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# A mapping of labor mobility costs in the developing world[☆]

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ABSTRACT

Estimates of labor mobility costs are needed to assess the responses of employment and wages to trade shocks when factor adjustment is costly. Available methods to estimate those costs rely on panel data, which are seldom available in developing countries. We propose a method to estimate mobility costs using readily obtainable data worldwide. Our estimator matches the changes in observed sectoral employment allocations with the predicted allocations from a model of costly labor adjustment. We estimate a world map of labor mobility costs and we use those estimates to explore the response of labor markets to trade policy.



## 1. Introduction

Labor market frictions, such as moving costs, firing–hiring costs, or sector-specific skills, make labor adjustment typically costly.[1] In this setting, a trade shock will only induce a gradual response of wages and employment and this pattern of sluggish labor adjustment has important welfare implications.[2] The assessment of these labor market responses requires estimates of the costs of labor mobility, but these estimates are seldom available in developing countries. In this paper, our aim is to create a map of estimates of labor mobility costs across the developing world and to use these estimates to explore labor market responses to trade shocks.

We set up a dynamic model of sectoral employment choices and we estimate it for a large sample of developing countries. We adopt the labor adjustment analytical framework of Artuc et al. (2010), where workers can move across sectors (e.g., in response to wage differences) at a cost. This cost has a common and an idiosyncratic component. The common component captures the average mobility cost of a labor market friction, while the idiosyncratic cost captures worker-specific costs. The parameters governing these costs can only be estimated with panel data, which are hard to find in developing countries.[3] To

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[1] Labor immobility is documented in Wacziarg and Wallack (2004), who show little inter-industry flows after liberalization across countries, and Muendler (2010) and Menezes-Filho and Muendler (2011), who show that the absorption of displaced workers from de-protected industries in Brazil was very slow. Labor immobility is also indirectly suggested by the presence of wage differentials, created in part by tariff protection (Attanasio et al., 2004; Goldberg and Pavcnik, 2005; Galiani and Porto, 2010).

[2] The estimation of the impacts of trade liberalization in the presence of imperfect labor mobility is a major ongoing theme in the recent trade literature. Structural models of the dynamics of costly labor adjustment following trade policy and trade shocks include Artuc et al. (2008, 2010), Coşar (2013), Coşar et al. (2013), Davidson and Matusz (2000, 2004a, 2004b, 2006a, 2006b, 2010), Dix-Carneiro (2014), and Kambourov (2009).

[3] Panel data provide information on the level of the gross employment flows (which identify the average mobility cost) and on the responsiveness of those flows to the observed wage differentials (which identifies the idiosyncratic component).

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overcome this limitation, we adapt the model and propose a novel estimation strategy (a minimum distance estimator) that requires only a time series of cross-sections of sectoral employment and wages—more easily obtainable data. Without the gross flows from the panels, we use net flows to identify the common mobility cost by matching the response of those flows to observed wage differences. We also need to impose a normalization of the idiosyncratic costs. This normalization turns out to be appropriate because our model allows for utility compensating differentials across sectors and also because our estimates are robust to small departures from this normalization. In the end, we generate a robust cross-country pattern of mobility costs caused by labor market frictions. This allows us to assess the responses to trade shocks in the presence of costly labor adjustment in a wide array of countries.

We use the United Nations Industrial Development Organization (UNIDO) database, which provides information on labor allocations and wages in the manufacturing sector, to estimate a map of the labor mobility costs for 25 developed countries and 31 developing countries. We estimate large costs of labor mobility. On average, the labor mobility costs in developing countries are equivalent to 3.71 times the annual wage. In the developed countries, the mobility costs are 2.76 times the annual wage—much lower, as expected. The highest costs are estimated in Sub-Saharan Africa (4.00), Eastern Europe and Central Asia (3.95), South Asia (3.88), Middle East and North Africa (3.59), East Asia and the Pacific (3.46), and Latin America (3.23). Labor mobility costs are negatively correlated with per capita GDP and positively correlated with less-developed, low-quality labor markets. The mobility costs are also positively correlated with other frictions, distortions and constraints in the economy.

To illustrate how our estimates of labor mobility costs can be used for policy analysis, we run simulations of the labor market responses to trade liberalization. For each developing country, we separately explore the impacts of a hypothetical decrease in the prices of Food and Beverages and Textiles (due to a worldwide decline in food demand, for instance). The magnitude of the labor mobility costs matters for the responses of these economies to such a trade shock. Typically, countries only reach close to the steady state after 6 years and the higher the mobility costs are, the longer this transition takes. This imperfect adjustment is costly. We estimate measures of trade adjustment costs and these estimates vary widely across countries. On average, the costs of adjustment to a trade shock in the food sector are as high as the actual welfare impacts caused by that shock. The median cost of adjustment is roughly half the actual welfare effects.

The rest of the paper is organized as follows. Section 2 introduces the structural model of labor mobility costs and, Section 3 discusses the estimation algorithm and the identification mechanism. The mapping of the estimates of the labor mobility costs is in Section 4. Section 5 assesses the identification assumptions of our model and the potential biases created by violations of those assumptions. Section 6 presents the simulations of the impacts of trade shocks. Finally, Section 7 concludes.

## 2. A model of labor mobility costs

Our model of labor mobility costs is based on Artuc et al. (2010). There are $N$ sectors in the economy, $M$ manufacturing sectors and one non-manufacturing sector.[4] Sector $i$ produces a good using labor $L^i$ and a specific factor (such as capital or land) with the following technology

$$Q_t^i = F^i\left(L_t^i, s_t\right), \tag{1}$$

where $s_t$ captures the overall state of the economy at time $t$. The state variable summarizes the role of shocks to prices, technology, policies, and to the specific factor. For estimation purposes, because of the aggregate nature of our data, we will assume that workers have perfect foresight so that they can make perfect predictions of the evolution of $s_t$ (see Section 3). With more detailed data, as in Artuc et al. (2010), the model can accommodate first order Markov processes for $s_t$. For presentational purposes, we keep a general notation in this section, and simplify the formulas for the case of perfect foresight in the estimation section. Firms are homogeneous and choose employment to maximize profits. The representative firm hires labor $L_t^i$ so as to equalize the equilibrium wage with the value of the marginal product of labor

$$w_t^i = p_t^i \frac{\partial F^i\left(L_t^i, s_t\right)}{\partial L_t^i}, \tag{2}$$

where $w_t^i$ is the wage in sector $i$ and $p_t^i$ is the price of good $i$.

At a given time period, each agent is employed in a sector and earns the sectoral market wage. At the end of each time period $t$, the agent chooses a sector of employment for the next period, $t+1$. If the utility differential is larger than the cost of moving, the workers move. This determines a new vector of equilibrium labor allocations. We can then estimate the key moving cost parameters by matching the employment predictions of the model with the employment allocations observed in the data.

A worker employed in sector $i$ at time $t$ earns the current sector specific wage $w_t^i$ and enjoys a sector specific (utility) effect denoted by $\eta^i$. Total instantaneous utility is thus $u_t^i = w_t^i + \eta^i$. These $\eta^i$ can be interpreted as compensating differentials across sectors. Both $w_t^i$ and $\eta^i$ are common to all workers in a given sector so that there is no worker heterogeneity.[5] The agent observes both $w$ and $\eta$, but only $w$ is observed in the data.

At the end of each time period $t$, the agent chooses the next period sector of employment based on the expected stream of future wages (which depends on the state variable $s_t$) and on the moving costs. The cost of choosing alternative $j$ for agent $l$ who is currently in sector $i$ is $C + \varepsilon_t^{j,l}$. The "moving cost" has two components, a deterministic part, $C$, common to all agents, and a random part, $\varepsilon_t^{j,l}$, specific to agent $l$. Each worker thus faces a vector of moving costs $\varepsilon_t^l$. All agents are identical except for their individual moving cost shocks $\varepsilon_t^l$ and their current sector. Hence, the state of each agent can be summarized by his/her sector $i$, the vector of shocks $\varepsilon_t^l$ and the aggregate state $s_t$ (which, under perfect foresight as in the estimation section, is known). We assume that $C = 0$ if agents stay in their current sector. At the end of time $t$, the random component of the "moving cost," $\varepsilon_t^{j,l}$, is revealed.

Agents are risk neutral, have rational expectations and a common discount factor $\beta < 1$. Let $U^i(s_t, \varepsilon_t^l)$ be the present discounted choice-specific utility of agent $l$ currently employed in sector $i$. The Bellman equation is

$$U^i\left(s_t, \varepsilon_t^l\right) = w_t^i + \eta^i + \max_j \left\{\beta E_{t,\varepsilon} U^j\left(s_{t+1}, \varepsilon_{t+1}^l\right) - 1_{i \neq j} C - \varepsilon_t^{j,l}\right\}, \tag{3}$$

where $1_{i \neq j}$ is the indicator function equal to 1 if $i \neq j$, i.e. if the agent moves, and zero otherwise. Note that, in Eq. (3), the workers take expectations, $E_{t,\varepsilon}$, at time $t$ over the idiosyncratic shocks $\varepsilon_{t+1}$ as well as on the state $s_{t+1}$.

We now need to solve the model to compute the equilibrium flows of workers across sectors. This solution delivers employment allocations for all sectors $i$ and periods $t$, and we can thus recover the structural parameters by matching the employment solution of the model with the employment levels observed in the data, our task in Section 3. To find the solution, let $V^j(s_t)$ be the expected value of $U$, conditional on the vector of idiosyncratic shocks $\varepsilon_t^l$, i.e., $V^j(s_t) = E_\varepsilon U^j(s_t, \varepsilon_t^l)$. Take expectations of Eq. (3) with respect to agent specific shocks to get

$$V^i(s_t) = w_t^i + \eta^i + E_\varepsilon \max_j \left\{\beta E_t V^j(s_{t+1}) - 1_{i \neq j} C - \varepsilon_t^{j,l}\right\}. \tag{4}$$

[4] In other settings, this "residual" sector could also include unemployment or informality. See our discussion below.

[5] As explained below, we work only with aggregate data, and therefore this is an unavoidable assumption. Dix-Carneiro (2014) introduces worker heterogeneity in a related structural model of labor mobility costs.