_{\pi(k)} \frac{\partial F(w;a)}{\partial a}\, dw \quad \geq 0; \tag{A.3}$$

$$\begin{aligned} EU_\lambda(k) &= -\pi(k) \cdot [1 - F(\pi(k))] + \int_{\pi(k)} w \cdot f(w)\, dw \\ &= \int_{\pi(k)} (1 - F(w))\ dw \quad \geq 0. \end{aligned} \tag{A.4}$$

where the last step involves performing an integration by parts. We can once more differentiate the partial derivatives (A.3) and (A.4) to show that the magnitude of the change in expected utilities decreases with k:

$$EU_{ak} = \lambda \cdot \frac{\partial F(\pi(k);a)}{\partial a} \cdot \pi'(k) \qquad \leq 0; \tag{A.5}$$

$$EU_{\lambda k} = -(1 - F(\pi(k))) \cdot \pi'(k) \qquad \leq 0. \tag{A.6}$$

[27]More precisely, it reduces k where $\frac{\partial F(w;a)}{\partial a}|_{w=\pi(k)} < 0$; so at levels of k where $\pi(k)$ overlaps with the range of the wage distribution $F(w;a)$. In other words, changes in wage opportunities matter only as far as they change the mass of wages above the reservation wage. In regions where profits are lower or higher than any wage offered in the market, this condition is not true. Similarly, equation (A.2) is only true for $F(\pi(k),a) < 1$. More wage offers only matter if there is some wage offer that could be acceptable.

Lemma 2 states this result.

Lemma 2. *(Comparative statics of expected utility) (i) An improvement in the wage offer distribution and (ii) an increase in the offer probability weakly increase expected utility at all levels of capital. This increase is stronger the lower the level of capital.*

These results allow us to make clear predictions about comparative statics without having to evaluate the expected utility, nor having to know which of potentially multiple solutions was selected before the change in the economic environment. Both local comparative statics, as well as the relative changes in expected utility at different levels of capital, point in the same direction: improvements in wage employment translate into a lower firm size. This can occur either through a local marginal change to the new optimum (Lemma 1) or through a jump from a higher to a lower optimum (a direct implication of Lemma 2). Then, Lemma 1 and Lemma 2 directly imply Proposition 1.

A.2 Proof of Proposition 3

First, we write the utility maximisation problem for the model extension. Expected utility is given by

$$EU(k,L) = \Big\{ \big[\pi(k,L) - wL\big] \cdot \big[1 - \lambda(1 - F(\pi(k,L))\big] + \lambda \int_{\pi(k,L)} w \cdot f(w)\, dw - rk \Big\}. \tag{A.7}$$

The first-order conditions are

$$\begin{aligned} H = &\quad \pi'_k \cdot \delta - r &= 0 \qquad (A.8)\\ G = &\quad \big[\pi'_L - w\big] \cdot \delta &= 0 \qquad (A.9) \end{aligned}$$

where from now on I omit the arguments of functions for the sake of clarity. By the implicit function theorem, the partial derivatives of this system in two equations G and H and two unknowns k and L are given by

$$\begin{pmatrix} \frac{dk}{d\lambda} \\ \frac{dL}{d\lambda} \end{pmatrix} = -\left(\frac{1}{G_k \cdot H_L - G_l \cdot H_K} \right) \begin{pmatrix} H_L \cdot G_\lambda - G_L \cdot H_\lambda \\ G_k \cdot H_\lambda - H_k \cdot G_\lambda \end{pmatrix}. \tag{A.10}$$

Evaluating and combining the partial derivatives in equation (A.10), we obtain the following intermediate results:

$$\begin{aligned} G_k \cdot H_L - G_l \cdot H_K &= \big[\pi''_{LK} \cdot \delta + (\pi'_L - w) \cdot \delta'_k\big] \cdot \big[\pi''_{KL} \cdot \delta + \pi'_K \cdot \delta'_L\big] \\ &\quad - \big[\pi''_{LL} \cdot \delta + (\pi'_L - w) \cdot \delta'_L\big] \cdot \big[\pi''_{KK} \cdot \delta + \pi'_K \cdot \delta'_K\big] \\ &= \delta^2 \big[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\big] \\ &\quad -\pi'_L \pi'_k \delta'_K \delta'_L + \pi'_L \pi'_k \delta'_K \delta'_L + w\pi'_k \delta'_K \delta'_L - w\pi'_k \delta'_K \delta'_L \\ &= \delta^2 \big[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\big] \end{aligned} \tag{A.11}$$

$$\begin{aligned} H_L \cdot G_\lambda - G_L \cdot H_\lambda &= \big[\pi''_{KL} \cdot \delta + \pi'_K \cdot \delta'_L\big] \cdot \big[\pi'_L - w\big] \cdot \delta'_\lambda \\ &\quad - \big[\pi''_{LL} \cdot \delta + (\pi'_L - w) \cdot \delta'_L\big] \cdot \pi'_K \cdot \delta'_\lambda \\ &= -\pi''_{LL} \cdot \delta \cdot \pi'_K \cdot \delta'_\lambda \end{aligned} \tag{A.12}$$

$$\begin{aligned} G_k \cdot H_\lambda - H_k \cdot G_\lambda &= \big[\pi''_{LK} \cdot \delta + (\pi'_L - w) \cdot \delta'_K\big] \cdot \pi'_K \cdot \delta'_\lambda \\ &\quad - \big[\pi''_{KK} \cdot \delta + \pi'_K \cdot \delta'_K\big] \cdot \big[\pi'_L - w\big] \cdot \delta'_\lambda \\ &= \pi''_{LK} \cdot \delta \cdot \pi'_K \cdot \delta'_\lambda \end{aligned} \tag{A.13}$$

Substitution into (A.10) and simplifying yields the local comparative statics of firm size expressed in capital and labour, respectively:

$$\frac{dk}{d\lambda} = \frac{\pi''_{LL} \cdot \delta \cdot \pi'_K \cdot \delta'_\lambda}{\delta^2 \left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} = -\frac{\pi''_{LL} \cdot \pi'_K \cdot \delta'_\lambda \cdot \left(\frac{1-\delta}{\lambda}\right)}{\delta\left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} \leq 0 \tag{A.14}$$

$$\frac{dL}{d\lambda} = -\frac{\pi''_{LK} \cdot \delta \cdot \pi'_K \cdot \delta'_\lambda}{\delta^2 \left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} = \frac{\pi''_{LK} \cdot \pi'_K \cdot \left(\frac{1-\delta}{\lambda}\right)}{\delta\left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} \leq 0 \tag{A.15}$$

using the fact that $\delta'_\lambda = -\frac{1-\delta}{\lambda} < 0$. From these representations, we can immediately see the qualification applied to propositions 2 and 3. Improvements in the option value of wage employment only translate into changes in firm size if they affect the probability of staying self-employed; that is, if $\delta'_\lambda \neq 0$.

Using the same approach, we similarly obtain comparative statics for an improvement in the wage offer distribution as

$$\frac{dk}{da} = \frac{\pi''_{LL} \cdot \delta \cdot \pi'_K \cdot \delta'_a}{\delta^2 \left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} = \frac{\pi''_{LL} \cdot \pi'_K \cdot \delta'_\lambda \cdot \lambda \cdot \frac{\partial F(w;a)}{\partial a}}{\delta\left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} \leq 0 \tag{A.16}$$

$$\frac{dL}{da} = -\frac{\pi''_{LK} \cdot \delta \cdot \pi'_K \cdot \delta'_a}{\delta^2 \left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} = -\frac{\pi''_{LK} \cdot \pi'_K \cdot \lambda \cdot \frac{\partial F(w;a)}{\partial a}}{\delta\left[\pi''_{LK} \cdot \pi''_{KL} - \pi''_{LL}\pi''_{KK}\right]} \leq 0 \tag{A.17}$$

The same comparative statics results on expected utility – which establish the direction of the global evaluation of local optima – complete the proof.

B Appendix: Model extensions

B.1 Extension: Credit constraints, risk-aversion and intertemporal investment

A second extension relaxes the assumptions of complete credit markets and risk neutrality. Under credit constraints, the agent needs to self-finance capital from past endowments and savings. With risk aversion, the agent also wishes to smooth consumption when making investment/savings decisions. In this appendix section, I formally develop an extension to a two-period dynamic model to consider the implications of these two features. This extension answers an important remaining question: can the non-separability of occupational and entrepreneurial choices leave agents stuck with a low level of capital?

Timing of the model: Consider the following extension to the basic model in section 2 of the paper. There are two periods. In period one, the self-employed agent owns capital k_1 and earns income $\pi(k_1)$. Still in period one, she has to decide how much to invest into future firm-specific capital k_2. The agent consumes what she does not invest: $c_1 = \pi(k_1) + k_1 - k_2$ and receives utility $u(c_1)$ from consumption. At the start of period two, wage offers are drawn from the compound lottery, and the agent decides whether to accept or reject if presented with an offer. Production, wage payments, and consumption are realised.

I introduce two additional assumptions. I specify an assumption on credit constraints, and replace Assumption 3 on risk neutrality with an alternative assumption on risk aversion and discounting. The main motivation behind this change is to guarantee an interior solution to the capital accumulation problem. If the credit constraint never binds at an optimal choice, then we can analyse the problem using unconstrained optimisation techniques.

Assumption 5. ***Credit constraints***
The agent cannot borrow, but she can invest up to the total of her wealth into capital: $k_2 \leq k_1 + \pi(k_1)$.

Assumption 6. ***Preferences***

a) Concave utility: *The utility function* $u(c)$ *is twice continuously differentiable, with* $u'(c) > 0$ *and* $u''(c) < 0$.

b) Discounting: *The discount factor is* $0 < \beta \leq 1$.

The entrepreneur maximises her expected discounted utility V which depends on initial capital k_1 and the capital choice in the second period k_2:

$$\begin{aligned} V(k_1, k_2) = {} & u\left(\pi(k_1) + k_1 - k_2\right) + \\ & \beta \cdot \left[\lambda \cdot \int_{\pi(k_2)} \Big(u(w) - u(\pi(k_2))\Big) \cdot f(w)\, dw + u(\pi(k_2))\right] \end{aligned} \tag{B.1}$$

where I express the problem in analoguous form to (2), noting that there is again a unique reservation wage $z = \pi(k_2)$. The first order condition for optimal firm size is given by

$$V_2 = -u'(\pi(k_1) + k_1 - k_2) + \beta \cdot \delta(k_2) \cdot\ u'(\pi(k_2)) \cdot \pi'(k_2) = 0. \tag{B.2}$$

Condition (B.2) expresses the Euler equation that characterises optimal asset allocation across periods. It implicitly defines the optimal capital choice given initial capital, $k_2(k_1)$. A particular interest lies in steady state solutions where $k_2(k_1) = k_1$.[28] In a steady state solution, the Euler equation simplifies to

$$\beta \cdot \delta(k_2) \cdot \pi'(k_2) = 1. \tag{B.3}$$

We can characterise the solution to the extended model as following. First, equation (B.3) equals the first-order condition from the static baseline model whenever $\beta = 1/r$. That is, the local optima of the static

[28] In analogy to models with many periods, I refer to an equilibrium that fulfils this condition as a 'steady state equilibrium'.

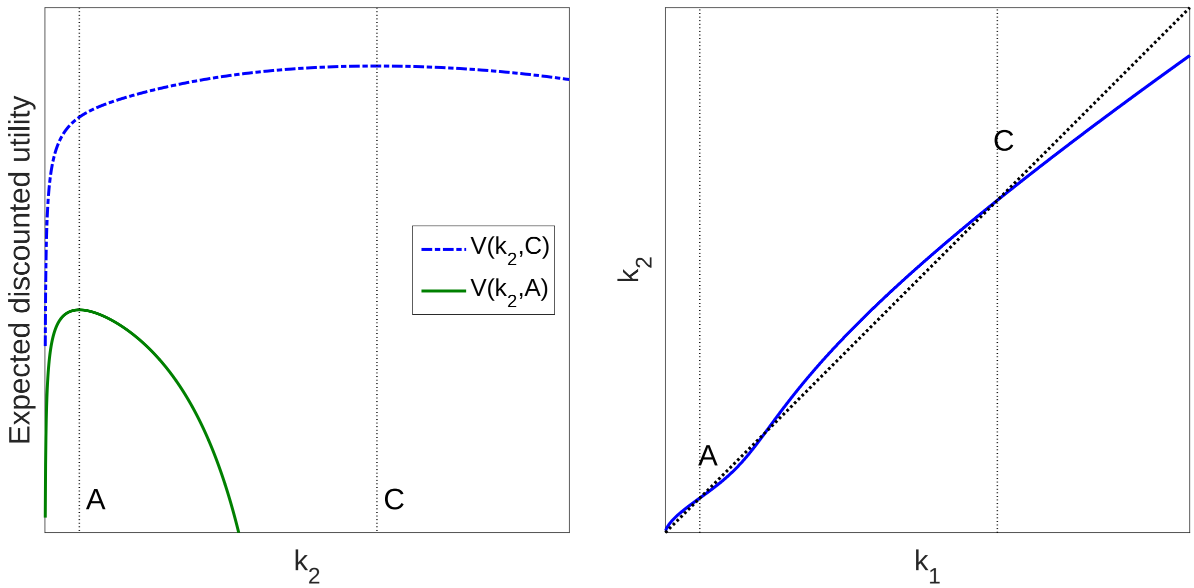
model with complete capital markets are steady-state solutions in a dynamic model under capital constraints. This mirrors well-known equivalences in macroeconomics between closed and open economy models. Second, whenever $\delta(k_2) = 1$, the model reduces to a standard neoclassical benchmark model: the Ramsey (1928) model of endogenous capital accumulation and growth. Third, the equivalence with local optima of the static model means that the steady-state equilibria inherit the properties of static solutions. For example, the equivalence characterises these steady-state solutions as local utility maxima. To see this, write the second derivative of V as:

$$\begin{aligned} V_{22} &= u''(\pi(k_1) + k_1 - k_2) + u''(\pi(k_2)) \cdot \beta\delta(k_2)\left[\pi'(k_2)\right]^2 \\ &+ \beta u'(\pi(k_2)) \cdot \left[\delta(k_2)\pi'(k_2) + \delta'(k_2)\pi''(k_2)\right]. \end{aligned} \tag{B.4}$$

Recognising that in a static optimum, the term in brackets equals (5) and is negative, we can establish that (B.4) is negative at $k_2(k1_1) = k_1$, which gives the result. Fourth, we can characterise the shape of the policy function $k_2(k_1)$ more generally. Losely speaking, the marginal expected discounted utility V_2 consists of the discounted marginal utility of the chosen capital stock k_2 – which is given by (3) – and a term which penalises large differences between initial and chosen capital stock. The convexity of this penalty term increases with the curvature of the utility function. Fifth and finally, this implies that even when multiple static optima exist, there can be a unique optimal k_2 for every initial capital stock; in this case $k_2(k_1)$ will be a well-defined function.

FIGURE B.1

Dynamic extension: Solution and Law of Motion



(a) Expected utility as a function of k_1

(b) Law of motion of capital

Figure B.1 illustrates this characterisation. I maintain the parameterisation from the baseline scenario in Figure 1, let $\beta = 1/r = 0.95$, and assume CRRA utility with a coefficient of relative risk aversion of 1.5. The left-hand panel of Figure B.1 illustrates expected discounted utility as a function of the capital choice k_2, for two different initial values k_1. These initial values correspond to the two steady state equilibria A and C. For both initial values, V is a globally concave function; and it can be verified that this is true for *any* k_1 in the given scenario. This implies that the law of motion $k_2(k_1)$ is a well-defined function. The law of motion is illustrated in the right-hand panel of Figure B.1. It follows an S-shape.

This example illustrates the potential of the model to generate dynamic inefficiency; in a way that is sometimes referred to as a 'poverty trap' (e.g. Advani (2018), Kraay and McKenzie (2014)). Entrepreneurs with an initial capital stock that is low – such as A – can remain stuck in a low-capital, low profit equilibrium. This equilibrium is not deterministic – after all, entrepreneurs at A leave self-employment at relatively high rates to take up better-paying wage jobs. Thus, low-profit self-employment is not a 'trap' – the very possibility of changing occupations for a better job creates the path dependency in the first place. However, it can be persistent. Those entrepreneurs who start in A and are not lucky enough to receive an attractive wage are worse off than those who start in C. Indeed, they are worse off in the initial period as well as in all future periods in which they remain self-employed.

B.2 Extension: Heterogeneous entrepreneurial ability

In a third extension, I discuss the implications of heterogeneity in ability. One immediate concern is that differences in entrepreneurial ability confound the predictions of the model. However, note that the predictions of propositions 2 and 3 only depend on *changes* to the probability of staying in self-employment, not on the level location of the production function. Thus, the main predictions of the model qualitatively hold for all levels of ability. Nevertheless, heterogeneous ability does have implications for empirical applications of the model.

I explore the effects of varying entrepreneurial ability graphically in Figure B.2. I first vary entrepreneurial ability while keeping all other parameters constant.[29] This changes the relative location of entrepreneurial profits and the wage offer distribution in the cross-section. I then contrast comparative statics of a given wage increase at different levels of ability.

The middle panels take the previous case as a baseline, where C is the optimal firm size, as before. Lower ability entrepreneurs (left panels) choose a low-capital solution A_1. Higher ability entrepreneurs (right panels) choose a high-capital solution C_2. In the illustrated examples, the optima for both low and high ability entrepreneurs are unique; whereas baseline ability entrepreneurs select among two local maxima.

Now consider again an increase in the wage offer distribution through an increase in a. Note that the discount factor depends on both ability (through the production function) and on the state of the labour market (through f and λ). Therefore, a different δ applies in each case. For ease of readibility, my notation continues to simply use δ; understand as being parameter-specific. In each of the upper panels, the desired rate of return (the effective cost of capital) changes to a new level; graphed as solid red curves. The equilibrium adjustment occurs through a mix in changes to local optima and in changes to equilibrium selection, as can be seen from the lower panels. For lower ability entrepreneurs, optimal firm size changes locally to A_1'. For higher ability entrepreneurs, a low-capital local maximum begins to exist, but it is still optimal to maintain a high-capital firm; although a slightly lower one than before (at $C_2' < C_2$). Entrepreneurs with baseline ability switch between local optima (from C to A').

Two key lessons can be drawn from this model extension. First, ability delimits the scope of applicability of the model. The model applies to all entrepreneurs who can expect, with some positive and non-degenerate probability, to encounter a wage opportunity that is competitive relative to the profits of their firm. This does not pose a theoretical restriction on the lower bound. The worst-performing entrepreneurs will still face barriers to wage employment in the form of search frictions. However, the worst entrepreneurs might also make the worst wage workers, and then their job offer probability could be negligibly small. On the other end, it places an upper bound to the applicability of the model. An entrepreneur with a multi-million dollar business is highly unlikely to find a wage job that pays at a level competitive with entrepreneurship.

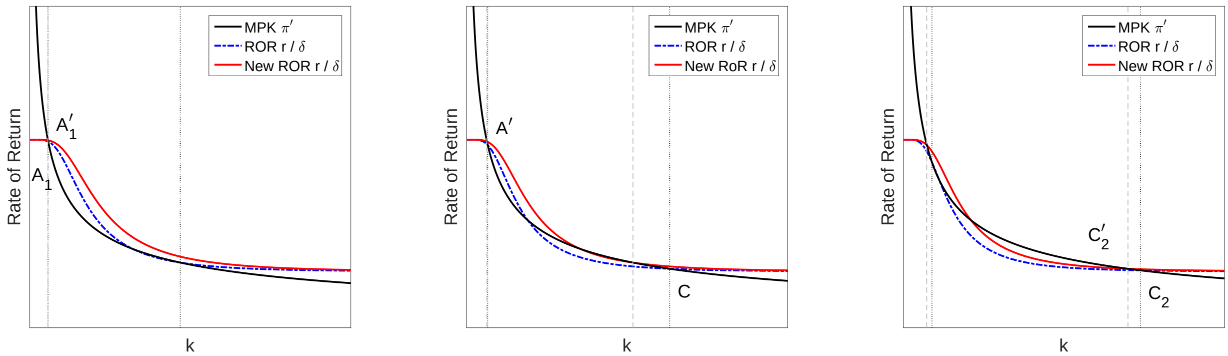
Second, the relevant dimension of ability is not the absolute advantage given by ability in entrepreneurship, but the *average comparative advantage* in entrepreneurship relative to wage-employment. We can expect abilities in either sector to be related, in a Roy-model sense. For example, a lawyer can expect a high income both as an employee in a law firm, or by running his own law practice. The higher the relative ability an individual in entrepreneurship, the smaller the chance of encountering an attractive wage offer.

[29] Here, higher entrepreneurial ability implies a Hicks-neutral upward productivity shift in the production function.

FIGURE B.2

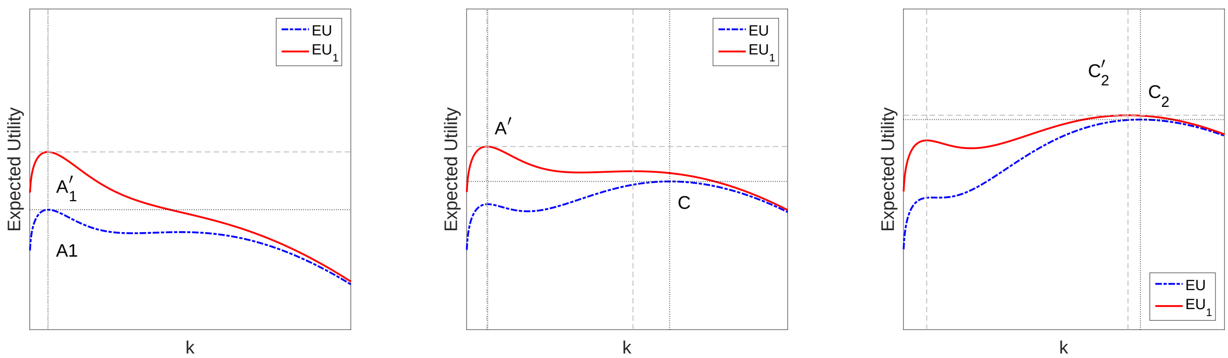
Heterogeneous entrepreneurial ability

A. Marginal products and discounted returns



(a) Lower ability (b) Baseline ability (c) Higher ability

B. Expected utility and global comparative statics



(d) Lower ability (e) Baseline ability (f) Higher ability

C Appendix: Data and context

C.1 More details on data construction

Individual data come from 40 quarterly waves of the Mexican labour force survey, ENOE (for *Encuesta Nacional de Ocupación y Empleo*) that span the years 2005 to 2014. The data are publicly available from INEGI. The ENOE was launched in January 2005, replacing two previous separate surveys for urban and rural labour markets, respectively. I pay particular attention to the trajectories of individuals who initially own and operate a non-agricultural business with a maximum of 10 workers as their main occupation. Information in the ENOE encompasses the kind of variables typically found in labour force surveys, including sociodemographics, employment information, and income. A smaller subset of the entrepreneurs surveyed for the ENOE underwent an additional, cross-sectional enterprise module called ENAMIN, carried out in the fourth quarter of 2008, 2010 and 2012.

Social security records are obtained from IMSS, and are also publicly available at the time of writing this article. I use monthly data series – based on database queries on the last day of each month – on insured persions (*asegurados*) and aggregate them by 3-digit industry and municipality. I then aggregate the monthly data by quarter.

In all of my analysis, I restrict the sample to the working-age population aged 15 to 64. I drop observations in the Federal District of Mexico City since I cannnot link them to the social security records. I deflate monetary amounts in nominal pesos using the Mexican consumer price index (INPC) provided by the *Banco de México*. I deal with extreme outliers by winsorising continuous variables (e.g. firm growth, or job creation), typically at the bottom and top 0.1th percentile. I exlude the Federal District of Mexico City (D.F.) from my analysis because I am not able to map IMSS records to municipality-level sub-units of the D.F.

For the construction of predicted export manufacturing employment per thousand working age population, I obtain monthly time series of Mexican exports to the US (in USD, which I deflate using the US CPI) at the level of 3-digit NAICS industries from the US Census Bureau. To construct the working-age population for each municipality and quarter, I combine population counts from the 2005 and 2010 Census, and official population predictions 2010-2050 from CONAPO, the National Population Council. My measure of working-age population is hence based on a model of long-term population trends, and not exposed to short-term fluctuations.

C.2 Additional descriptives: Microenterprises in Mexican labour markets

Around 67 percent of the Mexican working-age population – individuals between 15 and 64 percent of age – are gainfully employed. Of those in paid employment, a quarter are self-employed, 40 percent are in formal wage employment, and a third are in informal wage-employment.

Microenterprises operate in all kinds of sectors, in particular in commerce (37%), services (32%), manufacturing (15%) and construction and transport activities (15%). 65% are operate full-time by the entrepreneur. One third have fixed business premises separate from a home. Virtually all firms are personal, unincorporated businesses. Table C.1 tabulates the most common types of firms.

TABLE C.1

Most common types of business

Business type	Observations	Share
Street trader without workers	150,903	16.00
Home workshop without workers	69,358	7.35
Small retail shop without workers	67,263	7.13
Single construction contractor	60,853	6.45
Family-run bodega (family wokers)	45,853	4.86

Note: ENOE, 2005-2014.

There is a high degree of labour churning and employment transitions in the Mexican labour market. Table C.2 tabulates quarterly transition rates. Of all workers who were found self-employed in a given period, only two thirds remain self-employed when interviewed in the following trimester. 15 percent will have taken up a wage job, and a similar share will have left employment. Wage-employment is somewhat more stable: 83 percent of the wage-employed stay in the sector from quarter to quarter, and 93 percent of those in formal wage employment stay (not reported in Table C.2). Workers in export manufacturing stay in wage employment at the same rate as formal workers in other industries.

TABLE C.2

Transition rates in the Mexican labour market

	Employment status next quarter					
Employment status	OLF	WE	SE	OE	UE	Total
Out of LF %	69.8	8.0	5.4	3.2	13.6	100.0
Wage-employed %	5.7	82.8	5.7	1.2	4.5	100.0
Self-employed %	10.5	15.4	67.5	2.7	3.9	100.0
Other Employment %	24.4	14.2	11.0	43.4	6.9	100.0
Unemployed %	43.9	20.8	6.7	2.9	25.7	100.0
Total %	30.2	41.2	15.5	3.8	9.2	100.0

Source: ENOE, 2005-2014. Quarterly transitions for all respondents aged 15-64 with non-missing employment status in adjacent periods. OLF = Out of labour force; SE = self-employed; WE = wage employed; OE = unpaid employment; UE = unemployed.

Table C.3 provides some correlates of the decision to leave self-employment to either non-employment or to a wage job. Entrepreneurs who take up a wage job are predominantly male – as opposed to entrepreneurs who transit to non-employment, three quarters of whom are female. Retail shop owners make up almost half of those leaving work altogether, whereas construction firm owners are largely overrepresented in the group who leave to wage employment. Finally, those who take up wage jobs are younger than other entrepreneurs. Migration status, hours of work, and even education seem to play close to no role in the propensity to taking up a wage job. One should bear in mind, though, that these aggregates hide substantial heterogeneity: those who take up manufacturing jobs, for example, are much more likely to have left school with secondary education.

Export manufacturing offers a competitive salary compared to profits in most microenterprises. Figure C.1 plots the cross-sectional distributions of entrepreneurial profits and wages in export manufacturing. Export manufacturing pay on average higher wages; these should be attractive especially for the sizable group of very low-paid entrepreneurs. Nevertheless, the distributions overlap right to the top, suggesting that there exist export manufacturing jobs that are financially attractive for almost all entrepreneurs.

TABLE C.3

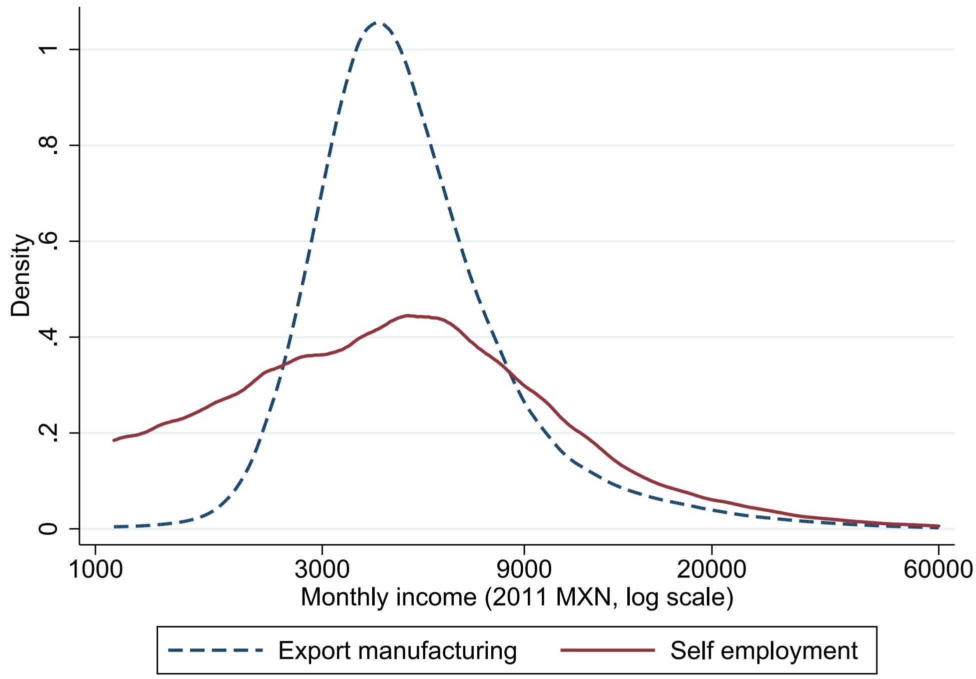
Correlates of the decision to leave self-employment

	Stay entrepreneur	To non-employment	To wage employment
Individual characteristics			
Male	0.60	0.28	0.75
Inter-state migrant	0.25	0.23	0.25
Education			
Primary	0.40	0.46	0.36
Secondary	0.45	0.45	0.49
Tertiary	0.15	0.10	0.15
Age			
15-29	0.11	0.20	0.22
30-39	0.26	0.24	0.31
40-49	0.31	0.24	0.27
50-64	0.30	0.31	0.20
Full time (min 35 hrs/week)	0.70	0.43	0.69
Industry			
Manufacturing	0.15	0.17	0.11
Construction & Transport	0.13	0.08	0.30
Commerce	0.38	0.44	0.24
Services	0.33	0.29	0.32
Observations	613,736	170,567	132,782

Source: ENOE, 2005-2014. Figures are obtained using sampling weights.

FIGURE C.1

The distribution of entrepreneurial profits and export manufacturing wages



Source: 2005-2014 ENOE. The graph shows the distribution of monthly income in self-employment/entrepreneurship and in formal wage work in the export manufacturing sector. Nominal incomes are deflated to 2011 Mexican Pesos using the consumer price index (INPC) provided by the Mexican Central Bank.

C.3 Additional descriptives: Mexican export manufacturing

I define the export manufacturing sector to consist of the ten 3-digit NAICS industries where more than 50 percent of output was exported to the US for all months in 2005-2007 This is the period immediately prior to the drop in Mexican manufacturing exports that came with the U.S. financial crisis. This definition is in spirit similar to the way Atkin (2016) defines export manufacturing industries. However, I work with the 3-digit NAICS classification system that is applied in both Mexican and US national statistics, whereas Atkin harmonises to the international ISIC classification. I also focus on export industries after 2005, while Atkin looks at the 1985-2000 period. There is a close correlation between the real volume of exports and employment in the export manufacturing sector. Exports and employment were on a slightly increasing path until the end of 2007, then dropped dramatically by 20-25 percent over the course of a year during the US financial crisis, and recovered swiftly from mid-2009 onwards.

I define the export manufacturing sector to consist of the ten 3-digit NAICS industries where more than 50 percent of output was exported to the US in all months of 2005-2007. This is the period immediately prior to the drop in Mexican manufacturing exports that came with the U.S. financial crisis. My definition is in spirit similar to the way Atkin (2016) defines export manufacturing industries. However, I work with the 3-digit NAICS classification system that is applied in both Mexican and US national statistics, whereas Atkin harmonises to the international ISIC classification. I also focus on export industries after 2005, while Atkin looks at the 1985-2000 period.

I obtain information on exports from US trade statistics, as detailed above. Manufacturing industry production comes from the INEGI Monthly Manufacturing Industries Survey (EMIM). This survey excludes *maquiladora* plants who have operate in a special tax regime, and are by law required to export almost all of their output. In the most export-extensive industries, the export share of output can therefore be an overestimate. Therefore, I do not rely on a sharp measure of the export share.

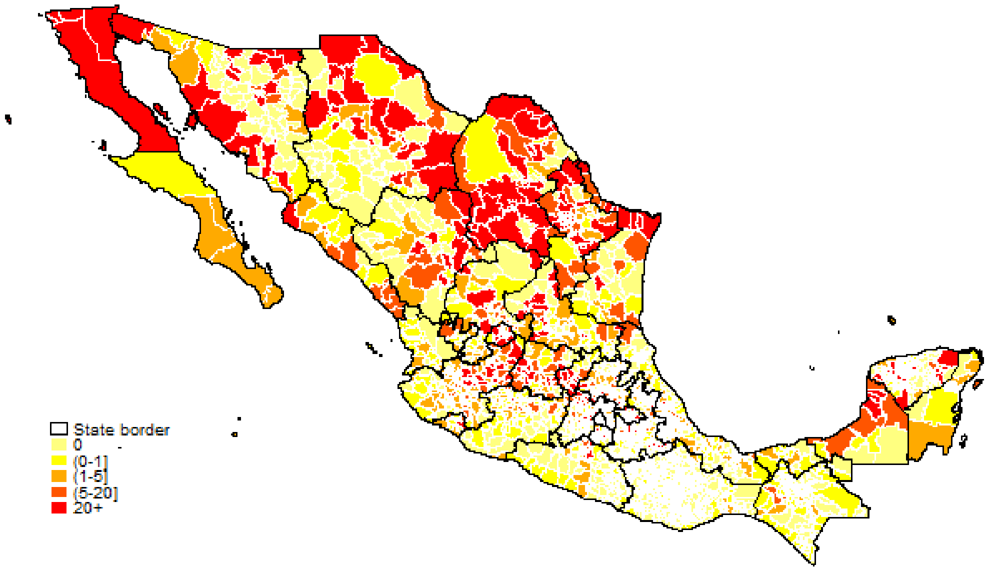
The ten industries that fall within this definition of export manufacturing are: Textile products mills; Apparel manufacturing; Leather and allied products manufacturing; Fabricated metal products manufacturing; Machinery and equipment manufacturing; Computer and electronic product manufacturing; Electrial equipment, appliance and component manufacturing; Transportation equipment manufacturing; Furniture and related products manufacturing; Miscellaneous manufacturing. The export manufacturing sector defined this way accounts for two thirds of all bilateral exports from Mexico to the US; around USD 13 billion of a total of USD 19 billion per month. The largest exporting sector industry that falls not under my definition is oil and gas, which exported USD 2.4 bn per month, on average.

Geographically, export manufacturing is concentrated in the border states (Baja California Norte, Sonora, Chihuaha, Coahuila, Tamaulipas and also Nuevo León) and in the central industrial valley spanning from Zacatecas to Querétaro. Figure C.2 graphs the export manufacturing penetration (export manufacturing jobs per 1,000 working-age population) across Mexican municipalities in 2005.

By visual inspection of the respective time series displayed in Figure C.3, there is a close correlation between the real volume of exports and employment in the export manufacturing sector. Exports and employment were on a slightly increasing path until the end of 2007, then started decreasing in 2008 and fell dramatically until the middle of 2009, when they again recovered. From peak to bottom during the US financial crisis, seasonally adjusted exports fell by about 25 percent, and export manufacturing employment by about 20 percent. This collapse of manufacturing exports, and the subsequent recovery, amplify the variation in wage employment opportunities across local labour markets over time and space.

FIGURE C.2

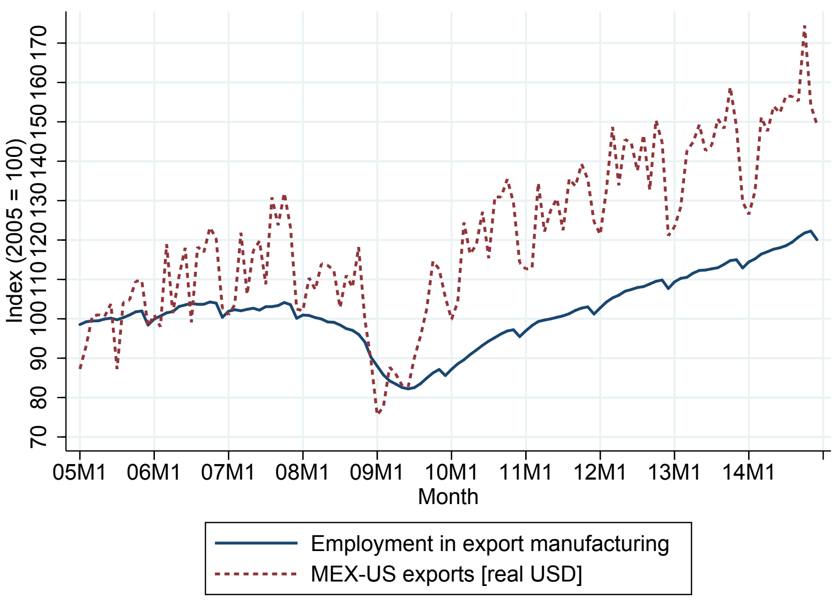
Export manufacturing employment across Mexican municipalities in 2005



Source: The map shows the penetration (per 1,000 working-age population) of export manufacturing jobs at the municipality level in 2005. Employment data from IMSS, population data from 2005 Census, municipality and state boundaries from INEGI *Marco Geoestadístico Nacional.*

FIGURE C.3

Employment and exports in Mexican export manufacturing



Source: IMSS end-of-month social security records on formal employment; US Census Bureau monthly volume of imports from Mexico in nominal USD, deflated with US CPI. Each time series normalised to their respective average annual level in 2005.

C.4 Validating predicted export job creation

Table C.4 validates my predicted measure of job creation, using my first-differenced model. The change in export manufacturing employment predicted from initial exposure and changes in Mexican-US exports alone explains about a quarter of the variation in observed export manufacturing employment changes. The raw correlation between actual and predicted employment is 0.696, in column (5). The following columns reveal that this correlation does not change by much when we separately control for individual ingredients of the prediction and state trends, as I will do in my preferred specifications. This confirms that it is really the interaction, and not the individual factors, that drive predicted employment changes. For comparison, I report the correlation in *levels* in columns (1)-(4). Employment levels are predicted almost perfectly, with a coefficient and an R^2 close to one. This reflects the role of the municipality fixed effect: some municipalities always have a high number of export jobs, while other municipalities always have zero export jobs. My first-differenced model partials out this municipality fixed effect.

TABLE C.4

Goodness of fit of predicted export manufacturing employment

	(1) Levels	(2) Levels	(3) Levels	(4) Levels	(5) FD	(6) FD	(7) FD
Pred. XME/WAPop	0.869***	0.875***	0.642***	0.670***			
	(0.030)	(0.030)	(0.063)	(0.057)			
	[29.247]	[29.183]	[10.131]	[11.728]			
Δ Pred. XME/WAPop					0.696***	0.723***	0.761***
					(0.092)	(0.105)	(0.116)
					[7.547]	[6.913]	[6.577]
Constant	2.467***	17.043***	2.144***	16.398***	-0.036	0.290	0.492***
	(0.671)	(3.347)	(0.593)	(3.243)	(0.070)	(0.193)	(0.179)
	[3.675]	[5.092]	[3.615]	[5.057]	[-0.510]	[1.505]	[2.752]
Initial XME	No	No	Yes	Yes	No	No	Yes
Trimester FE	No	Yes	No	Yes	No	Yes	Yes
State FE	No	Yes	No	Yes	No	Yes	Yes
Observations	97520	97520	97520	97520	95082	95082	95082
R^2	0.930	0.938	0.934	0.941	0.235	0.265	0.269

Notes. This table reports regression of predicted on actual export manufacturing employment for all 97,520 unique local labour market constellations in the cross-section / 95,082 in the first difference (2,438 non-D.F. municipalities over 40/39 quarters). Municipal employment variables are normalised per 1000 working-age population of the corresponding quarter and municipality, and winsorised at the top and bottom 0.1%. Two-way clustered standard errors by municipality and quarter in parentheses, t-statistics in square brackets.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

C.5 Additional descriptives: ENAMIN

This section provides some additional details on the ENAMIN survey, and the challenges that survey design and data collection pose for including this data in the analysis.

The Mexican National Microenterprise Survey (*Encuesta Nacional de Micronegocios*, ENAMIN) is the nationally representative small firms survey in Mexico, conducted by the statistical institute INEGI. For its three most recent waves in 2008, 2010 and 2012, the Mexican National Microenterprise Survey (*Encuesta Nacional de Micronegocios*, ENAMIN) draws its sampling frame from the national labour force survey, ENOE. The ENAMIN samples microenterprises in all households who are identified as having at least one self-employed member in the ENOE wave corresponding to the last quarter of the survey year. Firm size is an additional screening criterion: a microenterprise is included in the ENAMIN if it has a maximum of 15 workers (for manufacturing firms) or 10 workers (for service and commerce firms).

A microenterprise is marked for inclusion in the ENAMIN in the field, once the labour module of the ENOE has been completed. This screening is carried out by field survey staff (enumerators and supervisors). In

2008, the automatic screening was restricted to metropolitan areas only (and rural microenterprises were screened separately); in 2010 and 2012 all microenterprises were screened in the field. Especially from 2010 on, field staff were instructed to carry out interviews for the ENAMIN immediately after a microenterprise has been screened for inclusion; or to schedule an interview as soon as possible if the microentrepreneur was not at home during the ENOE interview. As a consquence of the different screening method in 2008, the ENAMIN in that year took place about a month after the respective ENOE interviews.

The survey collects variables both on the entrepreneur and on the microenterprise. In particular, it collects detailed information on the microenterprise which is not included in the ENOE. Part of the reason for this that the ENOE allows for proxy responses by an informed household member, whereas the ENAMIN requires the respondent to be the entrepreneur. The ENAMIN asks for detailed information on the business' origins, record-keeping, marketing, business location, time use, a roster of workers in the business, incomes and expenditures, capital stock and investment, and finance.

A first challenge arises in constructing the investment variable. In 2008, the survey asked: "In 2008, how much did you invest in purchasing tools, utensils, machinery, equipment and vehicles for your enterprise or business activity?" and elicited a single figure for all categories of investment. In 2010 and 2012, the question started the same way, but then asked individually about investment in a number of categories (with the total computed after the survey): tools and utensils, machinery, furniture and equipment, land or buildings, vehicles, other assets. As we can see, not only are the investment figures elicited by category; these categories are also somewhat different to those listed in 2010. Finally, while in 2008 investment was elicited after the value of assets, this order reversed in 2010 and 2012. While these differences create difficulties in interpreting results from a regression of investment that pools all the ENAMIN waves, we lack the power to separately analyse results by wave.

The second challenge lies in a potential misclassification of employment status in the ENOE waves that formed the basis for the ENAMIN. Figure C.4 plots the proportion of surveyed working-age individuals who were self-employed, wage-employed, or not in paid employment. The figure shows that in the waves that correspond to the ENAMIN (and only in these waves) there is a downward spike in the self-employment rate and an upward spike in the wage-employment rate. These spikes become more drastic when we look at transition rates constructed from the panel in Figure C.5. There is a sharp increase in measured transitions out of self-employment between the third and fourth quarters of 2008, 2010 and 2012. This pattern reverses in the subsequent quarter.

While these anomalies do not create a major challenge for using these transitions for the analysis (and my inclusion of quarter fixed effects control for them), they are a cause for concern that the microenterprises in the ENAMIN are a potentially selected subset of the true population.

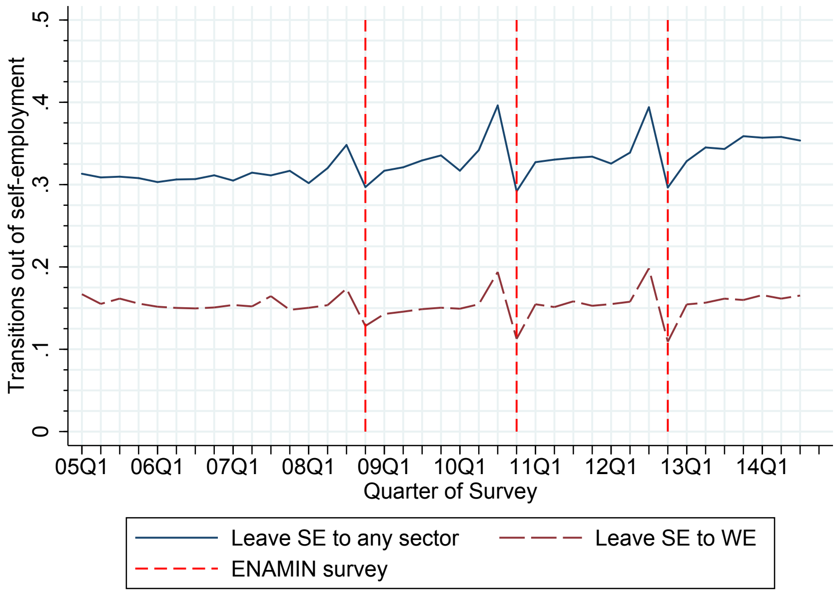
FIGURE C.4

ENOE Employment rates and ENAMIN waves

Source: ENOE 2005-2014. Sample restricted to working-age population. Raw averages without weights; results with weights are very similar and available upon request. ENAMIN waves took place in Q4 of 2008, 2010 and 2012.

FIGURE C.5

ENOE employment transition rates and ENAMIN waves



Source: ENOE 2005-2014. Sample restricted to working-age population. Raw averages without weights; results with weights are very similar and available upon request. ENAMIN waves took place in Q4 of 2008, 2010 and 2012. Transitions are assigned to their initial period (e.g. the transition rate in 08Q3 refers to transitions between 08Q3 and 08Q4).

D Appendix: Robustness checks

This appendix documents a number of robustness checks on the main results.

In Table D.1 I repeat the specifications from Table 1 and from columns (3) and (4) of Table 4, but I restrict the sample to entrepreneurs with at least one paid worker. This is the same restriction which is applied in order to create the relative firm growth variable. The coefficients are in general very similar to those in Table 1 for the full sample.

Table D.2 reports OLS results using actual instead of predicted export manufacturing employment changes. They are consistent with a downward bias of OLS for leaving, and an upward bias for growth. We would expect a bias in these directions if small and large (export manufacturing) firm growth are driven by a common, unobservable variable. Then, small firms and large firms growth together; and fewer entrepreneurs would switch to alternative occupations. This illustrates that OLS bias works against my findings.

In Table D.3, I report results from 2SLS instrumental variables regression (as opposed to the reduced form I report throughout in the main text). Predicted job creation is a strong instrument for actual job creation. The Kleibergen-Papp heteroscedasticity-robust test statistic is well above the the Stock and Yogo (2005) critical values for a 10% maximal IV size. The second stage regression coefficients are about 1.7 times as large as the associated reduced-form results in Table **??**. This is to be expected, given that the first-stage coefficient is around 0.6. I put not much emphasis on the instrumental variable estimates since the purpose of the empirical analysis is to test the model, not to estimate the average treatment effect of export job creation.

I finally report robustness checks to alternative definitions of XME changes. In Table D.4, I apply the commuting-zone aggregation from section 5 and redefine local labour markets as commuting zones (CZ), instead of municipalities. Results on firm growth are smaller and not significant, which suggests that the CZ is too large to be the salient local labour market. In Table D.5, apply a more generous definition of export manufacturing industries. Finally, conduct a check against reverse causality from locally concentrated industries that are large enough to drive aggregate exports. The ideal check to alleviate this concern would be to predict export employment in municipality m with exports from all other municipalities apart from m. However, municipality-level export data are not available. Instead, I check whether results are driven by exports and employment in any particular industry (defined by a NAICS sub-sector). In Table D.6, I in turn leave out each of the 10 constituent export industries in turn. I also report spatial concentration measures for the left-out industry. In Figure D.1 I regress the leave-one-out coefficients against the concentration measures. I find no relation between effect size and two of the three concentration measures; although when I leave out industries that are present in less markets, effect sizes increase. While not very conclusive, this is consistent with the idea that reverse causality, if anything, would drive the effect towards zero (see also the OLS estimates).

TABLE D.1

Robustness: Effects on leaving self-employment for entrepreneurs with paid workers

Dependent Variable:	(1) Leave	(2) Leave	(3) Leave to WE	(4) Leave to WE
Δ Pred. XME/WAP	0.0723*	0.000563	0.159***	0.0966***
	(0.0420)	(0.0734)	(0.0471)	(0.00733)
Municipality controls	Yes	Yes	Yes	Yes
Individual controls	No	Yes	No	Yes
Dep. var. mean	25.69	25.90	17.98	18.20
R^2	0.01	0.07	0.01	0.07
# distinct LLM	18,475	17,005	17,914	16,419
# municipalities	1,340	1,320	1,325	1,307
# periods	39	39	39	39
Observations	182,645	133,993	165,530	121,512

Notes. This table repeats the analysis in the first four columns of Table 1 for the subsample of entrepreneurs who employ at least one paid worker. It otherwise uses the same data and definitions. Two-way clustered standard errors by municipality and quarter in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE D.2

Robustness: OLS regression

Dependent Variable:	(1) Leave	(2) Leave to WE	(3) Firm growth paid workers	(4) Firm growth all workers
Δ XME/WAP	0.0364	0.0401*		
	(0.0237)	(0.0233)		
F.Δ XME/WAP			0.113	0.0196
			(0.229)	(0.124)
Dep. var. mean	33.61	17.39	-22.80	-18.98
R^2	0.07	0.08	0.03	0.03
# distinct LLM	20,419	20,046	12,986	16,656
# municipalities	1,489	1,476	1,274	1,417
# periods	38	38	39	39
Observations	707,913	573,675	99,540	175,368

Notes. This table reports OLS regression of outcomes on observed (instead of predicted) job creation. Sample and data construction are otherwise as described in Table 1. Regressions control for full vector of municipality and individual; and use ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses.
* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE D.3

Robustness: IV-2SLS regression results

	IV Second Stage results			
	(1)	(2)	(3)	(4)
Dependent Variable:	Leave	Leave to WE	Firm growth paid workers	Firm growth all workers
Δ XME/WAP	0.295**	0.239***		
	(0.115)	(0.0751)		
F.Δ XME/WAP			-1.483***	-0.709**
			(0.532)	(0.297)
Dep. var. mean	33.52	18.02	-23.32	-19.55
K-P Wald F-statistic	24.92	24.44	23.75	24.14
	IV First Stage results			
Δ Pred. XME/WAP	0.635***	0.640***		
	(0.127)	(0.130)		
F.Δ Pred. XME/WAP			0.619***	0.630***
			(0.127)	(0.128)
R^2	.	.	.	.
# distinct LLM	24,324	23,681	13,405	18,138
# municipalities	1,481	1,466	1,205	1,367
# periods	38	38	38	38
Observations	602,838	492,126	82,824	145,687

Source: This table reports IV-2SLS regression of outcomes on job creation. Observed job creation is instrumented with predicted job creation, where the instrument is constructed following equation (6) from the main text. Sample is restricted to entrepreneurs *not in manufacturing*. Sample and data construction are otherwise as described in Table 1. Regressions control for full vector of municipality and individual controls; and use ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses. *Stock-Yogo (2005) Critical Values: 16.38 (at 10% maximal IV size), 8.96 (at 15 % maximal IV size), 5.53 (at 20% maximal IV size).*

TABLE D.4

Robustness: CZ-level regression

Dependent Variable:	(1) Leave	(2) Leave to WE	(3) Firm growth paid workers	(4) Firm growth all workers
Δ Pred. XME/WAP	0.136*	0.171***		
	(0.0786)	(0.0518)		
F.Δ Pred. XME/WAP			-0.559	-0.353
			(0.436)	(0.249)
Dep. var. mean	33.57	17.41	-22.69	-18.89
R^2	0.07	0.08	0.03	0.03
# distinct LLM	18,123	17,752	10,548	13,928
# municipalities	1,490	1,477	1,255	1,401
# periods	39	39	38	38
Observations	727,539	590,176	97,524	171,768

Notes. This table repeats the analysis in Tables 1 and 4 on job creation at the commuting-zone level instead of the municipality level. Definition of commuting zones is discussed in the main text. Regressions control for full vector of municipality, individual, firm and locality controls; and use ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE D.5

Robustness: Alternative definition of export manufacturing

Dependent Variable:	(1) Leave	(2) Leave to WE	(3) Firm Growth hired workers	(4) Firm Growth all workers
Δ Pred. XME/WAP	0.117	0.129***		
	(0.0696)	(0.0407)		
F.Δ Pred. XME/WAP			-1.053***	-0.550***
			(0.247)	(0.173)
Dep. var. mean	33.57	17.41	-22.71	-18.90
R^2	0.07	0.08	0.03	0.03
# distinct LLM	25,754	25,201	14,815	19,590
# municipalities	1,490	1,477	1,255	1,401
# periods	39	39	38	38
Observations	727,539	590,176	97,524	171,768

Notes. This table reports robustness to the definition of export manufacturing., using a wider definition that includes wood product manufacturing and petroleum and coal product manufacturing. Outcome variables are defined as before, and the full set of controls is included. Each regression uses ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE D.6

ROBUSTNESS: LEAVING OUT INDUSTRIES FROM PREDICTED JOB CREATION

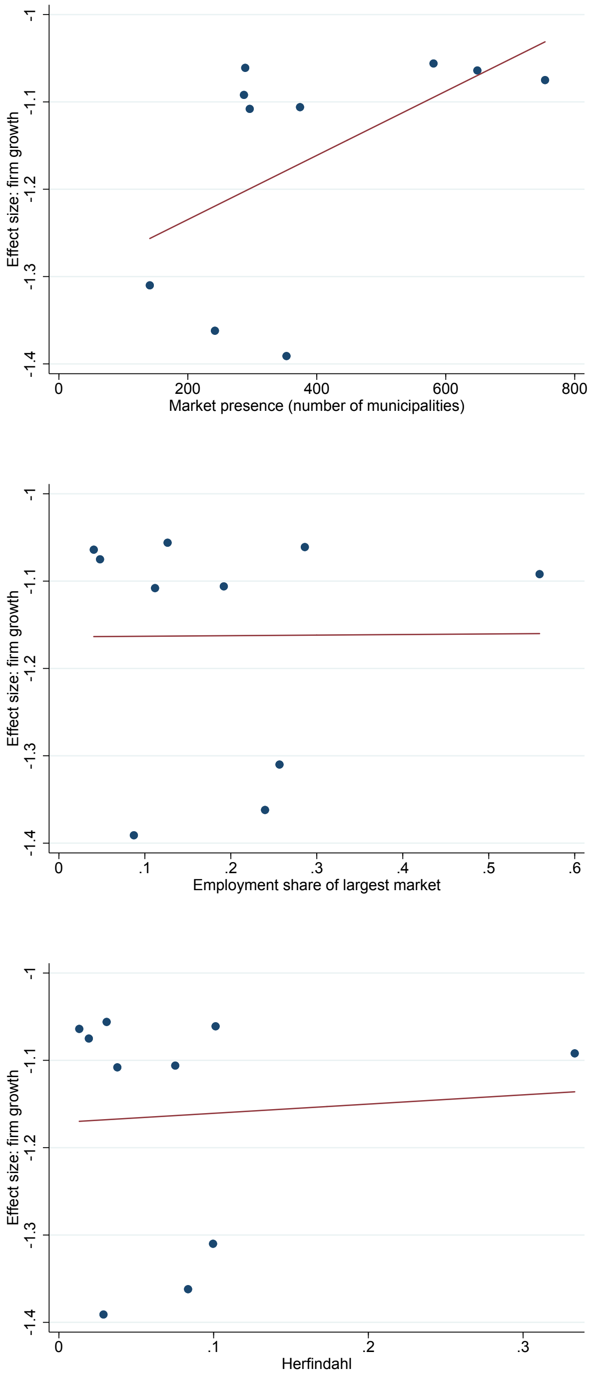
Industry left out	Dependent Variable				Concentration measure		
	Leave	Leave to WE	Firm growth paid workers	Firm growth all workers	Number of markets	Largest market	HCI
Textiles	0.119 (0.0737)	0.129*** (0.0424)	-1.061*** (0.253)	-0.551*** (0.168)	289	0.29	0.10
Apparel	0.129* (0.0709)	0.132*** (0.0434)	-1.064*** (0.277)	-0.552*** (0.177)	649	0.04	0.01
Leather	0.113* (0.0645)	0.123*** (0.0408)	-1.092*** (0.250)	-0.622*** (0.162)	287	0.56	0.33
Textile Products	0.119 (0.0739)	0.127*** (0.0435)	-1.075*** (0.255)	-0.553*** (0.173)	754	0.05	0.02
Machinery	0.111 (0.0724)	0.129*** (0.0398)	-1.108*** (0.248)	-0.577*** (0.174)	296	0.11	0.04
Computer	0.123 (0.0760)	0.133*** (0.0438)	-1.310*** (0.260)	-0.659*** (0.154)	141	0.26	0.10
Electrics	0.204** (0.0895)	0.180*** (0.0447)	-1.362*** (0.401)	-0.702** (0.301)	242	0.24	0.08
Auto	0.0655 (0.102)	0.157** (0.0672)	-1.391*** (0.376)	-0.732*** (0.279)	353	0.09	0.03
Furniture	0.127* (0.0680)	0.140*** (0.0390)	-1.056*** (0.254)	-0.559*** (0.173)	581	0.13	0.03
Other	0.121* (0.0707)	0.133*** (0.0425)	-1.106*** (0.222)	-0.588*** (0.144)	374	0.19	0.08

Notes. This table reports checks for robustness to market concentration. It uses an alternative definition of job creation which in turn leaves out each 3-digit industry from the predicted measure (indicated in the first column). Columns labelled (1) through (4) report the coefficient on suitably lagged predicted job creation; using this alternative definition. The last three columns display various degrees of market concentration for the industry in question: the number of labour markets this industry was active in 2005, the industry employment share of the largest market, and the Herfindahl concentration index (HDI) of industry employment.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

FIGURE D.1

LEAVE-INDUSTRY-OUT EFFECT SIZE AGAINST CONCENTRATION MEASURES

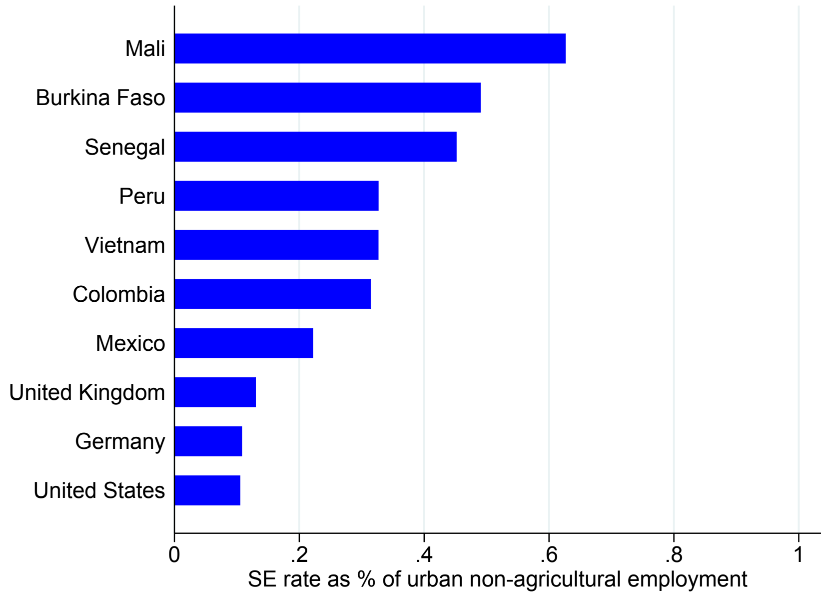


Source: This plots coefficient estimates from column (3) of Appendix Table D.6 against the concentration measures in the last three columns of the table, plus a linear fit.

E Appendix: Additional tables and figures

FIGURE E.1

International comparison of non-rural non-agricultural self-employment



Notes: Own calculation. Data restricted to capital cities or metropolitan areas with at least 1M population for the following sources: 2007 ENOE (Mexico), 2007 ESLF (Colombia) and WIEGO (2009) unified dataset compiled from: 2003 1-2-3 survey (Mali, Burkina Faso, Senegal); 2006 ENAHO (Peru), 2007 LFS (Vietnam), and 2007 LFS tabulations (UK). Data restricted to non-agricultural self-employment for 2004 Microcensus tabulations (Germany) and 2007 CPS tabulations (US).

TABLE E.1

Employment by firm size in Mexico

Firm Size (incl. entrepreneur)	**# Entrepreneurs**	**# Employees**	**% firms**	**% wage employment**
1	8.97M	1.16M	82.5	4.1
2-5	1.62M	8.47M	14.9	30.1
6-10	0.16M	2.84M	1.5	10.1
11+	0.12M	15.71M	1.1	55.7
Total	10.88M	28.19M	100.0	100.0

Source: ENOE, 2005-2014. Figures are obtained using sampling weights. Reported are averages across all 10 years. Employees in firms of size 1 are domestic workers.

TABLE E.2

Individual and job characteristics by occupation

	Entrepreneur	XM worker	Other worker
Employment share	0.25	0.06	0.69
Individual characteristics			
Male	0.57	0.63	0.61
Inter-state migrant	0.25	0.28	0.25
Education			
Primary	0.41	0.19	0.24
Secondary	0.45	0.67	0.54
Tertiary	0.14	0.14	0.23
Age			
15-29	0.15	0.43	0.38
30-39	0.26	0.30	0.27
40-49	0.29	0.19	0.21
50-64	0.28	0.08	0.13
Job characteristics			
Formal (IMSS-affiliated)	0.00	1.00	0.54
Full time (min 35 hrs/week)	0.65	0.96	0.81
Industry			
Manufacturing	0.15	1.00	0.15
Construction & Transport	0.15	0.00	0.17
Commerce	0.37	0.00	0.17
Services	0.32	0.00	0.50
Firm size (# workers)			
1-5	0.98	0.02	0.35
6-10	0.02	0.03	0.11
11-50	0.00	0.13	0.23
51-250	0.00	0.25	0.14
> 250	0.00	0.58	0.17
Observations	1,272,771	285,370	3,825,407

Source: ENOE, 2005-2014. Figures are obtained using sampling weights. Entrepreneurs are employers and self-employed; export manufacturing (XM) workers are formal wage employees in the export manufacturing industries; other workers are all other employees.

TABLE E.3

Effects on leaving self-employment: temporarily vs. permanently

	Leaving temporarily		Leaving permanently	
	(1)	(2)	(3)	(4)
Dependent Variable:	Leave temp.	Leave to WE temp.	Leave perm.	Leave to WE perm.
Δ Pred. XME/WAP	0.0238	-0.0287**	0.0749*	0.114***
	(0.0172)	(0.0125)	(0.0410)	(0.0280)
Dep. var. mean	12.45	5.94	13.29	6.55
R^2	0.02	0.03	0.05	0.04
# distinct LLM	25,159	24,750	24,579	24,159
# municipalities	1,487	1,476	1,489	1,476
# periods	39	39	39	39
Observations	642,036	552,911	648,193	556,949

Notes. This table reports effects on leaving self-employment of changes to export manufacturing employment opportunities. Temporary means individuals are observed to return to self-employment, permanent means they are not. Sample and data construction are as described in Table 1. Regressions control for full vector of municipality, individual, firm and locality controls; and use ENOE sampling weights. Two-way clustered standard errors by municipality and quarter in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

TABLE E.4

Effect of job creation on transition rates

		(1) To NPE	(2) To WE	(3) To SE
From NPE	Δ Pred. XME/WAP	-0.0296	0.0442**	-0.0138
		(0.0262)	(0.0183)	(0.0199)
	Dep. var. mean	83.42	10.89	5.69
	Observations	27,724	27,724	27,724
From WE	Δ Pred. XME/WAP	-0.0171	-0.0127	0.0298
		(0.0293)	(0.0452)	(0.0245)
	Dep. var. mean	11.46	83.69	4.86
	Observations	27,261	27,276	27,276
From SE	Δ Pred. XME/WAP	0.0122	0.0890**	-0.103**
		(0.0449)	(0.0437)	(0.0513)
	Dep. var. mean	19.07	14.62	66.39
	Observations	27,427	27,444	27,444

Notes. This table reports regression of municipality-level transition rates (in percentage points, rowwise) on predicted quarterly export manufacturing employment difference. Sample and data construction are as described in Table 3. Regressions control for full vector of municipality, individual, firm and locality controls. Observations are weighted by working-age population. Standard errors clustered by municipality in parentheses.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$.

TABLE E.5

Empirical tuning of the random forest

Hyper-parameters		Training data			Testing data		
Tree Depth	Leaf Size	R^2	MSE	Accuracy	R^2	MSE	Accuracy
10	5	0.3613	452.40	0.7369	0.2393	491.78	0.7238
10	5	0.3613	452.40	0.7369	0.2393	491.78	0.7238
10	10	0.3455	457.96	0.7352	0.2390	491.90	0.7232
10	15	0.3336	462.13	0.7350	0.2384	492.08	0.7232
10	20	0.3271	464.38	0.7332	0.2382	492.16	0.7245
10	25	0.3216	466.27	0.7326	0.2391	491.86	0.7246
15	5	0.5460	381.42	0.7560	0.2468	489.36	0.7253
15	10	0.4898	404.35	0.7527	0.2479	489.01	0.7254
15	15	0.4583	416.64	0.7487	0.2476	489.11	0.7264
15	20	0.4329	426.31	0.7461	0.2492	488.58	0.7281
15	25	0.4209	430.77	0.7462	0.2486	488.77	0.7235
20	5	0.6894	315.50	0.7795	0.2483	488.89	0.7249
20	10	0.5996	358.21	0.7700	0.2483	488.87	0.7260
20	15	0.5429	382.74	0.7631	0.2473	489.20	0.7270
20	20	0.5058	397.95	0.7582	0.2500	488.32	0.7264
20	25	0.4791	408.58	0.7568	0.2506	488.11	0.7245
25	5	0.7577	278.65	0.7923	0.2455	489.79	0.7243
25	10	0.6455	337.06	0.7789	0.2462	489.57	0.7240
25	15	0.5839	365.15	0.7724	0.2479	488.99	0.7269
25	20	0.5376	384.94	0.7661	0.2495	488.49	0.7259
25	25	0.5045	398.49	0.7620	0.2474	489.16	0.7279

Notes: This table shows goodness of fit of the random forest model for different values of the hyper-parameters: maximal tree depth and minimum leaf size. R-square and mean squared error (MSE) are obtained using a simple linear regression (with constant) of observed on fitted capital-labour-ratio. Accuracy is the inverse of the error rate of predicting whether the K/L ratio falls above or below the median. The graph illustrates overfitting: more flexibility always increases the in-sample fit. The preferred hyper-parameter configuration maximises the out-of-sample fit on the testing data.