Niche Firms, Mass Markets, and Income Across Countries: Accounting for the Impact of Entry Costs

Pedro Bento†

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Abstract

I develop a model of monopolistic competition in which I distinguish between niche markets and mass markets, in the spirit of Holmes and Stevens (2010). Firms choose between entering a small niche market with high markups or a large mass market with low markups. Entry costs have a much greater impact on output in the niche market as the gains to specialization are high, relative to the mass market where varieties are highly substitutable. Calibrated to match data from U.S. manufacturing, the model generates an elasticity of TFP with respect to entry costs more than twice that in a model that abstracts from heterogeneous markets. I use data on entry costs across countries to show the model can explain 45% of the cross-country variation in TFP and income per worker. In comparison, empirical estimates of the explanatory power of entry costs are about 50%.

JEL: O1 O4

keywords: aggregate productivity; niche; mass market; entry costs; regulation

†Department of Economics, University of Toronto. 150 St. George St., Toronto, Canada, M5S 3G7. Email: pedro.bento@utoronto.ca. Tel: 647-218-3266. I would like to thank my committee members Diego Restuccia (supervisor), Xiaodong Zhu, and Gueorgui Kambourov, as well as Margarita Duarte, Nicholas Li, Angelo Melino, and participants in various seminars for valuable comments and suggestions.
1 Introduction

Income differences across countries are enormous. GDP per capita in the poorest ten percent of countries averaged less than two percent of the U.S. level in 1996. Economists as far back as Adam Smith have considered barriers to entry for new firms to be a likely contributor to these differences across nations. But the last decade has seen a surge in studies of the effects of these barriers on aggregate outcomes, fueled in no small part by the efforts of Djankov et al. (2002) and the World Bank to measure, catalogue, and report standardized measures of the regulatory costs of doing business across countries. The story that has begun to emerge is one in which the (substantial) variation in entry costs across countries explain as much as half of the differences in both income and TFP.

While the empirical evidence suggests a large impact of entry costs on aggregate outcomes, quantitative models have consistently predicted a much lower impact. A number of papers have been written recently investigating a wide range of possible mechanisms through which high entry costs might affect both within-firm and aggregate TFP. These include reducing the number of firms and thereby inefficiently inflating the size of firms, allowing less productive firms to survive, allowing higher markups over marginal cost, and reducing incentives to adopt new technologies. Remarkably, this diverse group of theories share one common feature - a relatively low impact of entry costs on aggregate TFP and output.

To understand why entry costs have been consistently predicted to have a low impact, consider a simple constant-elasticity-of-substitution (CES) model of monopolistic competition (I will at times refer to this as the ‘standard’ model). An important parameter in the model is the elasticity of substitution between varieties. Estimating elasticities for a number

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1 From the sample of 136 countries used in this paper.
2 See Herrendorf and Teixeira (2011) and Barseghyan (2008). In the appendix I provide some additional evidence consistent with this claim.
3 Examples are Poschke (2010), Barseghyan and DiCecio (2011), and Boedo and Mukoyama (2012). I define ‘entry costs’ rather broadly to include any fixed costs of doing business.
4 Think here of Krugman (1979) as extended in Melitz (2003), but without trade or fixed operating costs.
of industries, Imbs and Méjean (2009) suggest a plausible elasticity between varieties of 6-7 in a model with constant elasticities across industries. In such a model, entry costs affect productivity by reducing the number of firms and thereby enlarging the average firm above its efficient size. The high substitutability between varieties suggested by Imbs and Méjean implies small gains from specialization, so that more output from a smaller number of firms is almost as efficient as less output from a larger number of firms (in the limit, an infinite elasticity implies any number of firms is efficient). As a result, this model can only account for about 7% of the variation in TFP across countries. Although the mechanisms differ, this general result holds across all of the models developed in recent papers.\(^5\)

In this paper, I develop a model of monopolistic competition in which I distinguish between niche markets and mass markets within the same industry. Incorporating these heterogeneous markets magnifies the impact of entry costs (and other distortions) significantly. In the spirit of Holmes and Stevens (2010), I allow entering firms in each industry to choose between producing a niche good or a mass-market good. Think here of McDonalds and Burger King versus a vegetarian burger chain, or a mass-market furniture manufacturer versus a manufacturer of Amish furniture. The market for niche goods is relatively small and characterized by a low elasticity of substitution between varieties, as niche goods target very specific tastes. The demand for mass-market goods, on the other hand, is large and characterized by high substitutability between varieties. In essence, new firms choose between a small market with high markups, or a large market with small markups.\(^6\) Each market exhibits a different relationship between entry costs (via the number of firms) and aggregate productivity. In particular, the impact of entry costs on aggregate niche output is

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\(^5\)The same story applies to a model with decreasing returns to scale in production at the firm level, as in Lucas (1978) or Hopenhayn (1992). The corresponding parameter of importance in such a model is the elasticity of firm output with respect to inputs. The value of this parameter is generally assumed to be about 0.85 (for example, in Restuccia and Rogerson (2008)), consistent with various empirical estimates. An elasticity this high has the same implications for the impact of entry costs as that in a CES model.

\(^6\)This assumption is consistent with Hsieh and Klenow (2009), who report a negative relationship between establishment size and markups in the U.S. (p. 1436-37).
far greater than that on mass-market output. I can compare the model to the standard CES model by ensuring the average elasticity of substitution between all firms in an industry is the same in both models. I show that for any targeted elasticity, the impact of entry costs on aggregate TFP is higher when both niche firms and mass-market firms are allowed for.

Calibrating the model to match moments from U.S. manufacturing data, I perform a counterfactual experiment in which I increase entry costs and observe the resulting change in aggregate TFP and output per worker. The calibrated model generates an elasticity of TFP with respect to entry costs of 0.45, about two-and-a-half times that in the standard model. The corresponding elasticity for output per worker is 0.77. I perform a second experiment in which I generate cross-country TFP and output per worker by feeding cross-country data on entry costs from the World Bank into the model. I find the model explains 45% of the variation in TFP and output per worker, close to the estimate of one half reported in Herrendorf and Teixeira (2011). This implies the elasticities generated by the model are 95% of the actual elasticities in the data.

The idea to distinguish between niche and mass-market firms is from Holmes and Stevens (2010). They offer the idea as an alternative theory of the plant size distribution, complementing the usual assumption that differences in size solely reflect differences in productivity across plants. The focus of their paper is on the location decision of firms and the differential effects of import competition on niche firms and mass-market firms.

Herrendorf and Teixeira (2011) develop a model that allows for a wide array of distortions, calibrate their model to match U.S. data, and then use a wide variety of cross-country data to isolate the variation in TFP and output per worker accounted for by entry costs. They estimate about half of the variation in TFP and output per worker is due to variation in entry costs. Barseghyan (2008) uses a number of different instruments to estimate the impact of regulatory entry costs and various proxies for institutional quality, and finds an increase in costs by one half of a standard deviation in his sample is associated with a 22% reduction
in TFP.

This paper’s focus on the aggregate impact of entry costs is related to the large recent literature analyzing the effects of various distortions in the prices faced by firms on the allocation of resources and aggregate outcomes.\textsuperscript{7} Although the focus of the present paper is on entry costs, I briefly explain how the model magnifies the impact of distortions more generally.

In the next section I present the model and solve for its steady-state equilibrium. In Section 3 I calibrate the model and show how the benchmark economy behaves when entry costs are increased. In Section 4 I construct a measure of entry costs for 136 countries and use the model to generate TFP and output per worker for each country in the sample. I then compare the model-generated outcomes to the data. Section 5 follows with a discussion about how accounting for heterogeneous markets affects the impact of other distortions. Section 6 concludes.

2 The Model

My focus here is on the aggregate impact of entry costs rather than the various mechanisms through which entry costs may affect firm dynamics or firm-level TFP, so I abstract from any heterogeneity in firm productivity or fixed costs of operation.\textsuperscript{8} Total output in the economy is a CES aggregate of intermediate inputs, and all intermediate firms produce one-for-one using labor.\textsuperscript{9} As such, output per worker in this economy is equivalent to aggregate TFP. I further assume one representative industry, which contains both a market for niche varieties and a market for mass-market varieties. Firms pay a one-time fixed cost of entry and choose whether to produce a niche variety or a mass-market variety. All firms

\textsuperscript{7}For example, Guner et al. (2008), Restuccia and Rogerson (2008), and Hsieh and Klenow (2009).
\textsuperscript{8}At the end of this section, I discuss the implications of allowing for both heterogeneous firms and fixed operating costs.
\textsuperscript{9}Henceforth I use ‘firm’ to mean an intermediate-good firm, unless otherwise indicated.
face an exogenous probability of death in each period, so there is firm turnover in steady state. I study the stationary competitive equilibrium of the economy in which firms take the economy-wide wage rate as given and free entry ensures zero expected profits for all entrants. I begin by describing the environment.

2.1 Environment

There is a representative consumer who supplies one unit of labor to intermediate firms. The consumer only values consumption ($C$) and has a constant discount factor $\beta \in (0, 1)$. Preferences over the stream of consumption in each period are described by the following utility function:

$$\sum_{t=0}^{\infty} \beta^t u(C_t).$$

The market for final output is perfectly competitive, with a representative firm using inputs from a representative intermediate industry to produce output according to the following production function:

$$y = X_n^\phi X_m^{1-\phi},$$

where $X_n$ is a CES aggregate of niche output, $X_m$ a CES aggregate of mass-market output, and $\phi$ the weight on niche output. Under the above assumptions, aggregate output $y$ is equivalent to both output per worker and aggregate TFP.

Niche output is aggregated in the following way;

$$X_n \equiv \left( \int_{0}^{N_n} x_n^\alpha_n dn \right)^{\frac{1}{\alpha_n}},$$

where $N_n$ is the measure of niche firms/varieties, $x_n$ the demand for the output of niche firm $n$, and $\frac{1}{1-\alpha_n}$ the constant elasticity of substitution between niche varieties. Mass-market

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10I focus my attention on the stationary equilibrium of the economy, so there is no need to specify the form of $u(\cdot)$.
11Throughout the paper, I omit the time subscript unless clarity requires it.
output is aggregated in the same way, but with an elasticity of substitution between mass-
market varieties of \( \frac{1}{1-\alpha_m} > \frac{1}{1-\alpha_n} \). Note that if the elasticity of substitution is made the same
across all varieties, this model collapses to a standard model of monopolistic competition.

Intermediate firms produce output one-for-one with labor, so \( x_i \) also denotes labor de-
manded by firm \( i \). In each period a new firm can choose to enter as either a niche firm or
a mass-market firm, but must pay a fixed entry cost equal to a multiple \( c_e \) of output per
worker \( y \). Entry costs are financed by issuing equity to consumers and I assume an unlimited
mass of potential entrants. Finally, all firms face the same exogenous probability of death \( \lambda \)
each period.

2.2 Competitive Equilibrium

I focus on the stationary competitive equilibrium of the model. In such an equilibrium,
the real wage \( w \) and real interest rate \( r \) will be constant, as will firm entry and exit. I
begin by describing the decision problems of each agent, and then define and solve for the
stationary equilibrium.

2.2.1 Consumer

In each period the consumer chooses both consumption and savings, and the only vehicle
for savings is the purchase of equity in intermediate firms, earning a rate of return of \( r \). The
consumer’s problem is therefore to choose consumption \( C \) and savings \( S \) in each period \( t' \),
given \( w \) and \( r \), to maximize;

\[
\sum_{t=t'}^{\infty} \beta^t u(C_t), \quad \text{s.t.} \quad C_t + S_t \leq w + S_{t-1}(1 + r).
\]
The first order conditions for this problem imply a constant real interest rate;

\[ r = \frac{1}{\beta} - 1. \]

### 2.2.2 Final-Good Producer

In each period, the final-good producer takes the prices of all intermediate inputs as given, and demands inputs from each intermediate firm to maximize profits;

\[ X_n^\phi X_m^{1-\phi} - \int_0^{N_n} P_n x_n dn - \int_0^{N_m} P_m x_m dm, \]

where \( X_i \equiv \left( \int_0^{N_i} x_i^{\alpha_i} di \right)^{\frac{1}{\alpha_i}}, i \in \{n, m\}, P_n \) is the price of niche input \( n \), and \( P_m \) the price of mass-market input \( m \). The first order conditions for the final-good firm’s problem imply the following inverted demand functions for intermediate inputs;

\[ P_n = \frac{\phi y x_n^{\alpha_n-1}}{X_n^{\alpha_n}} \quad \text{and} \quad P_m = \frac{(1 - \phi) y x_m^{\alpha_m-1}}{X_m^{\alpha_m}}, \]

for each niche input \( n \) and mass-market input \( m \).

### 2.2.3 Intermediate Firms

In each period, incumbent niche firms face the downward-sloping demand curves implied by the final-good firm’s problem above, and demand labor \( x_n \) given the measure, prices, and output of other firms, to maximize profits;

\[ \pi_n = P_n x_n - w x_n. \]
First order conditions imply an optimal price equal to;

\[ P_n = \frac{w}{\alpha_n}, \]

and optimal output equal to;

\[ x_n = \left( \frac{\alpha_n \phi y}{wX_n^{\alpha_n}} \right)^{\frac{1}{1-\alpha_n}}. \]

Analogous to a niche firm’s choices, the first order conditions for mass-market firm \( m \) imply an optimal price of;

\[ P_m = \frac{w}{\alpha_m}, \]

and optimal output of;

\[ x_m = \left( \frac{\alpha_m (1 - \phi)y}{wX_m^{\alpha_m}} \right)^{\frac{1}{1-\alpha_m}}. \]

In equilibrium, total expected discounted profits for incumbent niche and mass-market firms are;

\[ \frac{\pi_n}{1 - \rho} \text{ and } \frac{\pi_m}{1 - \rho}, \]

where \( \rho = \frac{1 - \lambda}{1 + r} \) is each firm’s discount rate, \( \lambda \) is the exogenous probability of firm death, and \( r \) is the real interest rate. Free entry ensures that new firms will enter as niche firms as long as;

\[ \frac{\pi_n}{1 - \rho} \geq c_ey, \]

and new firms will enter as mass-market firms as long as;

\[ \frac{\pi_m}{1 - \rho} \geq c_ey. \]
2.2.4 Steady-State Equilibrium

Here I take into account that all niche firms face the same problem and all mass-market firms also face the same problem. A stationary competitive equilibrium is a real wage $w$, a real interest rate $r$, a niche price $P_n$, a mass-market price $P_m$, a measure of niche firms $N_n$, a measure of mass-market firms $N_m$, niche firm output $x_n$, mass-market firm output $x_m$, and final-good output $y$ such that:

(i) Consumer Optimization: $r = \frac{1}{\beta} - 1$

(ii) Final-Good Firm Optimization: $P_n = \frac{\phi y}{N_n x_n}$ and $P_m = \frac{(1-\phi)y}{N_m x_m}$

(iii) Intermediate Firm Optimization: $P_n = \frac{w}{\alpha_n}$ and $P_m = \frac{w}{\alpha_m}$

(iv) Free Entry: $c_ey = \frac{(1-\alpha_n)wx_n}{\alpha_n(1-\rho)}$ and $c_ey = \frac{(1-\alpha_m)wx_m}{\alpha_m(1-\rho)}$

(v) Market Clearing (Goods): $y = \left( N_n^{1/\alpha_n} x_n \right)^{\phi} \left( N_m^{1/\alpha_m} x_m \right)^{1-\phi}$

(vi) Market Clearing (Labor): $1 = N_n x_n + N_m x_m$

where $\rho \equiv \frac{1-\lambda}{1+r}$.

These equilibrium conditions can be used to solve for the steady-state measures of niche and mass-market firms:

$$N_n = \frac{(1-\alpha_n)\phi}{c_e(1-\rho)} \quad \text{and} \quad N_m = \frac{(1-\alpha_m)(1-\phi)}{c_e(1-\rho)},$$

as well as aggregate TFP in this economy:

$$y = \frac{\Delta}{c_e^{\phi_n + 1 - \phi_n}},$$

$$\Delta \equiv \frac{[\alpha_n^{\alpha_n}(1-\alpha_n)^{1-\alpha_n}]^{\frac{\alpha}{\alpha_n}} [\alpha_m^{\alpha_m}(1-\alpha_m)^{1-\alpha_m}(1-\phi)]^{\frac{1-\phi}{\alpha_m}}}{[\alpha_n\phi + \alpha_m(1-\phi)][1-\rho]^{\frac{\phi}{\alpha_n} + 1 - \frac{\phi}{\alpha_m}}}.$$
This elasticity is increasing in $\phi$, and decreasing in both $\alpha_n$ and $\alpha_m$. As either of the $\alpha$’s increase, the gains from specialization decrease, lowering the impact of fewer varieties induced by higher entry costs. An increase in $\phi$ increases the relative importance of the niche market, where entry costs have a greater impact.

To see this elasticity is greater than that in the standard model, let $\frac{1}{1-\bar{\alpha}}$ denote the homogeneous elasticity between all varieties in the standard model. The elasticity of $y$ with respect to entry costs in the standard model is therefore $\frac{1}{1-\bar{\alpha}} - 1$. To discipline the comparison, I restrict $\alpha_n$ and $\alpha_m$ such that the average elasticity across firms is equal to $\frac{1}{1-\bar{\alpha}}$. This implies $\phi\alpha_n + (1-\phi)\alpha_m = \bar{\alpha}$. This is equivalent to forcing the share of aggregate output paid to labor to be equal to $\bar{\alpha}$ in both models. Given this restriction, entry costs have a greater impact on $y$ in the present model than in the standard model if;

$$\frac{\phi}{\alpha_n} + \frac{1-\phi}{\alpha_m} > \frac{1}{\bar{\alpha}} = \frac{1}{\phi\alpha_n + (1-\phi)\alpha_m},$$

or equivalently, if $\frac{\alpha_n}{\alpha_m} + \frac{\alpha_m}{\alpha_n} > 2$, which holds for any $\alpha_n \neq \alpha_m$.

### 2.3 Heterogeneous Firms

Here I discuss how a model of niche and mass markets can be extended to include heterogeneity in productivity and fixed operating costs. Consider first an environment identical to that described above, but where each firm draws its productivity from a distribution upon entry. Assuming all firms draw from the same distribution and realize their productivity after entry (as is standard in this class of models), the distribution of productivity across niche firms will be identical to that across mass-market firms. Heterogeneity in productivity implies that higher productivity draws will be associated with larger firms. Whereas the employment size of each mass-market firm in the benchmark model is larger than each niche firm by a factor of $\frac{x_m}{x_n} = \frac{(1-\alpha_m)}{\alpha_m} \frac{\alpha_n}{(1-\alpha_n)}$, heterogeneity in productivity implies that for any
given productivity draw, a mass-market firm will be larger (by the same factor) as a niche firm with the same productivity. Although this extension provides a useful framework to think about multiple drivers of the firm size distribution (which is interesting in and of itself), it does not change the aggregate impact of entry costs. The measure of firms in each market will continue to be (inversely) proportional to the cost of entry, and the impact of entry costs will continue to be determined by the elasticity of substitution in the two markets as well as the weight given to each market.

Now consider an identical environment, but where firms face a fixed cost in production as in Hopenhayn (1992). Assume this fixed cost is modeled in the same fashion as entry costs, as a fixed fraction of output per worker. Now after entering and realizing their productivity, firms must choose whether to produce or to exit the industry. Firms with a realized productivity under some threshold will exit, so that only the most productive firms will produce. In this class of models higher entry costs reduce the total measure of firms, while higher operating costs reduce the productivity threshold at which the marginal entrant is indifferent between exiting and producing. It turns out that free entry together with the assumption that all firms face the same costs ensures that the productivity threshold is the same for niche and mass-market firms. As a result, the aggregate impact of these fixed costs remains the same. The only difference is that the total elasticity of TFP with respect to these fixed costs will be split between entry costs and operating costs.\footnote{This split is determined by the productivity distribution from which entrants draw.} Accounting for niche and mass markets within an industry magnifies the aggregate impact of these costs (relative to a model without heterogeneous markets) by the same factor as that reported in Section 2.2.4.

3 Calibration

To quantify the impact of entry costs on TFP, I need values for three parameters: $\alpha_n$, which determines the elasticity of substitution between niche varieties; $\alpha_m$, which does the
same for mass-market varieties; and $\phi$, which determines the total revenue share of niche firms. To obtain these parameter values, I calibrate the model to match three moments from U.S. manufacturing data. The first target is the CES suggested by Imbs and Méjean (2009) for models with homogeneous elasticities between varieties. They suggest a value between 6 and 7, so I use 6.5. Following the same procedure outlined in Section 2.2.4, I restrict $\alpha_n$ and $\alpha_m$ to satisfy:

$$\phi \alpha_n + (1 - \phi) \alpha_m = \bar{\alpha} \equiv \frac{CES - 1}{CES},$$

where $CES = 6.5$ is the target.

The remaining targets are from Hseih and Klenow (2009). They report moments from the within-industry distribution of total factor revenue productivity (TFPR) across U.S manufacturing establishments in 1996. Here I assume (as is standard) the U.S. is an undistorted economy, so that the authors’ measure of TFPR can be interpreted simply as a firm’s markup over marginal cost (multiplied by a constant). The two moments I target are the gap between the 90th and the 10th percentile of deviations of log(TFPR) from industry means, and the standard deviation of the same. Hseih and Klenow report a 90/10 gap equal to 1.19 and a standard deviation equal to 0.49 for the U.S. in 1997. In the model, the markup of a niche firm is $1/\alpha_n$, while that of a mass-market firm is $1/\alpha_m$. For any firm $i$, the deviation of log($1/\alpha_i$) from the average value of log($1/\alpha_i$) across all firms is:

$$\log \left( \frac{1}{\alpha_i} \right) - \frac{N_n}{N_T} \log \left( \frac{1}{\alpha_n} \right) - \frac{N_m}{N_T} \log \left( \frac{1}{\alpha_m} \right),$$

where $N_T$ denotes the mass of all firms $N_n + N_m$. I assume (and then verify) that the 90th percentile firm in the model is a niche firm, while the 10th percentile firm is a mass-market

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13This is consistent with Broda and Weinstein (2006). This value also implies payments to factors of production equal to 85% of aggregate output, which is a value commonly used as a target in the recent misallocation literature (for example, see Restuccia and Rogerson (2008)).
firm, so matching the 90/10 gap requires that the values of $\alpha_n$ and $\alpha_m$ satisfy;

$$\frac{\alpha_m}{\alpha_n} = e^{1.19} = 3.3.$$

The standard deviation of the above statistic is;

$$\left(\frac{N_n}{N_T}\right)^{\frac{1}{2}} \left(\frac{N_m}{N_T}\right)^{\frac{1}{2}} \log\left(\frac{\alpha_m}{\alpha_n}\right).$$

Using the solutions for the measures of niche and mass-market firms from Section 2.2.4, the standard deviation can be expressed as a function of parameters. The parameter values must satisfy;

$$\frac{\phi(1 - \phi)(1 - \alpha_n)(1 - \alpha_m)}{\phi(1 - \alpha_n) + (1 - \phi)(1 - \alpha_m)} \log\left(\frac{\alpha_m}{\alpha_n}\right) = 0.49.$$

With three equations in hand, I can now obtain the required parameter values. These are;

$\phi : 0.17$, implying a revenue share for niche firms of 17%

$\alpha_n : 0.29$, implying an elasticity of substitution across niche varieties of 1.4

$\alpha_m : 0.96$, implying an elasticity of substitution across mass-market varieties of 25

A complication here is that the three targets give two sets of possible parameter values. The above values imply niche firms account for 78% of all firms, while the alternative set of values implies 22%. To choose between them, I note Holmes and Stevens (2010) estimate that niche firms account for 66% of all firms. Given the more narrow definition the authors use for ‘niche’, I choose the set of values above.\(^{14}\) The calibrated values also imply mass-market firms are much larger in terms of employment (by a factor of 58). For comparison, I note establishments in U.S. manufacturing industries in 1997 with less than 50 employees

\(^{14}\)Holmes and Stevens (2010) define a niche firm as a producer that requires face-to-face interaction with customers, and so tends not to ship long distances. The definition I use here is much broader, as it allows for firms that cater to niche markets around the country.
accounted for 83% of all establishments with payroll, and accounted for 12% of value-added.\textsuperscript{15}

The elasticity of TFP with respect to entry costs reported in Section 2.2.4 is:

$$\frac{\phi}{\alpha_n} + \frac{1 - \phi}{\alpha_m} - 1.$$  

Using the calibrated parameter values, I obtain an elasticity of 0.45. Given the distribution of entry costs across countries reported in the next section, the impact of entry costs is significant. An elasticity of 0.45 implies that an increase in entry costs of one half of the standard deviation of entry costs across countries above the mean will cause TFP to drop by 24%. To compare this elasticity to that in the standard model, I remind the reader that the elasticity of TFP with respect to entry costs in the standard model is $\frac{1}{\bar{\alpha}} - 1$, where $\bar{\alpha} \equiv \frac{CES - 1}{CES}$. Using the same value for $CES$ targeted in the above calibration (6.5), I calculate an elasticity in the standard model of 0.18. Allowing for niche and mass-market firms increases the elasticity by a factor of 2.5.

Note that this calibration strategy is robust to the extensions discussed in Section 2.3, where I consider the implications of allowing for firm heterogeneity in productivity and fixed operating costs. The elasticities of substitution across firms in an industry, the markups chosen by each firm, and the ratio of niche firms to mass-market firms are all independent of the productivity distribution in each market. Using the same calibration strategy for the extended model would therefore produce the same parameter values.

\section*{4 Cross-Country Experiment}

In this section I construct a measure of entry costs for 136 countries and use the model to generate values of TFP and output per worker for economies that differ only with respect to entry costs. I then compare the performance of the model to cross-country data. I begin\textsuperscript{15}

\textsuperscript{15}Calculated using U.S. Census Bureau data.
by explaining how I measure entry costs.\footnote{\textnormal{In the appendix, I describe this process in more detail.}}

\section{Constructing Entry Costs}

I assume entry costs consist of two components; nonregulatory costs which are constant across countries (as a fraction of output per worker), and regulatory costs. The World Bank Doing Business Survey reports measures of the various regulatory costs of doing business for a broad sample of countries. For my measure of regulatory costs, I start by summing the monetary costs reported by the World Bank. These include the cost of starting a business (registering the business, getting the necessary licenses, etc...), the cost of construction permits, the cost of registering property, the cost of obtaining an electricity connection, and the wage cost of time spent doing taxes. The World Bank also reports the delays in opening a business associated with each of the above costs. I add to my measure of regulatory costs the discounted value of lost profits and wages to the business owner due to these delays.\footnote{\textnormal{I assume owners pay themselves the same wage as any other employee. Without delays in opening the business this income could be ignored, as it is offset by the wage income the owner could earn elsewhere.}}

To obtain a measure of nonregulatory costs, I start with the average monetary startup cost reported by Acs et al. (2005) for the U.S. of 86\% of output per worker. From this number I subtract the monetary regulatory costs in the U.S. and find nonregulatory costs are 46\% of output per worker. I assume this fraction is constant across countries.

Total entry costs are calculated by combining the nonregulatory and regulatory costs in each country. Table I reports some descriptive statistics of total entry costs and output per worker, each relative to the U.S. level.
### Table I

**Descriptive Statistics: mean**

<table>
<thead>
<tr>
<th></th>
<th>entry costs</th>
<th>output per worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>all countries</td>
<td>13</td>
<td>31%</td>
</tr>
<tr>
<td>10% countries with lowest costs</td>
<td>1.2</td>
<td>84%</td>
</tr>
<tr>
<td>10% countries with highest costs</td>
<td>61</td>
<td>2.9%</td>
</tr>
<tr>
<td>10% richest countries</td>
<td>1.9</td>
<td>98%</td>
</tr>
<tr>
<td>10% poorest countries</td>
<td>51</td>
<td>1.9%</td>
</tr>
</tbody>
</table>

Output per worker from Penn World Tables v7.0 for 1996. Variables relative to U.S. ‘Richest’ and ‘poorest’ refer to output per worker.

#### 4.2 Experiment

I can now compare the model to the data. I construct measures of TFP for 116 countries for 1996 following Klenow and Rodríguez-Clare (2005), using data from Penn World Tables v7.0 and Barro and Lee (2012).\(^{18}\) I use the U.S. as a benchmark economy, so all variables are relative to the U.S. Using the entry cost data constructed above, the model generates predicted levels of TFP for all 136 countries in the sample. To compare the model to the cross-country output per worker data, I need an estimate of the elasticity of output per worker with respect to TFP. To this end, I perform a simple regression of output per worker on TFP and use the resulting estimated elasticity of 1.73. This all implies model-generated values for TFP in each country \(i\) equal to

\[
\text{TFP}_i = \left( \frac{c_i^e}{c_{US}^e} \right)^{-0.45},
\]

\(^{18}\)In the appendix I explain in more detail how TFP is constructed.
and output per worker $y$ in each country $i$ equal to

$$y_i = \left( \frac{c^i}{c^{US}} \right)^{-0.77}.$$

Table II compares TFP from the data to that generated by the model, while Table III does the same for output per worker. The third column in each table reports statistics generated by the same experiment using the standard CES model. ‘90/10 ratio (costs)’ refers to average TFP or output per worker of countries in the bottom decile of entry costs relative to the average of countries in the highest decile. ‘90/10 ratio (output)’ refers to average TFP or output per worker of countries in the highest decile of output per worker relative to the average of countries in the bottom decile.

The model accounts for 45% of the log-variation in TFP across countries and 44% of the log-variation in output per worker, while the standard model accounts for just 7% of each. These magnitudes are close to those reported by Herrendorf and Teixeira (2011), and consistent with Barseghyan (2008). In the appendix I report regression estimates of elasticities with respect to entry costs that are also consistent with these magnitudes.

Figures 1 and 2 provide a visual comparison of the model to the standard CES model, plotting TFP generated by each model against TFP in the data.
### Table II

**Cross-Country Experiment: TFP**

<table>
<thead>
<tr>
<th></th>
<th>data</th>
<th>model</th>
<th>CES model</th>
</tr>
</thead>
<tbody>
<tr>
<td>90/10 ratio (costs)</td>
<td>6.6</td>
<td>5.1</td>
<td>1.9</td>
</tr>
<tr>
<td>90/10 ratio (output)</td>
<td>9.0</td>
<td>3.7</td>
<td>1.7</td>
</tr>
<tr>
<td>variation in log(TFP)</td>
<td>0.52</td>
<td>0.24</td>
<td>0.04</td>
</tr>
</tbody>
</table>

Includes 116 countries with TFP data. Variables relative to U.S.

### Table III

**Cross-Country Experiment: output per worker**

<table>
<thead>
<tr>
<th></th>
<th>data</th>
<th>model</th>
<th>CES model</th>
</tr>
</thead>
<tbody>
<tr>
<td>90/10 ratio (costs)</td>
<td>29.5</td>
<td>17.9</td>
<td>3.3</td>
</tr>
<tr>
<td>90/10 ratio (output)</td>
<td>52.4</td>
<td>9.8</td>
<td>2.6</td>
</tr>
<tr>
<td>variation in log(output per worker)</td>
<td>1.71</td>
<td>0.76</td>
<td>0.13</td>
</tr>
</tbody>
</table>

Includes all 136 countries. Variables relative to U.S.
Figure 1: Model vs Data

Figure 2: Standard CES Model vs Data
5 Niche Firms, Mass Markets, and Distortions

Here I show how allowing for niche and mass-market firms amplifies the impact of distortions on aggregate outcomes. Consider the same model developed in Section 2, but now let all intermediate firms face a proportional tax such that firms keep only a fraction $\tau$ of output. The problem now facing any firm $i$ is to take the wage $w$ as given and choose labor $x_i$ to maximize

$$\tau P_i x_i - w x_i,$$

where $P_i$ is a function of $x_i$ as before. The profit-maximizing price for firm $i$ is now

$$P_i = \frac{w}{\tau \alpha_i}.$$

Changing the intermediate firm optimization condition that must be satisfied in equilibrium to reflect this new optimal price, I can now follow the same steps described in Section 2.2.4 to solve for the equilibrium measure of niche and mass-market firms;

$$N_n = \frac{(1 - \alpha_n) \phi \tau}{c_e (1 - \rho)} \quad \text{and} \quad N_m = \frac{(1 - \alpha_m) (1 - \phi) \tau}{c_e (1 - \rho)},$$

as well as aggregate TFP;

$$y = \Delta \cdot \left( \frac{\tau}{c_e} \right)^{\frac{\phi}{\alpha_n} + \frac{1 - \phi}{\alpha_m} - 1}.$$  

The elasticity of TFP with respect to $\tau$ is equal to

$$\frac{\phi}{\alpha_n} + \frac{1 - \phi}{\alpha_m} - 1,$$

which is the same as the elasticity with respect to entry costs. Using the same argument described in Section 2.2.4, it follows that this elasticity is higher than that in a standard model without heterogeneous markets. Using the parameter values obtained in Section 4,
this elasticity is about 2.5 times that in the standard model (0.45 versus 0.18).

The intuition for this result is the same as for the impact of entry costs. In equilibrium with free entry, a tax on output increases the profits required by each firm to cover the cost of entry. Profits are increased via a reduction in the measure of firms, and the impact of fewer firms is governed by the elasticity of substitution. The end result is an elasticity of TFP with respect to $\tau$ equal to the elasticity with respect to entry costs in both the standard and the present models.

## 6 Conclusion

I have shown how incorporating niche and mass-market firms into a standard model of monopolistic competition amplifies the impact of distortions, and entry costs in particular, on aggregate outcomes. The calibrated model amplifies elasticities with respect to these distortions by a factor of 2.5. Using cross-country data on entry costs the model can account for almost half of the log-variation in TFP and output per worker, consistent with recent estimates of a large impact of entry costs.

It is generally the case that the market guides agents in an economy to mitigate the effects of any tax or regulation by diverting resources to activities less affected by these policies. This is what leads to a smaller impact of bad policy in general equilibrium than what might be predicted by partial equilibrium analysis. One way around this is to tax all activities, as in Chapter 6 from Parente and Prescott (2000). Another way is to increase the cost of switching to the less-taxed activity. This second way is the approach used in Restuccia and Rogerson (2008), where taxes are tied to productivity and thus resources are diverted to much less productive firms. This paper also uses the second approach. Higher entry costs lead to a higher concentration of resources in a smaller number of firms, since a large firm can spread a fixed cost over more output. In a standard model with a relatively high CES across all varieties, the aggregate cost of this lower level of specialization is small,
since the gains to specialization are themselves small. But when some portion of expenditure
is devoted to niche output, where the gains to specialization are high, entry costs have a
much greater impact by forcing consumers to settle for varieties much less suited to their
needs.

University of Toronto
A Appendix

A.1 Sensitivity to Parameter Values

The elasticity of TFP with respect to entry costs generated by the model in Section 2 depends on the values of three parameters: $\alpha_n$, which determines the elasticity of substitution between niche varieties; $\alpha_m$, which does the same for mass-market varieties; and $\phi$, which determines the total revenue share of niche output. Here I consider the sensitivity of the elasticity of TFP (and output per worker) to changes in the target values used to calibrate the model in Section 3. The benchmark targets are an average elasticity of substitution ($CES$) of 6.5, a difference in the TFPR statistic between the 90th and 10th percentile establishments (90/10 gap) of 1.19 (implying a 90/10 ratio for TFPR of 3.3), and a standard deviation of the same TFPR statistic across firms within an industry of 0.49. These imply elasticities of TFP and output per worker with respect to entry costs of -0.448 and -0.775.

I start with an increase in $CES$ to 7.5 (above the range recommended by Imbs and Méjean (2009) of 6-7). As discussed in the introduction, this lowers the gains to specialization and so reduces the impact of entry costs in any model. The resulting elasticity of TFP with respect to entry costs is -0.385, while that of output per worker is -0.667. A decrease in $CES$ to 5.5 implies elasticities of -0.534 and -0.925.

I now consider an increase in the dispersion of TFPR by targeting a standard deviation of 0.6 and a 90/10 ratio of 4. An increase in the 90/10 ratio implies a bigger gap between $\alpha_m$ and $\alpha_n$, while a higher standard deviation implies a lower $\phi$. The implied elasticity of TFP with respect to entry costs is -0.524, while that of output per worker is -0.667. A decrease in $CES$ to 5.5 implies elasticities of -0.534 and -0.925.

Each of the different targets above reflect a change of approximately 15% to 25% from
the benchmark targets. These different targets imply elasticities 19% to 24% higher or lower than the benchmark elasticities. In all cases, the implied elasticities remain at least 1.9 times larger than in the standard \textit{CES} model.

\subsection*{A.2 Constructing Entry Costs}

Data for the regulatory cost of doing business comes from the World Bank Doing Business Survey.\footnote{World Bank (2012) describes each variable and the survey methodology.} I use the monetary cost and time required to start a business (registering the business, getting the necessary licenses, etc...), obtain construction permits, register property, and obtain an electricity connection, as well as the time required to comply with tax-related requirements. I use Penn World Tables v7.0 data to transform all entry cost measures into fractions (or multiples) of output per worker, making these measures comparable to those used in the model. To the same end, I use the present discounted value of all costs. This requires a value for the intertemporal discount rate of firms $\rho$, which in turn requires values for the probability of firm death $\lambda$ and the real interest rate $r$. I use $\lambda = 0.1$ and $r = 0.05$, which are common in cross-country calibrations. These values imply a $\rho$ equal to 0.86.

To ease exposition, let $c_e$ denote total entry costs, $c_{reg}^M$ monetary regulatory startup costs, $c_{reg}^W$ the wage costs of both startup delays and the post-startup time to do taxes, and $c_{nonreg}$ nonregulatory startup costs. I assume the wage cost of one year is a fraction $\frac{2}{3} \frac{CES - 1}{CES}$ of output per worker, consistent with a model that includes capital and in which capital receives one third of all factor payments.

Acs et al. (2005) report an average monetary startup cost in the U.S. in 2005 equal to 86% of output per worker. I calculate nonregulatory costs $c_{nonreg}$ (assumed constant across countries) equal to $0.46 = 0.86 - c_{reg}^M$.

In the model, free entry requires $c_e = \pi \cdot \left( \frac{1}{1 - \rho} \right)$, where $\pi$ denotes per-period profits relative to output per worker. If $c_e$ includes the cost of lost profits, then this condition can
be rewritten as;

\[ \hat{c}_e = \pi \left( \frac{1}{1 - \rho} - \text{delay}_0 - \rho \cdot \text{delay}_1 - \rho^2 \cdot \text{delay}_2 - \ldots \right), \]

where \( \hat{c}_e = c_{\text{nonreg}} + c_{\text{reg}}^M + c_{\text{reg}}^W \) is total costs without lost profits, and \( \text{delay}_t \) denotes the fraction of the \( t^{th} \) year included in total delays.\(^{20}\) This all implies total entry costs \( c_e \) can be calculated as;

\[ c_e = \frac{\hat{c}_e \cdot \left( \frac{1}{1 - \rho} \right)}{\left( \frac{1}{1 - \rho} - \text{delay}_0 - \rho \cdot \text{delay}_1 - \rho^2 \cdot \text{delay}_2 - \ldots \right)}. \]

### A.3 Constructing TFP

I construct TFP following Klenow and Rodríguez-Clare (2005). TFP for a country \( i \) relative to the U.S. in 1996 is calculated as;

\[ \text{TFP}_i = \frac{y_i}{k_i^{\frac{1}{3}} h_i^{\frac{2}{3}}}, \]

where \( y \) is output, \( k \) is capital, \( h \) is human capital, and all variables are per worker and relative to the U.S.

Penn World Tables v7.0 contains annual data on output per worker and per capita in constant PPP dollars, population, and the investment share of output for a large number of countries as far back as 1950. I drop all observations after 1996 and then construct an initial capital-output ratio \( \frac{K_0}{Y_0} \) for the first year each country \( i \) reports the required data;

\[ \frac{K_{i,0}}{Y_{i,0}} = \frac{\bar{I}_i}{\bar{g} + \delta + \bar{n}_i}, \]

where \( \bar{I}_i \) is the average investment share in country \( i \) over the sample, \( \bar{n}_i \) is its average population growth rate, \( \bar{g} \) is the average world growth rate in output per capita which I

\(^{20}\)For example, a delay of 547 days would imply \( \text{delay}_0 = 1, \text{delay}_1 = 0.5, \) and \( \text{delay}_{t>1} = 0.\)
assume to be 0.02, and $\delta$ is the depreciation rate of capital which I assume to be 0.08. I drop estimates for countries without at least ten years of continuous data, and then construct a capital-output ratio for each year up to 1996 using the usual capital accumulation equation.

I calculate human capital per worker as $\exp(0.085 \cdot \text{years of schooling})$, where $\text{years of schooling}$ refers to the average years of schooling of people at least 25 years of age. This last is from Barro and Lee (2012). The value 0.085 represents the return to schooling, and is common in the literature (including Klenow and Rodríguez (2005)).

### A.4 Empirical Estimates

The results of the cross-country experiment in Section 4.2 are not directly comparable to papers with different measures of entry costs, so I report here the empirical results of regressions using the entry costs constructed in this paper. I regress TFP and output per worker on total entry costs, controlling for institutional quality using two variables from Barseghyan (2008). The first control variable is the property rights index reported by the Heritage Foundation and described in Heritage Foundation (2012).\textsuperscript{21} The second control is the debt recovery rate for each country reported by the World Bank Doing Business Survey and described in World Bank (2012), for which I use the first reported value for each country. This is a measure of the fraction of debt recovered by claimants in bankruptcy proceedings. Table IV displays the results of the two regressions.

\textsuperscript{21}As in Barseghyan (2008), I use the average value of all reported years from 1987 to 1996 for each country. I also rescaled the reported values to match those used by Barseghyan.
The elasticities for TFP and output per worker generated by the model are 98% and 97% of the estimated elasticities, which are in turn consistent with entry costs accounting for about half of the log-variation in TFP and output per worker in the data. These estimated elasticities are not comparable to those in Barseghyan (2008) due to different measures of entry costs. But Barseghyan reports a decrease in TFP of 22% associated with an increase in one half of the standard deviation of entry costs from the mean. My estimates imply a decrease of 25%.

**Table IV**

**Estimation Results**

<table>
<thead>
<tr>
<th>Dependent Variable:</th>
<th>TFP</th>
<th>Output Per Worker</th>
</tr>
</thead>
<tbody>
<tr>
<td>Entry Costs</td>
<td>-0.459 (0.044)</td>
<td>-0.798 (0.060)</td>
</tr>
<tr>
<td>Property Rights</td>
<td>0.047 (0.059)</td>
<td>0.174 (0.081)</td>
</tr>
<tr>
<td>Debt Recovery</td>
<td>0.004 (0.002)</td>
<td>0.007 (0.003)</td>
</tr>
<tr>
<td>Observations</td>
<td>116</td>
<td>130</td>
</tr>
<tr>
<td>$R^2$</td>
<td>0.74</td>
<td>0.83</td>
</tr>
</tbody>
</table>

Constant coefficient omitted. Robust standard errors in parentheses.
References


