Informality and the Labor Market Effects of Mass Migration: Theory and Evidence from Syrian Refugees in Turkey*

Norman Loayza
World Bank

Gabriel Ulyssea
University of Oxford

Tomoko Utsumi
University of Minnesota

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Abstract

Since the Syrian war begun in 2011, Turkey has received over 2.8 million refugees, becoming the largest host country in the world. We build and estimate/calibrate a model using detailed micro data from Turkey to quantify the labor market effects of this sudden and massive migration wave. Low and high skill workers self-select into different regions based on idiosyncratic preferences and mobility costs, while firms within each region can exploit two margins of informality: to register or not their business, the extensive margin; and whether to hire their workers formally or not, the intensive margin. We combine minimum distance calibration and direct estimation from micro data to characterize the pre-shock, baseline Turkish economy and then use the calibrated model to perform counterfactual exercises. The results show that although the inflow of Syrian refugees induces an increase in informality among low skill workers, it also generates both a reduction in informality among high skill workers and a rise in the skill premium. Furthermore, while the regions receiving larger numbers of refugees experience larger effects, the shock spreads to all regions due to regional migration of native workers.

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1 Introduction

The magnitude of forced migration around the world has reached an unprecedented scale in recent years: by 2015, more than 65 million people had been forcibly displaced due to war, conflict or generalized violence, and 21 million of them had migrated to another country as refugees. Given the sheer magnitude and unexpected nature of these large inflows of refugees, they are likely to have substantial impacts on the hosting countries. These impacts are especially relevant in developing countries, which are often characterized by scarce resources, poor labor market conditions and high informality. Given that the vast majority of refugees, 86%, are hosted by developing countries (UNHCR, 2016), understanding how sudden waves of forced immigration affect less developed hosting economies is arguably an important question in economic development.

This paper exploits the case of Syrian refugees in Turkey and uses detailed microdata to quantify the labor market effects of a major immigration shock on a developing hosting country. Since its start in 2011, the Syrian war has generated the largest flow of war-displaced people since World War II. Turkey has received over 2.8 million Syrian refugees as of the end of 2016 (e.g. Del Carpio and Wagner, 2015; Ceritoglu et al., 2015), making it the largest host country in the world (UNHCR, 2016). Besides its considerable magnitude, this massive inflow of refugees has two distinguishing features. First, refugees were not granted work permits until 2016 and had high employment rates, therefore their arrival essentially represents a well-defined informal labor supply shock. Second, these inflows were heterogeneous across regions, which provides spatial variation in the magnitude of the shock that allows us to better understand the direct and indirect mechanisms through which this shock affected the labor markets across the country.

We develop a model where individuals of different skill levels self-select into their preferred region of residence based on their (idiosyncratic) comparative advantage and origin-destination specific mobility costs. This generates a labor supply structure similar to the general equilibrium Roy models developed by Bryan and Morten (2017) and Hsieh et al. (2016). Additionally, in each region heterogeneous firms can exploit two margins of informality (Ulyssea, 2018): (i) the extensive margin, i.e. whether to register or not their business; and (ii) the inten-

sive margin, which refers to the decision of firms that are formally registered to hire their workers with a formal contract or not. Potential entrepreneurs self-select into the formal or informal sectors based on their expected productivity and more productive, larger firms (in expectation) self-select into the formal sector. Regions differ in terms of their initial (pre-refugee shock) endowment of skilled labor and in terms of the distribution of potential entrants. The latter may capture, among other things, structural differences in technology and access to capital across regions. Finally, we also include a national minimum wage, which might be binding or not for low skill workers in a given region, depending on local labor market conditions. Since we allow for regions to be heterogeneous in their capacity to enforce the laws and regulations, this introduces yet another source of heterogeneity across regions.

We estimate the model using a two-step minimum distance method akin to the Simulated Method of Moments (SMM). In the first step, we use macro data to directly calibrate some of the aggregate parameters in the model, and micro data to directly estimate the parameters of the individual heterogeneity distribution (which is assumed to be Frechet) and the migration costs between regions. In the second step, we take as given the parameters determined in the first stage and use the structural model to generate simulated micro data sets of formal and informal firms and workers. The calibrated vector of parameters is the one that minimizes the distance between the moments computed from simulated and real micro data.

The estimated model is used to perform counterfactual analyses to assess the equilibrium labor market effects of the inflows of refugees, the distribution of effects across regions, and the mechanisms through which the shock plays out. We focus on key labor market outcomes, particularly the effect on the size of the informal sector and the skill premium, paying attention to differences across regions. In brief, we find that although the inflow of Syrian refugees induces an increase in informality among low skill workers (as expected), it also generates both a reduction in informality among high skill workers and a rise in the skill premium. Moreover, while the impact on informality varies across regions (with those with larger numbers of refugees experiencing larger effects), the shock spreads to all regions in the host country due to regional migration of native workers.

To date, most of the empirical studies have focused primarily on international

migration to developed countries. In general, the impact of voluntary international migration on local labor markets is found to be minimal (see, for example, Pischke and Velling, 1997, for Germany; Carrasco et al., 2008, for Spain). The main argument for such negligible impact is that capital inflows accompanying the inflow of immigrants lessen the negative impact of immigration on natives' employment outcomes (Angrist and Kugler, 2003; Ruist and Bigsten, 2013). In contrast, the impact of internal migration on local labor markets tends to be negative (Boustan et al., 2010; Strobl and Valfort, 2013; Berker, 2011).

In the cases of involuntary migration such as refugees, the empirical findings on the labor market impact on host communities are mixed (Ruiz and Vargas-Silva, 2013). For example, the influential paper by Card (1990) on the Mariel Boatlift does not find any significant effect of Cuban refugees on the wages and unemployment rates of less-skilled local workers in Miami. In contrast, Calderon-Mejia and Ibanez (2016) estimate the impact of forced migrants in Colombia using instrumental variables, and their results suggest that the wages and employment of unskilled workers in host communities are negatively affected. These effects of massive forced migration can also vary according to the types of native workers in receiving economies. Maystadt and Verwimp (2014) study the impact of refugee inflows from Burundi and Rwanda on native workers in host regions in Tanzania. They find that the refugee inflows have a positive impact on agricultural producers as they benefit from lower wages of these immigrants, while the inflows bring a negative effect on agricultural workers because of increased competition.

Closely related to our study, Tumen (2016) and Del Carpio and Wagner (2015) examine the economic impact of Syrian refugees in Turkey. Treating the forced immigration as exogenous shocks and using a difference-in-differences approach, Tumen (2016) finds that Syrian refugees decrease informal employment among Turkish natives by 2.26 percentage points and increase formal employment by 0.46 percentage points. The paper also examines the effect on the wages of Turkish natives and finds it to be insignificant for both formal and informal workers. Similar results are obtained in Del Carpio and Wagner (2015)'s study. They use an instrumental variable strategy and show that refugee flows lead to significant losses of natives' employment in the informal sector, especially for women and less educated workers. On the contrary, consistent with Tumen (2016)'s finding,

Del Carpio and Wagner (2015) find that formal employment of Turkish natives increases. Disaggregating the sample by gender and skill level, they reveal that this positive effect in the formal sector is found only for men with medium-level of education, suggesting occupational upgrading.

Our paper contributes to the literature by developing a new theoretical model to assess the effects of regional dynamics on informality and accounting for refugee shocks in the model. We seek to provide a framework to understand the effects of such shocks that can be applied to other countries' cases. Gaining a deeper insight into this issue is of particular relevance to both refugees and receiving countries and can help design policies to mitigate conflicts and concerns posed by the recent massive migration of refugees.

The remaining of the paper is organized as follows. Section 2 presents the most salient stylized facts regarding Syrian migration and labor market conditions in regions in Turkey, along with a description of related data sources. The following section then presents a structural spatial model of formal and informal firms and workers. After discussing the estimation methodology, the paper conducts a set of counterfactual exercises to assess the impact of the refugee migration shock on the Turkish labor market. The paper concludes with a discussion of the main findings and suggestions for further work.

2 Data and Facts

2.1 Data

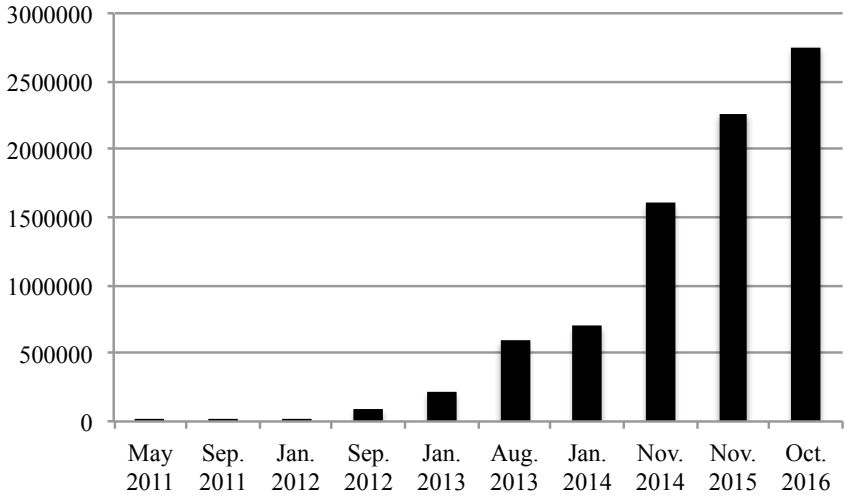
We use two different data sources to characterize workers and firms in Turkey: (i) Income and Living Conditions Survey (SILC) for 2010 and 2014; and (ii) Address Based Population Registration System (ABPRS) for 2010 and 2014. These data sets are compiled from the Turkish Statistical Institute. The SILC is a cross-sectional household survey from which we obtain information on workers' education and employment. The ABPRS covers regional statistics on in-migration. To complement our main data sources, we use data on refugees collected by the Directorate General of Migration Management in Turkey. We focus on 2010 and 2014, which are the pre- and post-periods for the largest inflow of Syrian refugees.

Throughout the paper, we use the 12 regions at NUTS-1 level in Turkey (the first administrative level) as the definition of an economic region. We define as informal workers those who are not registered with the social security system. In Turkey, every worker is required to be registered with the social security administration and therefore those who do not comply are defined as informal. High skill workers are defined as those who have at least completed high school. We include workers of age 15 and over in our sample.

2.2 Syrian Refugees in Turkey

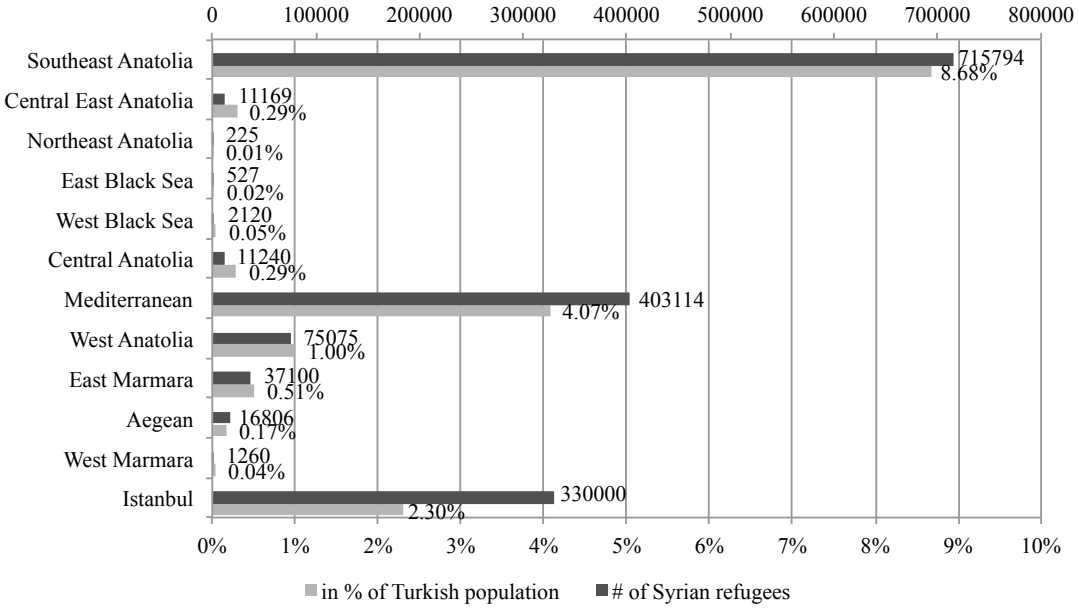
Syrian refugees began fleeing to Turkey in early 2011. As Figure 1 shows, the number of Syrian refugees in Turkey has increased dramatically over the years, from 260 in May 2011 to over 2.5 million in October 2016. The refugee inflows surged especially in 2014. Refugees are unevenly spread across regions, highly concentrated in the Southeast Anatolia region, which borders with Syria. Figure 2 presents the number of Syrian refugees in each region as of November 2014 (the post-period for refugee shock). There were 715,794 Syrian refugees residing in the Southeast Anatolia region, which is equal to approximately 8.7% of the Turkish population in that region. The Mediterranean and Istanbul regions also hosted a relatively large number of refugees, amounting to 4.1% and 2.0% of the Turkish population in the respective regions. In other regions, the ratio of Syrian refugees to Turkish population reached no more than 1%. Syrian refugees did not receive work permits during the period considered in this study as the Turkish government started granting them only in January 2016. Therefore, these refugees essentially entered the informal labor market, if employed, and engaged mostly in labor-intensive, low-wage jobs in sectors such as construction and agriculture (Del Carpio and Wagner, 2015; İçduygu, 2016).

Figure 1: Number of Syrian Refugees over Time



Sources: AFAD (Disaster and Emergency Management Presidency);
UNHCR & AFAD (as cited in Kirişci, 2014); Directorate General of Migration Management.

Figure 2: Number of Syrian Refugees by Region as of November 2014

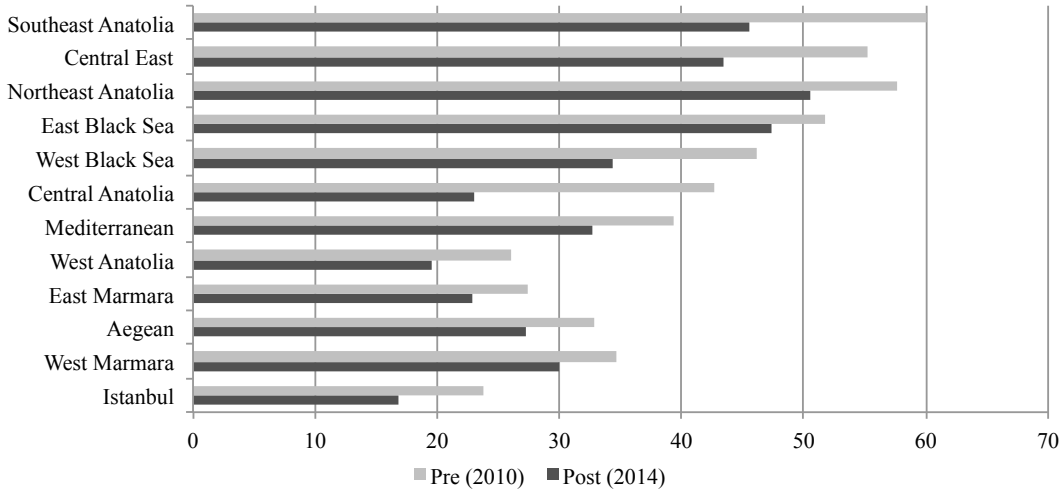


Source: Directorate General of Migration Management.

2.3 Labor Market and Informality in Turkey

We now turn to discussing the labor market of Turkish natives. Figure 3 presents the share of informal workers among Turkish natives by region for pre- and post-shock periods. Because of strong efforts by the Turkish government to reduce informality, we can see that the rate of informal employment decreased in all regions over this period; however, the progress largely vary across regions. For example, the share of informal workers significantly dropped from 42.7% in 2010 to 23.0% in 2014 in the Central Anatolia region, whereas that of the East Black Sea region decreased only slightly from 51.7% to 47.4%.

Figure 3: Informal Workers by Region (% of Total Employment)



Source: SILC 2010 & 2014.

A closer examination reveals that most informal workers are employed in small-size firms. Table 1 presents the employment distribution of formal and informal workers by firm size in 2014. The values on the left show that 41.3% of formal workers are employed in relatively large firms with 50 or more employees. In contrast, only 2.4% of informal workers work for this largest size category, and the majority of them work in in small firms with 10 or less employees. In fact, nearly half of informal workers are self-employed. The values on the right suggest that among the self-employed, 61.9% are informal workers. In small firms with 2 to 10 employees, 43.4% of workers are employed informally, whereas in large firms with

Table 1: Employment Distribution of Formal and Informal Workers by Firm Size, 2014

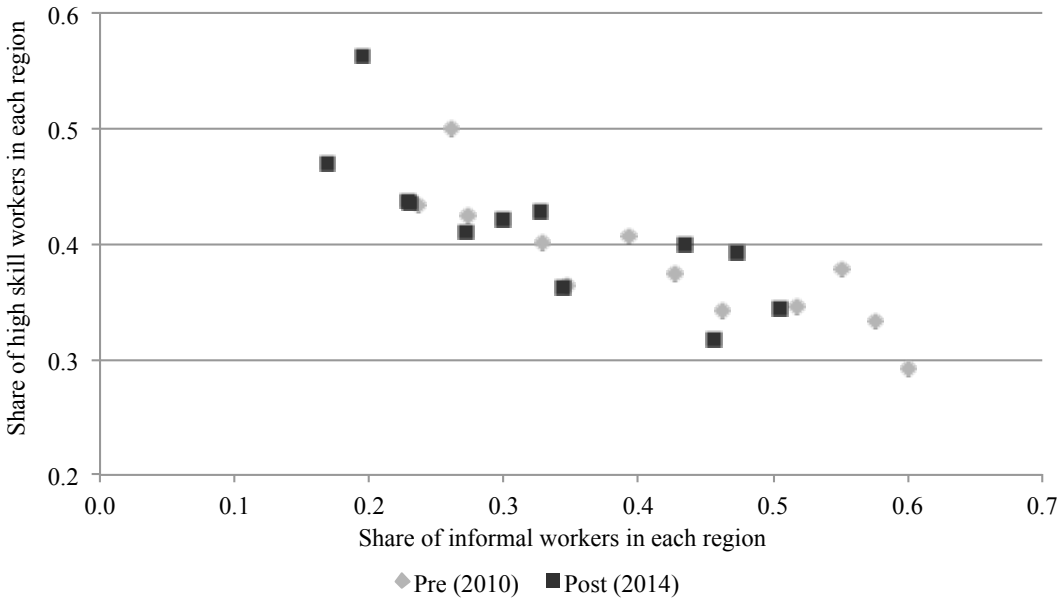
Firm Size (# of workers)	Formal Workers (%)	Informal Workers (%)
1 (self-employment)	11.5 / 38.1	48.1 / 61.9
2–10 (wage workers)	20.7 / 56.6	40.8 / 43.4
11–19 (wage workers)	10.2 / 81.8	5.8 / 18.2
20–49 (wage workers)	16.3 / 93.7	2.8 / 6.3
50+ (wage workers)	41.3 / 97.8	2.4 / 2.2

Note: The first numbers refer to employment distribution by firm size within formal or informal workers so that they add up to 100 column-wise. The second numbers refer to distribution of formal and informal workers within each size category so that they add up to 100 row-wise.

50 or more employees, only 2.2% are informal workers. Therefore, informality is primarily concentrated in small-size firms.

Another characteristic of informal employment is that low-skilled workers tend to be employed in informal jobs. Figure 4 illustrates this point by showing that regions with a low concentration of high-skilled workers tend to have a higher rate of informality. For instance, the Southeast Anatolia region had the lowest ratio of high-skilled workers (29.1%) and the highest ratio of informality (60.1%) in 2010. The figure suggests that low skills or low level of education may drive workers to the informal sector, and these low-skilled workers may be most affected by the massive inflows of Syrian refugees.

Figure 4: Share of Informal Workers vs. Share of High-Skilled Workers by Region



Source: SILC 2010 & 2014.

3 Model

The model economy is composed by a discrete set of N regions. Individuals place of birth is denoted by "o" (origin) and the place where they live and work is denoted by "d" (destination), which can be their birth place (i.e. no migration). Each region produces a differentiated good, which is used as an input in the production of the aggregate consumption good:

$$Y = \left(\sum_{d=1}^{N} Y_d^{\frac{\sigma}{\sigma-1}} \right)^{\frac{\sigma-1}{\sigma}} \tag{1}$$

where Y_d is total output of region d, and σ is the elasticity of substitution parameter.

3.1 Firms

Firms are indexed by their productivity, θ. They produce an homogeneous good using labor as their only input, and markets are competitive within regions.

There are two types of workers in this economy, low and high skill, which are aggregated using a CES technology:

$$\ell_s = \left(\eta_s l_1^{\rho} + (1-\eta_s)\, l_0^{\rho}\right)^{\frac{1}{\rho}}$$

where l_1 denotes high skill workers and l_0 low skill workers; $s = i, f$ indexes sectors; η_s denotes the share parameter in each sector; and ρ is a common elasticity of substitution parameter. Firms' production is standard, given by $y(\theta, \ell_s) = \theta q(\ell_s)$, where $q(\cdot)$ is assumed to be increasing, concave, and twice continuously differentiable.

Firms can exploit two margins of informality (Ulyssea, 2018): (i) the extensive margin; that is, the firm decides whether to formalize their business or not; and (ii) the intensive margin; that is, registered firms decide whether to formalize or not their workers. Sector membership is defined by the extensive margin and the (in)formal sector is comprised by (un)registered firms. Thus, potential entrants first decide whether to enter the formal or informal sectors (or not to operate at all); and, if entry occurs, formal firms have the option to hire formal or informal workers (the intensive margin).[1]

Firms face the same problem across regions, so we omit the region subscript for notational simplicity. If a firm decides to operate in the informal sector, it evades all taxes and regulations, which amount to the payroll and revenue taxes and the minimum wage. Even though informal firms do not comply with taxes and regulations, they face an expected cost that takes the form of a labor distortion denoted by $\tau_i(\ell_i)$, which is increasing in firm's composite employment ℓ_i (see Ulyssea, 2018). This formulation captures the fact that larger firms are more visible to the government, and therefore they are more likely to be detected. When detected, informal firms must pay fines, bribes or shut down entirely. Informal firms' profit function is given by:

$$\Pi_i\left(\theta, w_1^i, w_0^i\right) = \max_{l_1, l_0} \left\{ p\theta q(\ell_i) - \tau_i(\ell_i)\left(w_1^i l_1 + w_0^i l_0\right)\right\} \tag{2}$$

[1] By definition, informal firms cannot hire formal workers, as their entire business is at the margin of the relevant laws and regulations. Thus, informal firms' employees are necessarily informal.

where ℓ_i is the composite employment given by the CES aggregation of low and high skills workers, and $\tau_i(\cdot) > 1$, $\tau_i(\cdot)' > 0$.

When operating in the formal sector, firms must pay payroll and revenue taxes, as well as to comply with minimum wage regulations. The minimum wage is national and it might be binding or not in a given region, which will depend on local labor market conditions. Even though formal incumbents must comply with taxes and regulations, they can hire informal workers to avoid the costs implied by the labor legislation. However, there are costs associated to hiring informal workers as well, which are analogous to the costs faced by informal firms: there is an increasing and convex expected cost to hire informal workers, which can differ across workers' skill levels: $\tau_{fk}(l_s)$, $\tau'_{fk}, \tau''_{fk} > 0$, where $k = 0, 1$. The rationale for this specification is to account for the fact that formal firms may face different costs and benefits to formalize low and high skill workers, which are captured by different cost functions.

Conditional on skill, formal and informal workers are homogeneous and perform the same tasks within the firm. Therefore, at the margin firms only hire the cheaper factor (formal or informal labor). The marginal cost of hiring informal workers, $\tau'_{fk}(\cdot)w_k$, is strictly increasing and the marginal cost of hiring formal workers, $(1 + \tau_w) w_k$, is constant. Hence, there is a unique threshold that equates marginal costs, denoted by $\tilde{l}_k$, above which the firm starts to hire only formal labor, for each skill level k. Since the the cost functions can differ across skill levels, formal firms might have different thresholds for hiring low and high skill formal workers. The functions $\tau_{fk}(\cdot)$ are parameterized and estimated, so the data will determine whether the thresholds $\tilde{l}_1$ and $\tilde{l}_0$ are different. If, for example, $\tilde{l}_1 < \tilde{l}_0$, then formal firms can be in one of three possible situations: (i) hire all of its workers informally, if $l_k^* \leq \tilde{l}_k, k = 0, 1$; (ii) hire all of its low skill workers informally but some high skill workers formally, if $l_1^* > \tilde{l}_1, l_0^* \leq \tilde{l}_0$; and (iii) hire some formal workers of both skill levels, if $l_k^* > \tilde{l}_k, k = 0, 1$. The profit maximization can thus be written as follows:

$$\Pi_f\left(\theta, w_0^f, w_1^f\right) = \max_{l_0, l_1} \left\{(1 - \tau_y) p\theta q\left(\ell_f\right) - C\left(l_0, l_1\right)\right\} \tag{3}$$

and

$$C\left(l_1, l_0\right) = \begin{cases} \tau_{f1}\left(l_1\right) w_1^i + \tau_{f0}\left(l_0\right) w_0^i, \text{ for } l_k \leq \tilde{l_k} \\ \tau_{f1}\left(\tilde{l_1}\right) w_1^i + \left(1+\tau_w\right) w_1^f \left(l_1 - \tilde{l_1}\right) + \tau_{f0}\left(l_0\right) w_0^i, \text{ for } l_1 > \tilde{l}_1, l_0 \leq \tilde{l}_0 \\ \sum_{k=0,1} \tau_{fk}\left(\tilde{l_k}\right) w_k^i + \left(1+\tau_w\right)\left[w_1^f\left(l_1 - \tilde{l_1}\right) + \max\left\{\bar{w}, w_0^i\right\}\left(l_0 - \tilde{l_0}\right)\right], \text{ for } l_k > \tilde{l_k} \end{cases}$$

where $\bar{w}$ denotes the minimum wage. Firms in both sectors must pay a per-period, fixed cost of operation, which is denoted by $\bar{c}_s$, $s = i, f$. This is a standard formulation in the literature and can be interpreted as the opportunity cost of operating in sector s. The profit function net of this fixed cost of operation is denoted by $\pi_s(\theta, w) = \Pi_s(\theta, w) - \bar{c}_s$.

3.2 Entry

There is a mass of potential entrants in each region, denoted by M_n, $n = 1, ..., N$. Potential entrants only observe a pre-entry productivity parameter, ν, which can be interpreted as a noisy signal of their effective productivity and has a distribution G_d that varies across regions. Regional differences in G capture, among other things, structural differences in technology and access to capital across regions. G is assumed to be absolutely continuous with support $(0, \infty)$, with finite moments, and it is the same for all firms and independent across periods (i.e., ν is i.i.d.). Hence, the mass of entrants in one period does not affect the composition of potential entrants in the following period. To enter either sector, firms must pay a fixed cost (denominated in units of output) that is assumed to be higher in the formal sector: $E_f > E_i$.

After entry occurs, firms draw their actual productivity from the conditional c.d.f. $F_d\left(\theta|\nu\right)$, which can also vary across regions but is the same in both sectors and independent across firms. $F_d\left(\theta|\nu\right)$ is assumed to be continuous in θ and ν, and strictly decreasing in ν. Hence, a higher ν implies a higher probability of a good productivity draw after entry occurs. Once firms draw their productivity θ, it remains constant forever and firms face an exogenous exit probability denoted

by κ_s, $s = i, f$. If firms are surprised with a low productivity draw $\theta < \bar{\theta}$, where $\pi_s\left(\bar{\theta}, w\right) = 0$, they decide to exit immediately without producing. Aggregate prices remain constant in steady state equilibria and since firms' productivity also remains constant, a firm's value function assumes a very simple form:

$$V_s(\theta, w) = \max\left\{0, \frac{\pi_s(\theta, w)}{\kappa_s}\right\}$$

where for notational simplicity we assume that the discount rate is normalized to one.

The expected value of entry for a firm with pre-entry signal ν:

$$V_s^e(\nu, w) = \int V_s(\theta, w)\, dF(\theta|\nu), \qquad s = i, f \tag{4}$$

Firms enter the formal sector if $V_f^e(\nu, w) - E_f \geq \max\{V_i^e(\nu, w) - E_i, 0\}$, and they choose the informal sector if $V_i^e(\nu, w) - E_i > \max\left\{V_f^e(\nu, w) - E_f, 0\right\}$. When entry in both sectors is positive the following entry-conditions hold:

$$\begin{aligned} V_i^e(\overline{\nu}_i, w) &= E_i \\ V_f^e(\overline{\nu}_f, w) &= V_i^e(\overline{\nu}_f, w) + (E_f - E_i) \end{aligned}$$

where $\overline{\nu}_s$ is the pre-entry productivity of the last firm to enter sector $s = i, f$.

3.3 Labor Supply

The economy has an overall mass of L_k workers of skill level $k = 0, 1$, which is fixed. Each region is endowed with a mass of workers of low and high skill, $L_{0,o}$ and $L_{1,o}$, such that $\sum_o L_{k,o} = L_k$, for $k = 0, 1$. Workers born in a given region o can choose where to live/work, including staying in their region of origin. The utility of individual j, from region o and living/working in d is determined by three components: (i) her consumption of the final good, c_j; (ii) a taste-shifter parameter, ϵ_{jd}^s, which we allow to differ across skill levels; and (iii) the migration

cost associated to moving from o to d , z_{od}:

$$U_{jod} = \frac{\epsilon_{jd}^k c_j}{z_{od}} \tag{5}$$

where the shock ϵ_{jd}^k is i.i.d. and drawn from a multinomial Frechet distribution

$$F_k(\epsilon_1, \ldots, \epsilon_N) = \exp\left\{\sum_{d=1}^{N} \epsilon_d^{-\zeta_k}\right\}$$

where we allow the shape parameter to vary across skill levels (ζ_k) and a higher ζ_k corresponds to a smaller dispersion of ϵ.

When deciding where to live/work, individuals do not know *ex ante* if, conditional on moving to a given region d, they will get a formal or an informal job. Since workers are homogeneous conditional on skill, we assume that they are randomly allocated between formal and informal jobs, and therefore the probability of finding a formal/informal job is given by the share of formal/informal jobs in that given region and skill level. We assume that individuals are risk neutral and therefore they look at the expected wage when deciding where to migrate to: $w_{dk}^e = \gamma_{dk} w_{dk}^i + (1 - \gamma_{d,k}) w_{dk}^f$, where $\gamma_{d,k}$ is the share of informal jobs of type k in region d. Conditional on skill, formal and informal workers should receive the same wage unless the minimum wage binds. Since it never binds for skilled workers, formal and informal wages are the same and we have that $w_{d1}^e = w_{d1}^i = w_{d1}^f$. For low skill workers the minimum wage can be binding in some regions and thus $w_{d0}^f = \bar{w}_0$ and $w_{d0}^i < \bar{w}_0$.

We assume that individuals cannot save nor borrow and therefore they consume all of their earnings. Hence, we can write the indirect (expected) utility of moving to d by individual j, born in o and with skill level s as

$$V_{jod}^k = \frac{\epsilon_{jd}^k w_{dk}^e}{z_{od}}$$

Labor supply in region d is given by the share of workers from other regions who decide to migrate to d plus the share of its own workers who decide to stay in d. Conditional on their place of birth o, individuals choose their place of residence

solving $\max_{d \in N|o} V^k_{o,d}$. Using standard results from the Frechet distribution, the share of workers born in o who decide to live and work in d is given by

$$p^k_{d|o} = \frac{\tilde{w}^{\zeta_k}_{odk}}{\sum_{n=1}^{N} \tilde{w}^{\zeta_k}_{onk}} \tag{6}$$

where $\tilde{w}_{odk} = w^e_{dk}/z_{od}$. Labor supply in d is thus given by

$$L^{SS}_{d,k} = \sum_{o=1}^{N} p^k_{d|o} L_{k,o} \tag{7}$$

3.4 Equilibrium

We focus on stationary equilibria, where all aggregate variables remain constant. Hence, the size of the formal and informal sectors must remain constant over time in every region, which implies the following condition:

$$\mu_s = \frac{1 - F_{\theta_s}\left(\overline{\theta}_s\right)}{\kappa_s} M_s \tag{8}$$

where μ_s denotes the mass of active firms in sector s. This condition simply states that the mass of successful entrants in both sectors must be equal to the mass of incumbents that exit.

Finally, the labor market in every region must clear, which implies that firms' demand for each type of labor, k, in every region d must be equal to the endogenous supply, $L^{SS}_{d,k}$. Additionally, the equilibrium is also characterized by the zero profit cutoff (ZPC) condition in both sectors, $\theta \geq \overline{\theta}_s$ where $\pi_s\left(\overline{\theta}_s, w\right) = 0$.

4 Estimation and Calibration

The model is calibrated using a method of minimum distance that is very close to the Simulated Method of Moments. The calibration proceeds in two steps. In the first step, we use macro data to directly calibrate some of the aggregate parameters in the model, and we use the statutory values of the revenue and payroll taxes. Also, we use micro data to directly estimate the parameters of the Frechet distribution and the migration costs between regions.

In the second step, we rely on the method of minimum distance to obtain the values for the remaining parameters. The intuition for the calibration is straightforward. We use the structural model to generate simulated data sets of formal and informal firms and workers, which make decisions regarding production and location. For each simulated data set, we compute a set of moments that are also computed from real data. The calibrated vector of parameters is the one that minimizes the distance between the estimated and simulated vector of moments.

4.1 The Frechet and Migration Cost Parameters

Labor supply in region d is given by the share of workers from other regions who decide to migrate to d plus the share of its own workers who decide to stay in d. As discussed above, the share of workers born in o who decide to live and work in d is given by

$$p_{d|o}^{k} = \frac{\tilde{w}_{odk}^{\zeta_k}}{\sum_{n=1}^{N} \tilde{w}_{onk}^{\zeta_k}}$$

where $\tilde{w}_{dk} = w_{nk}^{e}/z_{od}$.

In order to identify the parameters of interest, we make the following standard assumptions: (i) symmetry in mobility costs, $\tau_{od} = \tau_{do}$; and (ii) no mobility costs for stayers, $\tau_{oo} = 1$. With these normalizations, we can identify the ζ_k from the retention rates:

$$\frac{p_{o|o}^{k}}{p_{d|d}^{k}} = \frac{\frac{\left(w_{ok}^{e}\right)^{\zeta_k}}{A}}{\frac{\left(w_{dk}^{e}\right)^{\zeta_k}}{A}} = \left(\frac{w_{ok}^{e}}{w_{dk}^{e}}\right)^{\zeta_k} \tag{9}$$

where $A \equiv \sum_{n=1}^{N} \left(w_{nk}^{e}/z_{on}\right)^{\zeta_k}$.

Remember that $w_{dk}^{e} = \gamma_{dk} w_{dk}^{i} + (1-\gamma_{d,k}) w_{dk}^{f}$, where $\gamma_{d,k}$ is the share of informal jobs of type k in region d, is the expected wage in region d. In the data, this corresponds to the average wage for skill level k in region d, including formal and informal employees. Hence, we observe $\frac{p_{o|o}^{k}}{p_{d|d}^{k}}$ and $\frac{w_{ok}^{e}}{w_{dk}^{e}}$ in the data and can compute the ζ_k from the equation 9 above. Log-linearizing it:

$$\ln\left(\frac{p_{o|o}^{k}}{p_{d|d}^{k}}\right) = \zeta_k \ln\left(\frac{w_{ok}^{e}}{w_{dk}^{e}}\right)$$

If we assume that these variables are measured with error, we can obtain the ζ_k from a regression of the ratio of retention rates on the relative wages. We proceed in an analogous way in order to estimate the mobility costs, τ_{od}:

$$\frac{p^k_{o|o}}{p^k_{d|o}} = \frac{\frac{\left(w^e_{ok}\right)^{\zeta_k}}{A}}{\frac{\left(w^e_{dk}/z_{od}\right)^{\zeta_k}}{A}} = \left(z_{od}\frac{w^e_{ok}}{w^e_{dk}}\right)^{\zeta_k} \tag{10}$$

and taking logs one obtains

$$\ln\left(\frac{p^k_{o|o}}{p^k_{d|o}}\right) = \zeta_k \ln\left(\frac{w^e_{ok}}{w^e_{dk}}\right) + \zeta_k \ln z_{od}$$

where again we can obtain all mobility costs by allowing measurement error in the relationship above and estimating it using OLS.

4.2 Second Step: Minimum Distance Calibration

In order to proceed with the calibration, it is necessary to complete the model's parameterization by imposing functional forms to the objects that were left unspecified. Starting with the productivity distribution among potential entrants, we assume it follows a Pareto-Lognormal distribution. This three-parameter distribution was first introduced by Colombi (1990), and can be obtained as the product between a Pareto random variable with shape parameter ξ and a log-normal with mean μ and variance σ^2. Assuming that $\mu = 0$, we have that $\theta \sim PLN(0, \sigma^2, \xi)$. This distribution has a log-normal body with a Pareto right tail, which provides a very good approximation for firm size distributions (e.g. Luttmer, 2007; Ulyssea, 2018).

The cost functions faced by informal firms and by formal firms that hire informal workers (extensive and intensive margins of informality, respectively) take a very simple functional form (as in Ulyssea, 2018): $\tau_i(\ell_i) = \left(1 + \frac{\ell_i}{b_i}\right)$, where $b_i > 0$ and $\tau_{f,k}(l_k) = \left(1 + \frac{l_k}{b_{fk}}\right)$, $k = 0, 1$. We assume that the per-period, fixed costs of operation are a function of the equilibrium wage for low-skilled workers, which makes the exit margin more meaningful since it now responds to market conditions. The fixed costs are determined as follows: $\bar{c}_s = \phi_s w_0$, $0 < \phi_s < 1$. As for

the production function, we assume a span-of-control formulation: $y(\theta, \ell_s) = \theta \ell_s^{\alpha}$, where $\alpha < 1$ and ℓ_s is the CES aggregation of low and high skill labor in sector $s = i, f$.

We use the following set of moments for each of the 12 regions at NUTS-1 level in Turkey:

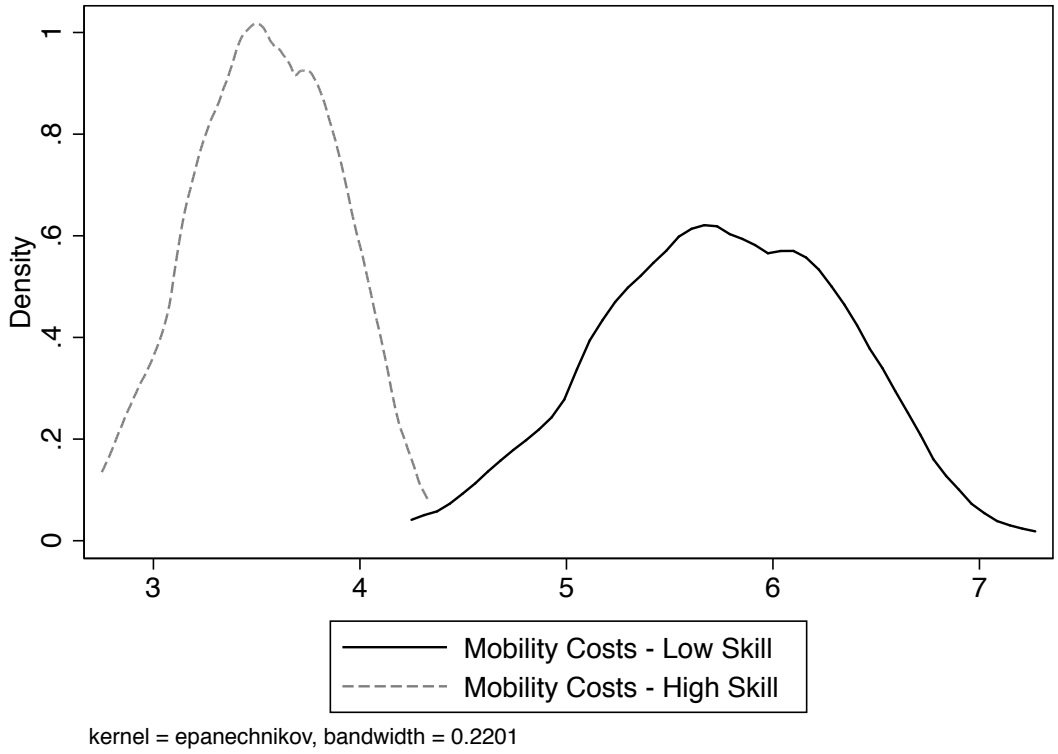
1. Overall share of informal workers (12 moments).
2. Share of high skill workers (12 moments).
3. Share of informal workers among high and low skill workers (2×12 moments).
4. Formal employment distribution in five size categories (5×12 moments).
5. Informal employment distribution in five size categories (5×12 moments).

4.3 Results and Model Fit

Even though we impose symmetry of mobility costs, there are 66 mobility cost parameters. Hence, to summarize the results, Figure 5 shows the density plots of the estimated mobility cost parameters for low and high skill workers. As the figure shows, mobility costs are substantially higher for low skill workers, which is intuitive, as these workers are more likely to face, for example, credit constraints that prevent them from moving.

Table 2 contains the values for all the remaining parameters in the model. As the table shows, formal sector's share parameter for high skill workers (η_f in the CES production function) is quite high in all regions, ranging from 0.65 to 0.73. The opposite is true for informal sector's production function, which ranges from 0.22 (in Istanbul) to 0.29 in West Anatolia (and other regions as well). This result is expected, as the formal sector employs more high skill workers than the informal one. Interestingly, the estimated entry costs are everywhere higher in the formal than in the informal sector but this differential also varies greatly across regions. If we interpret this difference between formal and informal entry costs as the regulatory and bureaucratic costs, as well as infrastructure and information barriers to open a formal business, then the results reveal a great degree of heterogeneity

Figure 5: Mobility Costs for Low and High Skill Workers (as a Share of the Minimum Wage)



between regions. Consistently, the lowest differential between formal and informal entry costs is observed in the most developed region – Istanbul, only a 12% difference – which under this interpretation would suggest the lowest bureaucratic cost to open a formal business. The largest differences are observed in West Black Sea and Northeast Anatolia, which indicates the presence of high costs to open a formal business.

Table 2: Parameter Values

Parameter	Description	Values					
		Istanbul	West Marmara	Aegean	East Marmara	West Anatolia	Medite-rranean
τ_w	Payroll Tax	0.332	0.332	0.332	0.332	0.332	0.332
τ_y	Revenue Tax	0.18	0.18	0.18	0.18	0.18	0.18
κ_f	Formal Sector's Exit Probability	0.1	0.1	0.1	0.1	0.1	0.1
κ_i	Informal Sector's Exit Probability	0.305	0.23	0.27	0.259	0.3	0.245
ϕ_f	Per-period Fixed Cost (Formal)	0.25	0.25	0.25	0.25	0.25	0.25
ϕ_i	Per-period Fixed Cost (Informal)	0.31	0.29	0.26	0.25	0.25	0.25
α	Cobb-Douglas Coefficient	0.65	0.65	0.65	0.65	0.65	0.65
b_i	Extensive Mg. Cost	9	8	8	8	8	8
b_{f1}	Intensive Mg. Cost (High Skill)	1.1	1.2	1	1.3	1	2.2
b_{f0}	Intensive Mg. Cost (Low Skill)	3.1	7	8.7	6.2	8	9.5
ξ	Pareto's Shape Parameter	5.7	4.9	4.9	4	4.2	4.8
σ	Post-Entry Shock Variance	0.63	0.59	0.58	0.54	0.54	0.57
E_f †	Formal Sector's Entry Cost	2800	2500	2500	3000	3000	3000
E_i †	Informal Sector's Entry Cost	2500	2000	2000	2000	2000	2000
ρ	CES Elasticity $\varepsilon = \frac{1}{1-\rho}$	0.3	0.3	0.3	0.3	0.3	0.3
η_f	High Skill Share Parameter (Formal)	0.65	0.66	0.68	0.66	0.68	0.68
η_i	High Skill Share Parameter (Informal)	0.22	0.26	0.28	0.29	0.29	0.26

† Values in Turkish Lira.

Note: The tax rates are set to their statutory values, and all other parameters are calibrated.

Table 2: Parameter Values (Continued)

Parameter	Description	Values					
		Central Anatolia	West Black Sea	East Black Sea	N.E. Anatolia	C.E. Anatolia	S.E. Anatolia
τ_w	Payroll Tax	0.332	0.332	0.332	0.332	0.332	0.332
τ_y	Revenue Tax	0.18	0.18	0.18	0.18	0.18	0.18
κ_f	Formal Sector's Exit Probability	0.1293	0.1293	0.1293	0.1293	0.1293	0.1293
κ_i	Informal Sector's Exit Probability	0.36	0.36	0.365	0.3	0.35	0.3
ϕ_f	Per-period Fixed Cost (Formal)	0.25	0.25	0.25	0.25	0.25	0.25
ϕ_i	Per-period Fixed Cost (Informal)	0.27	0.27	0.27	0.25	0.25	0.3
α	Cobb-Douglas Coefficient	0.65	0.65	0.65	0.65	0.65	0.65
b_i	Extensive Mg. Cost	8.5	3.1	5	5	9	8
b_{f1}	Intensive Mg. Cost (High Skill)	2	1.9	1.5	1	2.62	3.5
b_{f0}	Intensive Mg. Cost (Low Skill)	4	3	7.5	9	11	9
ξ	Pareto's Shape Parameter	4.3	3.78	4.8	5.7	5.7	5.9
σ	Post-Entry Shock Variance	0.45	0.4	0.48	0.6	0.61	0.56
E_f †	Formal Sector's Entry Cost	2700	3500	3500	3500	2800	3000
E_i †	Informal Sector's Entry Cost	2000	2000	2300	2000	2500	2500
ρ	CES Elasticity $\varepsilon = \frac{1}{1-\rho}$	0.3	0.3	0.3	0.3	0.3	0.3
η_f	High Skill Share Parameter (Formal)	0.72	0.67	0.68	0.72	0.73	0.65
η_i	High Skill Share Parameter (Informal)	0.26	0.23	0.25	0.26	0.2	0.24

† Values in Turkish Lira.

Note: The tax rates are set to their statutory values, and all other parameters are calibrated.

As for the fit of the model, Figure 6 and Table 3 show that the model reproduces well the different moments in all regions.

Figure 6: Share of Informal Workers in Each Region: Model vs. Data

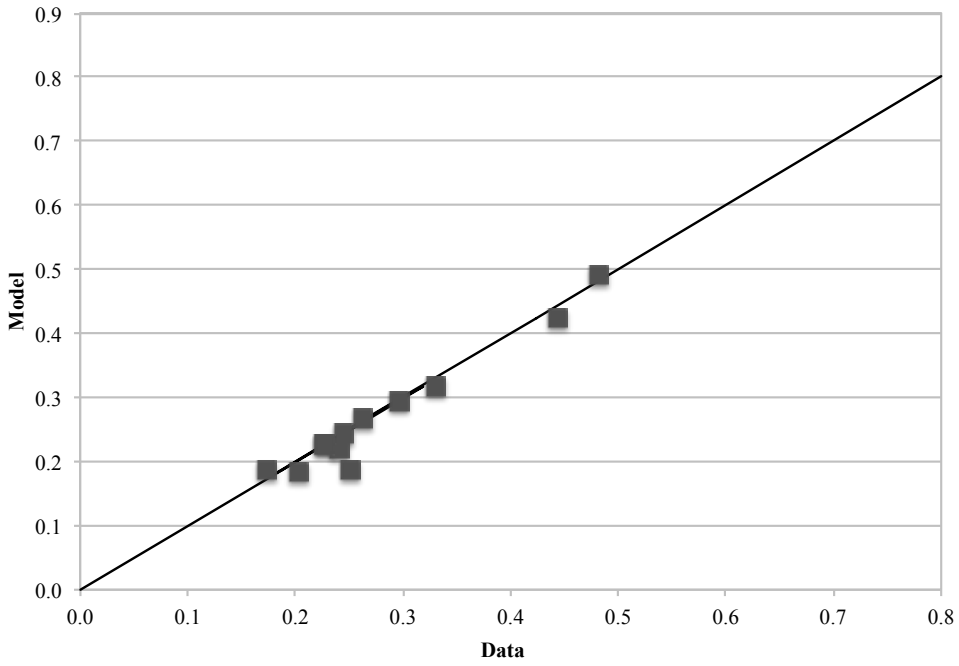


Table 3: Formal and Informal Employment Distribution: Data vs. Model

	Istanbul		W. Marmara		Aegean		E. Marmara	
	Data	Model	Data	Model	Data	Model	Data	Model
Informal Employment								
10 or less	0.635	0.888	0.774	0.850	0.818	0.864	0.769	0.897
11-19	0.169	0.093	0.140	0.114	0.107	0.087	0.108	0.067
20-49	0.131	0.016	0.008	0.027	0.051	0.035	0.066	0.024
50+	0.066	0.003	0.079	0.009	0.025	0.013	0.058	0.011
Formal Employment								
10 or less	0.220	0.300	0.201	0.177	0.230	0.225	0.195	0.179
11-19	0.126	0.133	0.108	0.116	0.127	0.130	0.120	0.105
20-49	0.199	0.200	0.162	0.201	0.178	0.206	0.139	0.167
50+	0.456	0.366	0.529	0.507	0.465	0.439	0.546	0.549

	W. Anatolia		Mediterranean		C. Anatolia		W. Black Sea	
	Data	Model	Data	Model	Data	Model	Data	Model
Informal Employment								
10 or less	0.816	0.890	0.753	0.859	0.866	0.894	0.838	0.978
11-19	0.104	0.067	0.162	0.101	0.065	0.093	0.046	0.011
20-49	0.043	0.030	0.068	0.029	0.029	0.010	0.032	0.007
50+	0.038	0.013	0.018	0.011	0.040	0.003	0.084	0.003
Formal Employment								
10 or less	0.215	0.228	0.223	0.161	0.263	0.212	0.252	0.248
11-19	0.125	0.119	0.105	0.128	0.145	0.128	0.122	0.125
20-49	0.161	0.183	0.173	0.220	0.176	0.198	0.191	0.175
50+	0.499	0.470	0.499	0.492	0.416	0.462	0.435	0.452

	E. Black Sea		N.E. Anatolia		C.E. Anatolia		S.E. Anatolia	
	Data	Model	Data	Model	Data	Model	Data	Model
Informal Employment								
10 or less	0.835	0.885	0.874	0.907	0.657	0.719	0.753	0.768
11-19	0.124	0.063	0.045	0.057	0.116	0.219	0.150	0.189
20-49	0.029	0.038	0.055	0.025	0.095	0.056	0.052	0.037
50+	0.012	0.013	0.027	0.010	0.132	0.006	0.045	0.007
Formal Employment								
10 or less	0.283	0.314	0.217	0.253	0.204	0.152	0.218	0.131
11-19	0.162	0.156	0.172	0.135	0.120	0.115	0.125	0.123
20-49	0.225	0.209	0.241	0.214	0.194	0.215	0.196	0.225
50+	0.330	0.321	0.370	0.397	0.482	0.518	0.461	0.521

5 Counterfactual Simulations

In order to assess the different impacts of the inflow of Syrian refugees, we calibrate the model to the Turkish economy in the baseline year of 2010, before the migration waves took place. We then use the structural model to simulate the impacts of receiving the inflow of Syrian migrants. For that, we make three assumptions about the inflow of migrants: (i) it represented a positive shock *only* to the supply of low skill workers; (ii) the refugees were restricted to informal labor; and (iii) once the refugees settle in one region, they stay there. These assumptions are motivated by the actual context in which the arrival of the Syrian refugees occurred. In particular, these assumptions derive from the fact that the refugees were not granted work permits during our period of analysis, which implies that regardless of the skill level these refugees had, they only had access to low skill, informal jobs.

As for the size of the shock, we parameterize it to correspond to the actual shock. We use the number of working-age refugees settled in a given region as of November 2014 and compute the corresponding share with respect to the population of low skill individuals aged 15 or above in the receiving region. Once the shock hits the different regions, we compute the new equilibrium in the labor market of each region accounting for both demand and supply responses, which include the decisions to migrate or stay in the same region. Table 4 shows the results, where "before" corresponds to the actual outcomes before the immigration of Syrian refugees started and "after" corresponds to the counterfactual simulation after the shock hit.

Table 4: Impacts of Syrian Migration

	Istanbul		W. Marmara		Aegean		E. Marmara		W. Anatolia		Mediterranean	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
% Informal Workers (High Skill)	0.105	0.106	0.079	0.079	0.072	0.072	0.038	0.038	0.067	0.067	0.137	0.131
% Informal Workers (Low Skill)	0.362	0.363	0.391	0.389	0.370	0.369	0.170	0.169	0.353	0.352	0.442	0.441
% Informal Workers (All)	0.251	0.254	0.253	0.253	0.230	0.230	0.102	0.102	0.208	0.209	0.299	0.298
% High Skill Workers	0.432	0.425	0.443	0.441	0.471	0.469	0.517	0.514	0.508	0.504	0.470	0.460
Informal Employment												
10 or less	0.887	0.884	0.850	0.849	0.863	0.862	0.896	0.895	0.889	0.889	0.860	0.851
11-19	0.097	0.101	0.112	0.113	0.088	0.089	0.068	0.069	0.068	0.069	0.099	0.107
20-49	0.013	0.013	0.029	0.029	0.036	0.036	0.024	0.024	0.029	0.029	0.031	0.031
50+	0.003	0.003	0.009	0.009	0.013	0.013	0.012	0.011	0.013	0.013	0.011	0.011
Formal Employment												
10 or less	0.300	0.296	0.191	0.190	0.231	0.229	0.095	0.095	0.236	0.233	0.163	0.161
11-19	0.133	0.133	0.130	0.130	0.126	0.126	0.058	0.057	0.122	0.122	0.126	0.125
20-49	0.205	0.202	0.219	0.218	0.212	0.213	0.089	0.089	0.190	0.190	0.225	0.221
50+	0.362	0.369	0.460	0.461	0.431	0.432	0.758	0.759	0.453	0.455	0.486	0.493
Skill Premium	1.914	1.946	1.942	1.951	2.143	2.156	1.771	1.786	1.960	1.979	1.948	1.997

Table 4: Impacts of Syrian Migration (Continued)

	C. Anatolia		W. Black Sea		E. Black Sea		N.E. Anatolia		C.E. Anatolia		S.E. Anatolia	
	Before	After	Before	After	Before	After	Before	After	Before	After	Before	After
% Informal Workers (High Skill)	0.107	0.107	0.122	0.121	0.103	0.103	0.068	0.068	0.111	0.110	0.172	0.134
% Informal Workers (Low Skill)	0.515	0.519	0.361	0.361	0.393	0.392	0.485	0.484	0.638	0.645	0.635	0.685
% Informal Workers (All)	0.331	0.333	0.254	0.254	0.232	0.231	0.258	0.258	0.434	0.440	0.484	0.513
% High Skill Workers	0.452	0.451	0.447	0.446	0.557	0.556	0.543	0.542	0.386	0.383	0.327	0.311
Informal Employment												
10 or less	0.899	0.898	0.978	0.978	0.886	0.886	0.904	0.904	0.717	0.713	0.769	0.726
11-19	0.089	0.090	0.012	0.012	0.063	0.063	0.060	0.060	0.220	0.223	0.188	0.222
20-49	0.009	0.010	0.007	0.007	0.039	0.039	0.026	0.026	0.057	0.059	0.036	0.045
50+	0.003	0.003	0.003	0.003	0.012	0.012	0.010	0.010	0.006	0.006	0.007	0.007
Formal Employment												
10 or less	0.206	0.204	0.263	0.262	0.322	0.321	0.251	0.251	0.146	0.146	0.131	0.147
11-19	0.127	0.127	0.133	0.134	0.160	0.161	0.133	0.133	0.110	0.110	0.119	0.109
20-49	0.192	0.193	0.179	0.179	0.217	0.217	0.225	0.224	0.213	0.214	0.234	0.222
50+	0.475	0.476	0.425	0.425	0.301	0.301	0.391	0.392	0.530	0.530	0.516	0.522
Skill Premium	2.099	2.110	1.930	1.939	1.773	1.779	1.947	1.953	2.500	2.520	2.319	2.466

As one could expect, the immigration increased the share of informal employees among low skill workers in the region that received the largest inflow of migrants (Southeast Anatolia). However, the increase in the share of informal workers was much lower than the size of the supply shock that the inflow of refugees represented. In part this is caused by the migration of native low skill workers to other regions in response to the decline in low skill wages observed in Southeast Anatolia. Indeed, when we perform the simulations in partial equilibrium – not allowing workers to migrate – the effects on informality are substantially higher (results not reported but available upon request). This results is confirmed by Table 5, which shows the size of the shock in each region (first column), as well as the variation in the stock of low and high skill workers in each region (all in percentage terms). As the table shows, the refugee shock propagates to all regions, as all regions observe changes in the stocks of low and high skill workers.

Table 5: Size of the Refugee Shock and Changes in Low and High Skill Labor Supply

	Refugee Shock (in %)	Δ Low Skill Workers (in %)	ΔHigh Skill Workers (in %)
Istanbul	3.48	3.09	0.09
West Marmara	0.05	0.89	0.29
Aegean	0.21	1.14	0.17
East Marmara	0.69	1.23	-0.07
West Anatolia	1.52	1.60	0.03
Mediterranean	5.48	4.43	0.28
Central Anatolia	0.37	0.45	0.07
West Black Sea	0.05	0.59	0.00
East Black Sea	0.03	0.64	0.24
Northeast Anatolia	0.01	0.49	0.19
Central East Anatolia	0.41	0.69	-0.52
Southeast Anatolia	12.75	6.53	-0.98

The refugee shock is defined as in the text: the share of total refugees received by a given region up to 2014 over the population of low skill individuals aged 15 and above. The change in the stock of low skill workers (second column) and high skill workers (third column) is computed as the variation between the baseline economy and the new equilibrium after the arrival of refugees.

Another interesting aspect of the results is that they show that, if anything, high skill workers are positively affected by the inflow of refugees. The skill premium remains roughly constant or increases in all regions, and more substantially so in Southeast Anatolia (the region with the largest inflow). Similarly, the informality share among high skill workers decreases or remains constant in all regions, which again indicates that these workers actually benefited from the inflow of refugees. The greater availability of low skill workers does not substantially affect the employment distribution across firm size, except again for Southeast Anatolia. In this region, since informal labor is now cheaper, informal firms can grow more and the size distribution becomes slightly more concentrated in mid-sized firms, 11-19 and 20-49 employees. The opposite happens in the formal sector, where small firms (with less than 10 employees) increase their participation.

6 Conclusion

Large waves of migrants can have important economic impacts on receiving countries, especially on their labor markets. With 21 million people forcibly displaced as refugees worldwide, this represents a major challenge to potential host countries, the majority of which have poor and developing economies. In this paper, we study the case of Syrian refugees in Turkey to help understand the labor market effects of a major immigration shock.

The paper first presents a structural model, featuring regional labor markets, formal and informal firms and workers, labor and revenues taxes, exogenous productivity shocks, and workers with different skill levels. The model generates a steady state equilibrium, after firms decide whether to formalize and whether to hire formal workers, workers decide where to live and work through regional migration, and prices and wages adjust to clear labor and output markets. The model is then calibrated by selecting parameters that best match the model to actual pre-shock conditions, in Turkey in 2010. Finally, the calibrated model is used to conduct a counterfactual analysis, which compare the pre-shock condition to the simulated effect of a large labor supply shock, corresponding to the inflow of Syrian refugees. In broad terms, this allows us to gauge the impact of mass immigration on the labor market of a host economy.

The first set of results is obtained from the model's calibration itself. In general qualitative terms, Turkish regions are similar with each other. Notably, in all regions the formal sector employs a large share of high skill workers (about two-thirds), much larger than the share of high skill workers employed by the informal sector (about one-quarter). This fact is consistent with the calibrated result that, in all regions, the relative cost of formalizing a low skill worker is larger than that of formalizing a high skill worker. Quantitatively, though, there are large differences across regions in the relative costs of formalizing high and low skill workers. Likewise, the calibration indicates that the formal sector faces a higher entry cost than the informal sector does in all regions. However, the value of the calibrated entry cost differential between the formal and informal sector varies substantially across regions, with larger differentials in less developed regions.

The second, most important, set of results is obtained from the counterfactual analysis. This uses the calibrated model to simulate the effect of a large labor supply shock on key outcomes of the labor market. In this way, we gauge the impact of the massive inflow of Syrian refugees on the Turkish economy. The first result is possibly unsurprising: it shows that the regions with larger inflows of refugees, notably Southeast Anatolia, have experienced bigger increases in the share of informal employment among low skill workers. The second result is less obvious: the magnitude of the increase in informality for low skill workers has been much smaller than the size of the actual supply shock. Although mobility costs for low skill workers tend to be high, this result implies that the refugee shock has caused some of the native low skill workers to migrate to other regions. Therefore, all regions are affected directly or indirectly by the refugee shock, experiencing changes in the supply of low and high skill workers. The third result is equally interesting: high skill workers throughout Turkey appear to have benefitted from Syrian immigration, as their skill premium increases in most regions. Moreover, the share of informal employment among high skill workers has also decreased after the shock, especially in Southeast Anatolia.

From a public policy perspective, the results have four clear policy implications. The first is that refugees should be allowed to work legally, especially if there is the dual goal of integrating them into society and supporting the formalization of firms and workers. Turkey has made significant progress in this regard by granting work

permits to refugees starting in January 2016. The second is that the larger skill premium induced by the inflow of refugees should be capitalized by improving the opportunities and lowering the costs of obtaining and upgrading technical and professional skills, both for future entrants and current participants of the labor market. The third is that labor mobility is an effective buffer mitigating large shocks and, therefore, should be encouraged by lowering transportation and residential settlement costs both within and across regions. The fourth is that the formalization costs and benefits should be reviewed and reformed not only nationally but also at the regional and local levels, where substantial differences remain.

Regarding future research, two issues stand out. The first is that we have very limited information regarding the labor characteristics of the Syrian refugees. Once detailed labor force survey information becomes available, the analysis can be better refined regarding the type and magnitude of the shock that the inflow of refugees represents, as well as its likely consequences on the host labor market. The second is related to the effects of the policy change that allowed Syrian refugees to work legally by granting them work permits in January 2016. This is likely to have consequences on Syrian migration throughout Turkey, sectoral impacts as Syrian refugees may leave agriculture and primary activities, and pressures to integrate and formalize new businesses.

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