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Essays in Macroeconomics and International Trade

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Executive Summary

Abstract

The economy consists of millions of businesses that are extremely varied. This dissertation focuses on understanding them more in order to better understand aggregate economic outcomes. The first paper studies why there has been a decline in entrepreneurship in the US in recent decades. The second paper investigates why there are changes in uncertainty in the economy, which is important for understanding business cycles, financial crises and asset prices. The final paper develops an international trade model with rich firm dynamics that is useful for studying the exporting process and better understanding the effects of trade policy changes.

Categories: Macroeconomics, Entrepreneurship, International Trade
Keywords: Entrepreneurship, Declining Dynamism, Uncertainty Shocks, Disaster Risk, Firm Dispersion, Exporter Dynamics

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Introduction

The US economy has millions of businesses that vary greatly in terms of their sizes, ages, the industries they operate in and the amount of exporting they do (if any), to name a few dimensions. This dissertation explores the importance of understanding these individual businesses in order to understand the overall state and trajectory of the economy. Chapter 1, *What's Driving the Decline in Entrepreneurship?,* seeks to understand why the level of entrepreneurship in the economy has declined over the last three decades. Chapter 2, *What are Uncertainty Shocks?,* considers how uncertainty affects businesses and uses the insights along with uncertainty data to investigate where economic uncertainty comes from. The third chapter, *Demand Shocks, Customer Capital and Exporter Dynamics*, develops a model of firms engaging in international trade. In particular it models the process of becoming an exporter and growing in an export market. This provides an environment for studying how opening up to international trade affects these dynamics, and how this impacts the overall benefits of such trade.

What's Driving the Decline in Entrepreneurship?

The US is famous for providing an environment that fosters entrepreneurship and for its high degree of competition that ensures that the best firms flourish. Research supports the idea that entrepreneurship plays an important role in the economy by identifying its importance for understanding the growth of the economy, the creation of jobs, income and wealth inequality, as well as economic mobility.[1] Entrepreneurship also receives considerable policy attention through ubiquitous political and media discussion, and from the Small Business Administration, the federal government department who's mission is to support small businesses. In light of this, research documenting that measures of entrepreneurship in the US have declined in recent decades have generated considerable concern.[2]

The purpose of this paper is to address the question, why has there been a decline in entrepreneurship? Answering this question is important for two reasons. First it is a step towards understanding the economic consequences of this trend because different explanations will have different implications for the economy. For example, if the the decline in entrepreneurship is due to regulations impeding business creation then the consequences are likely to be worse then if this change is an efficient response to changes in technology. Second, understanding the cause of the decrease in firm entry is important for formulating policy responses. Different causes will have different policy implications so identifying the cause is important for policy makers interested in

[1] For growth of the economy see, for example, Luttmer (2011); Acemoglu et al. (2013); Akcigit and Kerr (2015). For job creation see Haltiwanger et al. (2013); Adelino et al. (2016). For inequality and economic mobility see, for example, Quadrini (2000) and Cagetti and De Nardi (2006).

[2] Research documenting the decline in entrepreneurship includes (Davis et al., 2007; Decker et al., 2014a,b; Pugsley and Sahin, 2014). For discussion of this trend in leading media outlets see Weissmann (2012); Casselman (2014); The Economist (2014); Harrison (2015).

this trend.[3]

To evaluate why there has been a decline in entrepreneurship the paper considers a broad set of potential explanations and evaluates them using data and a model-based quantitative exercise. The main conclusion is that the key driver of the decline in entrepreneurship is an increase in the fixed costs of businesses—costs that don't vary with the amount that a business produces. These costs include some production costs, such as the cost of property and equipment, and overheads such as marketing, legal, accounting and human resources costs. They also include regulatory costs such as the costs of obtaining government licenses, satisfying tax laws and complying with government regulations in areas such as employment, health and safety, and environmental protection. Other papers have argued that the increase in regulatory costs is particularly important, but it is beyond the scope of this paper to assess that. Rather the point of this paper is to show that the data supports the fixed cost explanation over other alternatives. This provides a foundation upon which future research can investigate which component of fixed costs is most important for driving the decline in entrepreneurship.

Potential explanations The paper considers four classes of explanations for the decline in entrepreneurship. The three explanations other than an increase in fixed costs are as follows. One idea is that new technologies have allowed a small number of firms to grow large and dominate industries (think of companies like Amazon, Walmart, Facebook, and Google) making it more difficult for smaller competitors to survive. A second idea is that over time the demand of businesses for high skill employees has increased, causing the wages of these employees to rise rapidly so that some people choose to take high paying jobs as employees instead of starting their own businesses. A recent example of this would be the high salaries that people with good IT skills can earn by working for the leading tech companies. There has been extensive research into the increase in wages for high skill people which shows that a key driver of this trend is the development of new technologies which requires more high skill people to operate and allows these workers to be more productive. This type of technical change is known as *skill-biased technical change.* The third class of explanations is based on changes in demographics, such as the aging of the population, increasing life expectancy and changes in the labor force growth rate. A number of theories argue that these changes could explain the decline in entrepreneurship.

The approach of the paper to assessing these explanations is to start with the data. The data also provides evidence that the demographic explanations have limited explanatory power for the decline in entrepreneurship. It also provides a number of facts that, when combined with the model, enable us to distinguish between the other potential explanations for the decline in entrepreneurship.

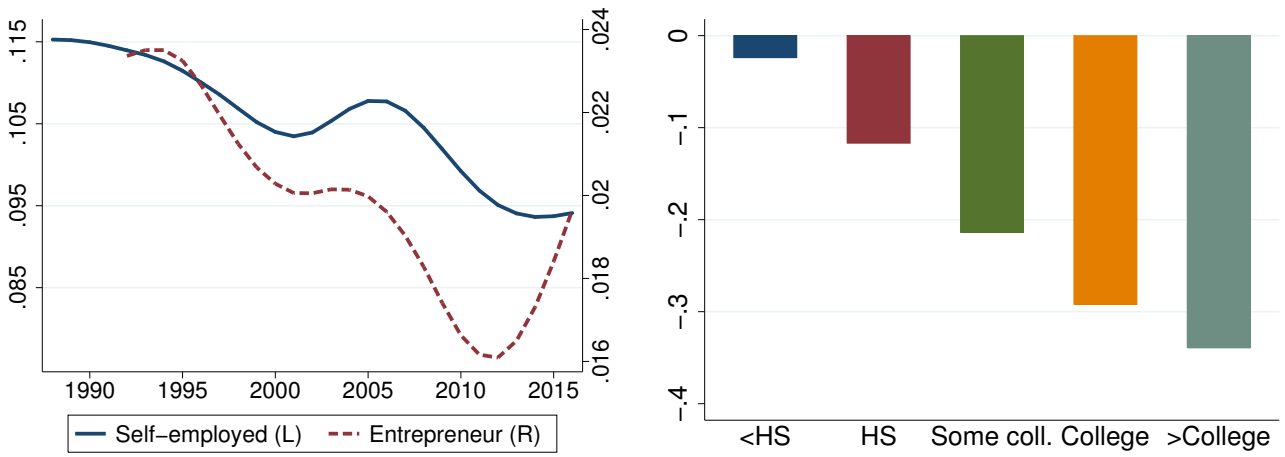
[3]For discussion of the decrease in the firm entry by a policy maker see Yellen (2014).

Empirics For the empirical analysis the paper studies the entrepreneurial decisions of people in the US for 1988 to 2016 using a large survey administered by the Bureau of Labor Statistics. This survey asks people detailed questions about their demographic characteristics, their education and their work, amongst other things. The paper considers two definitions of an entrepreneur: a person who is self-employed (they own and run their own business) and a person who also has at least 10 employees. The analysis primarily focuses on the definition that requires at least 10 employees as this ensures that the results are not driven by people with very small businesses with little economic impact, but it turns out that the results hold for either definition. The first fact is that the entrepreneurship rate (the share of the labor force who are entrepreneurs) has declined by 16% from 1988 to 2016 (see Figure 1(a)). In addition to this the paper shows that this is not a direct result of many well know changes to the economy over this period, such as the shift away from manufacturing, the aging of the population, the increase in education, the change in the gender composition of the labor force or the increasing share of the population in metropolitan areas.

The second fact is that the decrease in entrepreneurship has been larger for higher education groups (see Figure 1(b)). For example, for people with less than a high school education the entrepreneurship rate has decreased by 2.4%, while for people with more than a college education it has decreased by 34%. As far as I am aware this has not been documented before. This fact means that as well as entrepreneurship declining, there has been a shift in the composition of entrepreneurs towards those with smaller businesses and lower profits, suggesting lower productivity. A natural explanation for this is the rapid increase in wages for high skill employees has resulted in more high skill people choosing to work for companies rather than start their own business. This explanation is studied with the model.

The third fact is that the size distribution of entrepreneur firms has been quite stable over time. With a lower share of people choosing to be entrepreneurs and their firms staying about the same size, it implies that economic activity has shifted towards non-entrepreneur firms over time. This change in the data is predicted by two of the potential explanations for the decline in entrepreneurship. An increase in fixed costs affects the profitability of entrepreneurial business more than non-entrepreneurial businesses because the former are smaller. Changes in technology that allow large businesses to expand and dominate industries also have this implication. However, while both of these explanations are qualitatively consistent with this feature of the data, the model will show that they have quite different implications for the magnitude of the shift in economic activity towards non-entrepreneurial firms and this allows us to distinguish between them.

The paper also uses the data to address alternative explanations for declining entrepreneurship based on changes in demographics. Karahan et al. (2016) argue that the decrease in the labor force growth rate explains at least part of the decline in the firm entry rate. This paper argues that there have been changes in entrepreneurship beyond what this theory can explain because it implies a constant share of the labor force are entrepreneurs in the long run while the data shows



(a) Entrepreneurship rate

(b) Percentage change by education level

Figure 1: Entrepreneurship rate and percentage change by education. Panel (a) is the share of the labor force who are self-employed and entrepreneurs. Panel (b) is the the percentage change in the entrepreneurship rate from the average for 1992–93 to the average for 2015–16 for five education groups: did not complete high school, completed high school, less than 4 years of college, bachelor's degree, more than a bachelor's degree.

that this share has been decreasing. A second demographic theory is based on the aging of the population and increasing life expectancy (Kopecky, 2017). This theory implies that changes in the age composition generate some of the decrease in entrepreneurship and that the decline in entrepreneurship should be more pronounced for older people, but neither of these patterns are in the data. A third theory is based on the idea that an older population makes it more difficult more people to accumulate experience which would help them be entrepreneurs (Liang et al., 2014). This theory predicts a larger decrease in entrepreneurship for people in the middle of the age distribution, however in the data the decline has been similar for all ages.

Model and quantitative results The second part of the paper uses a model to evaluate the ability of the non-demographic explanations (increasing fixed costs, changes in technology advantaging the largest firms and changes in technology driving up the wages of high skill people) to explain the changes in entrepreneurship that have been documented in the data. The basic idea is to setup a model of peoples' decisions about what type of work to do. The model has a large number of people with different education levels and different abilities for doing various types of work. In particular each person has an ability level for doing high skill work (think of occupations that require a person to perform relatively difficult mental tasks such as engineering, computer science jobs, and many managerial, medical and high skill service jobs), an ability for low skill work (all other jobs, which are mostly jobs involving manual labor or low skill service jobs such as those in retail and hospitality) and an ability for being an entrepreneur. Each person chooses which type of work to perform or to not work at all. The entrepreneurs and some non-entrepreneur businesses hire low and high skill workers in order to produce. These two types of businesses have access to the same type of technology, but they differer in their productivity (their skill at using

it) which results in businesses being a wide range of sizes, just as we see in the world.

To use the model to evaluate the three non-demographic explanations for the changes in entrepreneurship the approach is to adjust parameters to simulate forces affecting the economy from 1988 to 2016 and assess the effects of each force. The fixed costs of businesses can be changed directly in the model. Changes in technology that have advantaged large firms are simulated with changes in the productivity of these firms, while changes in technology that have caused the wages of high skill employees to increase rapidly are simulated through changes in the production technology. The exercise also allows peoples' education levels to change over time. This is important because the education level of the population has increased a lot over the last three decades and this affects peoples' skills, which affects their employment decisions.

A key challenge for the analysis is determining how large the changes in fixed costs and technology have been. Fortunately other research has directly measured the type of technical change that has driven the wages of high skill employees up. However, this is not true for the change in fixed costs or the change in technology that has allowed the largest firms to expand. The approach to discipling these forces is therefore to allow these features of the model to change so that the model fits the data as well as possible. In particular the exercise requires the model to match the decline in the entrepreneurship rate and the shift in economic activity to non-entrepreneur firms. This methodology means that the model matches the decline in entrepreneurship by design and teaches us about the relative contribution of each of the explanations. It also allows us to evaluate whether these forces can explain the larger decline in entrepreneurship for more educated people.

The analysis produces three main results. First, if the only change to the economy from 1988 to 2016 was the change in the education distribution, then the entrepreneurship rate would have increased. This is because with an increase in education the supply of high skill workers goes up, pushing the high skill wage down. This lowers an input cost for entrepreneurs and makes working as an employee less attractive for high skill types, leading to more entrepreneurship. So the the decline in entrepreneurship has actually been larger than it appears in the raw data.

Second, the key force generating the decrease in the entrepreneurship rate is the increase in the fixed costs of businesses. The first step towards understanding this is to understand the effect of changes in technology that have driven up the wages of high skill employees. The analysis shows that these changes also push down the wages of low skill employees, because businesses are using fewer of them as they demand more high skill employees. Thus, while the increase in wages for high skill employees entices more people to do these jobs instead of being entrepreneurs, the decrease in wages for low skill employees results in more of these employees leaving their jobs and starting businesses instead. Overall these changes result in only a small change in the overall entrepreneurship rate. Their main effect is a change in the composition of the type of people who are entrepreneurs.

This leaves the increase in the fixed costs and the increase in the productivity of non-entrepreneur

firms to explain the decrease in the entrepreneurship rate. When the productivity of non-entrepreneur firms increases production shifts towards those firms. This happens through entrepreneurs decreasing the size of their firms and some of them exiting. However, most of the change happens through entrepreneurial businesses shrinking, rather than exiting. This means that given the size of the increase in the non-entrepreneur share of the economy, the entrepreneurship rate does not decrease that much. On its own this force accounts for only 15% of the decline in the entrepreneurship rate. In contrast, when the fixed costs of businesses increase it causes a lot of businesses to close, while those that continue to operate do not actually shrink. This means that for a given increase in the non-entrepreneur share of the economy, an increase in the fixed cost generates a much larger decrease in the entrepreneurship rate. Given the change in the entrepreneurship rate and the change in the non-entrepreneur share of the economy that has occurred, the model estimates that most of the decline in entrepreneurship is due to the increase in fixed costs.

A common concern with the fixed cost explanation for the decline in entrepreneurship is that on its own this force causes entrepreneurial businesses to grow larger on average because it causes the smallest ones to close. In the data the size of these businesses has been stable. The paper shows that this tension can be resolved once other forces affecting the economy from 1988 to 2016 are considered. Specifically the increase in the productivity of non-entrepreneur business offsets the effect of the increase in fixed cost by causing entrepreneur businesses to shrink. Changes in wages that result in more people with low education being entrepreneurs also causes the size of entrepreneur businesses to shrink, because on average these people have smaller businesses than more highly educated people. Once these factors are considered the size distribution of entrepreneur businesses is actually stable, consistent with the data.

As discussed earlier, this paper does not take a stand on what the source of the increase in fixed costs is. However, since one potential source that has been discussed in the literature is an increase in regulatory costs, the paper performs an exercise to place an *upper bound* on the potential costs. Specifically, if you assume that the entire increase in costs is due to regulatory red tape that has no social value then the losses for the economy are 3.4% of aggregate consumption, with 80% of this due to the direct cost and the remainder due to resulting production inefficiency. I emphasize that this is an upper bound since some of the increase in fixed costs could be due to other reasons and regulations usually have some social value. More research is required to evaluate this further.

The final main result is that the model generates a larger decline in entrepreneurship for more educated people, with the magnitude of the decline for each education group almost exactly matching the data. Changes in technology driving an increase in demand for high skill employees is the force that is driving this. Since more educated people are more likely to be high skill, more of them are attracted out of entrepreneurship by increasing high skill wages. In contrast less educated people are more likely to be low skill and have less incentive to leave entrepreneurship

because of decreasing low skill wages. While at face value the shift in entrepreneurship towards less educated people may seem like a negative development, this explanation implies that it is an efficient response to the change in technology.

What are Uncertainty Shocks?

One of the primary innovations in modern business cycle research is the idea that uncertainty shocks drive fluctuations in the economy. A recent literature starting with Bloom (2009) demonstrates that uncertainty shocks can explain business cycles, financial crises and asset price fluctuations with great success (e.g., Bloom et al., 2018; Ordoñez, 2013; Pastor and Veronesi, 2012). But the measures of uncertainty are wide-ranging. Changes in the volatility of stock prices (VIX), disagreement among macroeconomic forecasters, and the cross-sectional dispersion in firms' earnings growth, while all used as measures of uncertainty, are not the same. Comparing VIX and firm earnings growth dispersion is like comparing business cycle volatility and income growth inequality. One measures aggregate changes in the time-series and the other differences in a cross-section. Are these disparate measures really capturing a common underlying shock? If so, what is it? Uncertainty is not exogenous. People do not spontaneously become uncertain, for no good reason. One person might. But a whole economy changing its beliefs, unprompted, is collective mania. Instead, people become uncertain after observing an event that makes them question future outcomes. That raises the question: What sorts of events can make agents uncertain in a way that shows up in all these disparate measures? Uncovering the answer to this question opens the door to understanding what this uncertainty shock is and why the aggregate economy fluctuates.

This paper contributes to answering these questions in the following ways. First it shows that the various measures of uncertainty are statistically distinct. While most measures of uncertainty are positively correlated after controlling for the business cycle, even the most correlated measures have correlations that are far from unity and some measures have correlations close to zero. Thus it is not obvious that these various measures of uncertainty are measuring the same shock to the economy. Using a model the paper shows that, depending on the type of shock, different types of uncertainty can covary positively or negatively. The fact that these distinct measures are conflated in the literature is troubling because it means that there is not one uncertainty shock that explains the various aggregate outcomes linked to uncertainty. The discovery of many different shocks that explain many different outcomes is not the unified theory of fluctuations one would hope for. To unify uncertainty measures a model is used to identify a type of shock that can generate comovement in the different types of uncertainty that is consistent with the data. The model shows that changes in the volatility of the aggregate economy (i.e. the fact the the economy is more volatile at some times than others) are a quantitatively plausible explanation.

Empirical analysis The paper starts with a statistical exploration of various uncertainty measures. These measures are organized into three categories: measures of uncertainty about macroe-

conomic outcomes (*macro uncertainty*); measures of the dispersion of firm outcomes (*micro dispersion*); and measures of the uncertainty that people have about what others believe (*higher-order uncertainty*). The analysis focuses on assessing whether these different measures of uncertainty are positively correlated beyond the fact that the all rise during recessions. The results show that while these measures are positively correlated, their correlations are far from one. This raises the question of whether these various series are really measuring the same shock to the economy, which is necessary for a unified theory of uncertainty shocks.

Theoretical analysis To understand these correlations and attempt to identify what kind of shock could generate them, a model is used. In the model agents observe economic outcomes, receive information about the future from public and private sources (public sources are sources that everyone has access to such as the media and government statistics, while private information comes from personal contacts and observations of the economy that some others do not have access to), form beliefs about the future and choose economic inputs in production. In this framework the three types of uncertainty and dispersion are formally defined and solved for. The model allows for three types of shocks to the economy that can generate fluctuations in uncertainty: changes in the quality of public information (e.g. sometimes commentators are betting at forecasting the economy than others), changes in the quality of private information (e.g. sometimes a person's contacts have better information than at other times) and changes in the volatility of the economy (i.e. sometimes the economy is inherently more volatile making it harder to predict the future even if you have the same quality of information).

The paper then investigates the implications of the three possible shocks to the economy for the covariance of the three types of uncertainty and dispersion. The analysis shows that it is not given that the three types of uncertainty and dispersion are positively correlated. Their correlations can be negative. This shows that the different types of uncertainty are theoretically distinct. Therefore if we want to think of the various uncertainty shocks as a unified phenomenon, then there needs to be a common origin for them. The negative correlations can arise when there are shocks to the quality of private or public information. For example, when information sources are lower quality, they convey less information, leaving agents with more uncertainty about the economy. When agents place less weight on their information there will be less disagreement, which results in less dispersed firm decisions (lower micro dispersion) and less dispersed forecasts (lower higher-order uncertainty).

In contrast, changes in the volatility of the macroeconomy are a reliable common cause of the disparate collection of changes referred to as uncertainty shocks. Macro volatility creates macro uncertainty by making the economy inherently less predictable. This unpredictability causes agents to put more weight on the information they receive about the future. Since some of this information is private—while one firm may incorporate their firm's sales numbers, another will examine its competitors' prices, and yet another will purchase a forecast from one of many

providers—this generates greater differences in beliefs.

Divergent beliefs (forecasts) create higher-order uncertainty and micro dispersion. When forecasts differ, and the difference is based on information others did not observe, another person's forecast becomes harder to predict. This is higher-order uncertainty. Firms with divergent forecasts also choose different inputs and obtain different outputs. This is more micro dispersion. All three forms of uncertainty and their covariance can be explained in a unified framework that brings us one step closer to understanding what causes business cycle fluctuations.

While the model points to plausible sources of uncertainty measure comovement, it misses a mechanism to make uncertainty rise during recessions, as it does in the data. Of course one could assume that economy is just more volatile in recessions, as many theories do. But since our goal is to uncover sources of fluctuations, it makes sense to ask why. To explain why uncertainty is countercyclical, the model needs one additional ingredient: disaster risk. The is the risk of extreme recessions such as the Great Depression. Disaster risk is important for understanding uncertainty because disaster probabilities are difficult to assess, so a rise in disaster risk creates both uncertainty about aggregate outcomes (macro uncertainty) and disagreement; and this is especially so in recessions when disasters are more likely.

Quantitative analysis The final part of the paper explores whether the theory is quantitatively plausible. The simple model generates half of the fluctuations and most of the correlations of the various uncertainty measures. Adding disaster risk makes these uncertainty measures countercyclical. It also amplifies uncertainty fluctuations. The reason is that disasters are rare and difficult to predict. When outcomes are difficult to predict, firms disagree (higher-order uncertainty); they make different input choices and have heterogeneous outcomes (micro dispersion). With the learning and disaster risk mechanisms operating together, the model is able to generate over two thirds of the fluctuations in the various uncertainty measures. The uncertainty measures also comove appropriately with the business cycle and each other.

Demand Shocks, Customer Capital and Exporter Dynamics

Recent empirical research has paid considerable attention to the dynamics of exporters and shown that exporting is a risky activity that firms typically take time to succeed at. In order to evaluate the importance of these dynamics for the effects of changes in trade policies or other changes in the trade environment, such as technological change or changes in trade costs, we need models that have these features. Most general equilibrium heterogeneous firm trade models ignore these dynamics and this paper contributes to bridging this divide. Specifically we develop a model in which individual firms evolve in a way that is consistent with the data and the dynamics are primarily a result of the optimal decisions of firms. The fact that the dynamics of firms result from their decisions rather than exogenous processes or shocks is important. It means that the framework is suitable for studying how changes in the environment affect the dynamics, which in

turn affects other outcomes, rather than just being able to study the effect on outcomes assuming that the dynamics are fixed.

In developing a model with realistic dynamics for exporters the paper focuses on three key facts about these that have been established in existing research. First firms have a high probability of leaving an export market soon after entering, and this exit rate declines only gradually over time. In data for Columbian firms Ruhl and Willis (2017) show that the probability that a firm stops exporting after one year is 35% and this declines to less than 10% in the fourth year. Second, conditional on surviving in export markets, firms take time to grow. Amongst firms that export for at least five years, on average their foreign sales double relative to their home country sales over this period (Ruhl and Willis, 2017). Third, as firms grow their prices are stable (Fitzgerald et al., 2017).

The model takes a standard Melitz (2003) environment as its foundation and makes two adjustments in order to generate realistic dynamics. First it assumes that firms face uncertainty about their demand in an export market and resolve their uncertainty over time as they sell more in the market. Second, firms need to invest in marketing in order to acquire customers. These two features of the model interact because the quicker a firm acquires customers the faster it learns about its demand. The model is able to replicate the three facts for the dynamics of exporters in the following way. Firms take time to grow because it takes time to acquire customers. Since this friction to firm growth is on the demand side rather than the supply side, firms can grow over time while their productivities are stable. Since the price of each firm is a constant markup over marginal cost in the Melitz environment, this results in stable prices for exporters. This would not be true in a model in which firm growth is driven by productivity. Finally, the exit rate of firms from an export market declines the longer a firm is in the market for two reasons. First, when a cohort of firms starts exporting many firms learn that their demand is low and exit quickly. Second, the longer firms are in an export market the more customers they have on average. All else being equal, a larger number of customers increases the value of being in the export market, causing the exit rate to decrease.

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