



# Comparative analysis of labor market dynamics using Markov processes: An application to informality<sup>☆</sup>

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## ABSTRACT

This paper discusses a set of statistics for examining labor market dynamics in developing countries and offers a simple search model that informs their interpretation. It then employs panel data from Argentina, Brazil and Mexico to generate a set of preliminary stylized facts about patterns of sectoral transition and duration. Finally, it nests two competing views of the informal sector within the model and uses variation in the statistics across age and the business cycle to help discriminate between them. The results suggest that a substantial part of the informal sector, particularly the self-employed, corresponds to voluntary entry, although informal salaried work may correspond more closely to the standard queuing view, especially for younger workers.

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## 1. Introduction

Traditional static analysis of labor markets provides evidence on stocks of workers found in different labor market states, but can tell us little about where those workers arrived from, how long they will stay, or where they will go next. The importance of answering these questions and developing the tools to do so has been increasingly apparent in the mainstream literature, for example, on the causes of unemployment (whether due to shedding of labor by firms or reduced hiring) or the different motivations behind being unemployed vs. out of the labor force (see, for example, Flinn and Heckman, 1982; Blanchard and Diamond, 1992; Shimer, 2007). Increasingly, panel data sets are becoming available in developing countries, offering the potential for greater understanding of how their labor markets function and how they may differ from advanced country markets.

This paper makes three contributions in this direction. First, it offers a simple heuristic search model to aid in the interpretation of transitions and discusses a corresponding set of statistics based on the estimations of continuous time Markov transition processes. Second, it employs these techniques to study and compare labor market dynamics in Argentina, Brazil and Mexico, thus generating the first continuous time comparative work on labor markets in developing countries.<sup>1</sup> The estimates suggest broad commonalities among the three countries as well as some suggestive differences. In the process, we discuss how a statistic that conditions on both rate of separation and new matches in the destination sector has the interpretation of workers' revealed comparative advantage in a particular sector.

Third, we use these statistics to examine the particular question of the role of the informal sector, defined as workers lacking coverage by formal labor benefits, which accounts for a large share of the developing world work force. For example, the ILO (2002) argues that the sector accounts for 51% of non agricultural employment in Latin America, 65% in Asia, and 72% in sub Saharan Africa. One view, broadly analogous to the dual labor market literature in the US sees informality as disguised unemployment, receiving workers who have

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<sup>1</sup> See also Bosch and Maloney (2005).

comparative advantage in formal sector jobs, but have lost or are unable to find one.<sup>2</sup> An alternative, more in the spirit of Lucas (1978) sees workers indifferent at the margin of formality and informality and transiting to take advantage of profitable opportunities arising in both sectors.<sup>3</sup> We nest the competing views on reasons for entry into the sector in our search model and discuss the implications for expected transition patterns.

This question offers a rich case study through which to view the strengths and weaknesses of these tools, but it is also of intrinsic interest. As the flow approach to modeling labor markets has become the standard in the literature, a new generation of search models has focused on developing countries, including the incorporation of an informal sector.<sup>4</sup> We therefore contribute to the limited supporting body of empirical stylized facts available upon which to anchor these models. From a policy point of view, understanding the nature of the sector is critical. If, for instance, the large fraction of developing country workers found in the informal sector shows dynamics similar to those of the unemployed, then the distortions in the formal sector are indeed large and the case for reform is compelling. If, however, they show dynamics closer to those of the formal sector, then the policy focus shifts to understanding the cost–benefit analysis that agents undertake in choosing among sectors, also with important policy implications (see, for instance, Levy, 2008).

Finally, we discuss the challenge to inference posed by the fact that these statistics are both reduced forms capturing comparative advantage considerations as well as the state of the markets, and aggregates across heterogeneous sectors. We therefore explore additional identification strategies arising from worker heterogeneity and the business cycle. The results indicate that a substantial part of the informal sector, particularly the self-employed, corresponds to voluntary entry although informal salaried work may correspond more closely to the standard queuing view, especially for younger workers.

## 2. A simple search model with informal jobs

This section presents a simple stylized model to illustrate these two views in a search context, and how they translate into the statistics we discuss. The model focuses on the direct transitions between formal and informal employment which are most likely to offer insight into the drivers of entry into informality. We are especially interested in isolating the parameters driving selection of one sector vs. another and, more specifically, the impact of market distortions on the estimated statistics.

Consider a three sector search and matching model with unemployment, formal, and informal jobs. Assume that there are  $h$  types of workers with a series of attributes that affect two parameters. The first is  $a_{k,l}^h$  which reflects worker  $h$  in sector  $k$ 's preference for, or ability to work in, sector  $l$  relative to all other possible destination sectors given wages and a particular state of the market.<sup>5</sup> In our model this ability translates into the capacity to generate work opportunities in sector  $l$ , superior to the present job in sector  $k$ . The second is  $s_k^h$ , which captures the search intensity of worker  $h$  in sector  $k$ . For instance, young people in general have a higher search intensity and corresponding turnover than older people. If sector  $k$  is comprised of young workers relative to sector  $l$ , we would expect higher turnover in sector  $k$ . For simplicity we

abstract from the firm side and focus on worker decisions to enter each of the two sectors.<sup>6</sup> Following the now standard search and matching models in the literature (see Pissarides, 2000) and given an interest rate of  $r$ , we can write the present discounted value of an informal job for type of worker  $h$ ,  $I^h$ , as

$$rI^h = w_I + \theta_{I,F}^h(a_{I,F}^h, v_F, s_I^h)(F^h - I^h) + \lambda_I(U^h - I^h) \quad (1)$$

Eq. (1) is straightforward to interpret. The instantaneous return for worker  $h$  holding an informal job is given by its wage,  $w_I$ , which for simplicity is assumed to be exogenous. While holding an informal job, the worker encounters profitable opportunities in the formal sector that give the worker higher value than the current job, that is,  $I^h < F^h$ . Due to the existence of search frictions in the labor market, these opportunities come stochastically at a rate  $\theta_{I,F}^h(a_{I,F}^h, v_F, s_I^h)$ , which is a function of the preference/ability of the worker to obtain a formal job,  $a_{I,F}^h$ , the search intensity of worker  $h$  in the informal sector,  $s_I^h$ , and the abundance of openings (vacancies) in the destination sector,  $v_F$ . We assume that  $\theta_{I,F}^h(a_{I,F}^h, v_F, s_I^h)$  is increasing in all three arguments. When an opportunity materializes, the worker  $h$  transits to a formal job and quits the informal job. The net gain of this transition is represented by  $F^h - I^h$ . Finally, the last term of Eq. (1) shows the change in the value of the job if the worker is thrown into unemployment, which happens at a constant exogenous rate,  $\lambda_I$ . Let  $U^h$  represent the present discounted value of unemployment for worker  $h$ . Similarly, the present discounted value of holding a formal job for worker  $h$ ,  $F^h$ , can be expressed as

$$rF^h = w_F + (\theta_{F,I}^h(a_{F,I}^h, v_I, s_F^h) + \phi_{F,I})(I^h - F^h) + \lambda_F(U^h - F^h) \quad (2)$$

In this case formal workers earn a wage  $w_F$ . The specification in Eq. (2) is flexible enough to nest competing views of the drivers of inter-sectoral transitions and hence, the particular view of the role of the informal sector. In the absence of segmentation, a transition from a formal to an informal job may occur because, similar to the reverse flow, formal workers manage to find profitable opportunities in the informal market,  $\theta_{F,I}^h(a_{F,I}^h, v_I, s_F^h)$ . However, a segmenting distortion that artificially raises the relative wages in the formal sector (i.e. minimum wage) may generate that in the limit  $\theta_{F,I}^h(a_{F,I}^h, v_I, s_F^h) = 0, \forall v_I \forall s_F^h$ . That is, no formal worker can find profitable opportunities in the informal sector for any state of the market simply because  $a_{F,I}^h$  is very low. We should only see transitions from formal jobs towards informality due to involuntary separations which occur at the rate  $\phi_{F,I}$  in which case workers take up informal jobs in order to avoid unemployment. By a similar logic, the informal–formal transition rate  $\theta_{I,F}^h(a_{I,F}^h, v_F, s_I^h)$  reflects queuing to access a superior job through two offsetting effects. First, the distortion reduces the number of positions opening in the formal sector,  $v_F$ , since higher wages reduce the firm's labor demand. Second, it increases the relative attractiveness of those openings. Translated into our model, the latter implies an increase in  $a_{I,F}^h$ .

If a worker is separated from either of the two sectors, a new job search starts in both sectors simultaneously. Given the generalized absence of unemployment insurance programs in developing countries, we assume the flow income when unemployed to be zero. We also assume that the worker accepts the first offer that arrives from either sector, that is  $U^h < I^h$  and  $U^h < F^h$ . Further, the probability of transition towards formal or informal jobs depends on the same fundamentals as those driving the inter-sectoral flows, but

<sup>2</sup> See Fields (2006) for a guide to multi-sectoral models with informal jobs.

<sup>3</sup> See for instance, Magnac (1991), Rauch (1991), Loayza (1996), Maloney (1999), Maloney and Nuñez (2004) and De Paula and Scheinkman (2008).

<sup>4</sup> See Fugazza and Jacques (2004), Albrecht et al. (2009) and Zenou (2008).

<sup>5</sup> The idea that workers' relative endowments of characteristics determines their comparative advantage in different types of jobs appears in Lucas' (1978) discussion of choices between salaried work and self-employment, and explicitly in Rosen (1978), Heckman and Sedlacek (1985), Magnac (1991).

<sup>6</sup> To ensure profits for the firm (and vacancy posting) we assume that the productivity of the workers in each sector is above the corresponding wages. For more detailed search models with informal workers the reader is referred to Albrecht et al. (2009) and Zenou (2008).

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