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Unemployment Protection for Informal Workers in Latin America and the Caribbean*

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April 19, 2013

Abstract

We use a dynamic stochastic general equilibrium search and matching model with salaried employment and informal self-employment to analyze the implications of introducing universal unemployment protection for informal workers through transfers, which are conditional on participation in training programs. We study how changes in unemployment benefits (UB) for unemployed workers in training programs (training UB), modify labor market outcomes for the unemployed. The model suggests that increasing training UB reduces unprotected unemployment and improves labor market outcomes through higher formal salaried employment and lower informal self-employment. Allowing for idiosyncratic quality in these training programs is key for these results. Higher training UB can also reduce total informal employment through a drastic reduction in the share of informal self-employment, without necessarily causing a large increase in total unemployment. Finally, the model suggests that increasing training UB may increase the volatility of unprotected unemployment. The influence of training programs on formal wage-setting is crucial to explain these results.

JEL Classification: E02, E24, E26

Keywords: Business cycles, informality, labor search

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Executive Summary

Latin American and Caribbean (LAC) labor markets are known to have large employment shares in informal salaried employment and self-employment. Most countries in the region currently offer different types of unemployment protection for formal workers, ranging from severance packages to savings accounts that workers have access to during unemployment spells. Individuals in informal jobs lack a formal safety net, even though they face higher and more volatile separation rates that make them more vulnerable to unemployment risk. Protecting informal workers against unemployment is a challenge for several reasons. Given the unstable earnings structure in informal employment, workers are unlikely to contribute voluntarily to savings accounts, while the high cost of monitoring excludes the possibility of any type of mandatory contribution program. However, providing protection to informal workers through unconditional transfers also means that some could work in the informal sector and, simultaneously, receive unemployment benefits (referred to hereafter as UB). To reduce these incidences, many LAC governments have established training programs that give all unemployed workers access to skill development and job-search assistance, thus providing an avenue through which informal workers can potentially transition to the formal sector. Empirical evidence has shown that training can improve labor market outcomes by creating more job stability for workers. Since these programs require a time commitment—which minimizes the possibility of simultaneously working in the informal sector and receiving UB—they offer an excellent channel through which governments can provide unemployment assistance to informal workers.

Herein, we explore the aggregate consequences of expanding these training programs in a general equilibrium labor search model that explicitly accounts for formal salaried workers, informal salaried workers, and informal self-employed workers. In particular, we consider the provision of unemployment protection to workers—regardless of type of employment—through training programs as a conditional transfer program. Taking the tax structure of the economy as given, we analyze the impact of increasing UB for unemployment workers in training programs (referred to hereafter as training UB) on the shares of formal employment, informal salaried employment, self-employment, and unprotected unemployment in the economy. We also document how these policy reforms affect the probability of finding salaried employment and self-employment. We consider Mexico as a benchmark case, and take into account the following existing structure in the labor market: (1) formal workers receive a severance payment upon separation from their firm, implying that formal UB is a lump sum payment, and (2) current training programs tend to last less than two quarters. In the model, the policy change we implement can effectively be interpreted as reducing the share of severance payments that formal workers receive ex-post and channeling the remaining share to finance training UB.

We find that increasing replacement rates during training unemployment (the state of unemployment in which the worker is unemployed, but also participating in a training program) from 9 percent of formal wages to close to 40 percent of formal wages can improve labor market outcomes in the economy. This result stands in contrast to the standard prediction in models with frictional labor markets. We find that, by increasing the replacement rates as stated, formal salaried employment increases from 50 percent of the labor force to 53 percent; informal salaried employment increases by 1.5 percentage points from 22 percent to 23.5 percent; and informal self-employment drops from 23 percent to 18 percent. Furthermore, unprotected unemployment drops almost 2 percentage points, thereby reducing its contribution to total unemployment from 60 percent to 30 percent. Overall, the total unemployment rate changes by 0.2 percentage points, since the policy change simply alters the composition of unemployment by reducing unprotected unemployment and increasing training (protected) unemployment.

The surprising positive impact of higher training UB can be traced back to the way training benefits affect firms' incentives to hire salaried workers and use capital in the salaried sector. In the model, increasing such benefits has a small adverse impact on formal wages. Intuitively, the outside options for workers have a direct impact on wages. Hence, an increase in the value of any of the outside options generally puts upward pressure on wages, which pushes firms to reduce hiring. In the case of formal wages in our model, both severance payments (referred to hereafter as formal UB) and training UB have a direct impact. In particular, higher training UB increases the likelihood that a worker will enter such a program after being separated from employment, and reduce the influence of formal UB on wages.

The fall in the influence of formal UB, as the likelihood of entering training rises, effectively translates into a fall in the value of formal unemployment. This puts downward pressure on formal wages and pushes salaried firms to increase formal vacancy postings. At the same time, the influence of providing increased training UB on wages rises, since the outside training option becomes more attractive, and thus more likely. This pushes formal wages up and decreases formal vacancies. In addition, the increase in training UB expands the outside training option for self-employed individuals and puts downward pressure on the rental rate of capital, which is a key input in the self-employment sector. Since firms supplying capital now face a lower rental rate from lending capital, they become more reluctant to supply capital to the self-employed, which reduces the likelihood of entering self-employment. The fall in the self-employment option puts further downward pressure on wages. Combining these effects, we find that higher training UB leads to a marginal fall in formal wages. This is enough to push firms in the salaried sector to create more salaried employment positions on net, and in particular, more formal salaried positions. A higher number of job vacancies in the economy increases the likelihood that unemployed workers will finding

salaried employment, which implies better job prospects in more stable employment positions.

The model also predicts that increasing the replacement rate in training unemployment more than doubles the variability in unprotected unemployment and reduces overall employment volatility. This increase in the volatility of unprotected unemployment occurs because higher training UB imply that a larger share of workers who separate from employment move directly into training unemployment every period. This makes entry into unprotected unemployment more sporadic and stabilizes the flow into training unemployment. The model we provide is very parsimonious and abstracts from important characteristics of LAC labor markets to highlight the importance of the composition of employment in the region. Thus, the results should be interpreted with caution. In this paper, we stress the need to take a closer look at the impact of active labor market policies on wage-setting, as well as the behavior of the different outside options for salaried employment—most importantly, self-employment in the form of own account work—since the impact of these policies on firms' incentives to create salaried jobs may have important consequences for labor market outcomes and the protection of workers in the LAC region.

1 Introduction

Interventions that aim to modify the structure of the labor market are both a recurring theme in the policy debate and the subject of a large empirical and theoretical literature. The general focus in developed countries has typically centered on the mechanisms that can protect salaried workers from idiosyncratic and aggregate shocks, ranging from providing unemployment benefits (referred to hereafter as UB) to offering training and skill acquisition programs. Extending the same framework to countries in the Latin American and Caribbean (LAC) region poses serious challenges. The prevalence of informal employment arrangements across the region makes it extremely difficult to implement standard unemployment protection programs that offer partial insurance against unemployment risk. While targeting informal salaried workers has often proved to be an elusive task, the difficulty of addressing the microeconomic and macroeconomic consequences of particular unemployment protection mechanisms in the region is compounded by having a large share of individuals—close to one-fourth or more of total employment—in the informal self-employment sector. It is crucial to have a sound theoretical structure to study the implications of various types of policy interventions—one that captures the most important types of employment arrangements in the region—before attempting to introduce or expand particular labor market policies. Therefore, models that embody the key elements of LAC labor markets can be an excellent complement to empirical work on unemployment protection and a useful component of the toolkit for policymakers. These models can be used to identify some of the tradeoffs that emerge during the implementation of particular policy initiatives.

This paper uses a dynamic stochastic general equilibrium (DSGE) search and matching model with three employment states—formal salaried, informal salaried, and self-employment—to explore the aggregate implications of introducing programs that would offer partial protection to workers who have been displaced from informal jobs.[1] In particular, we explicitly address the prevalence of informal self-employment in the LAC region, which is a theme that is absent from most of the theoretical literature. The main experiment we conduct consists in analyzing the static and dynamic effects of increasing UB in short-term training programs for the unemployed.[2] There are several reasons why training programs might be an effective way to expand unemployment protection to informal workers in the LAC region.

[1]We are certainly not the first to consider the implications of unemployment protection in developing country labor markets in a theoretical framework. For example, Álvarez-Parra and Sánchez (2009) consider the role of hidden or informal labor markets and their moral hazard implications on the implementation of unemployment insurance programs. Also, see Margolis, Navarro, and Robalino (2012) for an alternative framework based on search frictions in the labor market with an application to unemployment insurance in Malaysia.

[2]Osikominu (2012) points out that short-term training programs in Germany can last from a few days to up to 12 weeks. These programs stand in contrast to regular long-term training programs that last up to a year.

First, there is some evidence that, for the workers, these programs may reduce time spent in unemployment and lead to more stable jobs. The evidence on wages is more mixed. Some studies document that wages either increase slightly or actually fall after training. Second, since training programs often require a time commitment, participation in these programs can limit a worker's ability to receive the program's UB while simultaneously working in the informal sector. Third, these programs seem to be a natural channel through which governments can directly transfer UB to participants in the programs, since part of the infrastructure is already put in place in many countries.

To focus on the consequences of active labor market policies for labor market outcomes, we take the tax system in the economy as given. Our objective is not to analyze the different ways in which these training programs could be financed, so we restrict the fixed set of tax instruments available to finance unemployment protection in the model to salaried labor income taxes, payroll taxes, and firing taxes in the formal sector. Analyzing unemployment protection in a business cycle, labor search framework allows us to explore the implications of policy changes for labor market volatility alongside the static effects from these policies. We build on the basic labor market structure in Finkelstein Shapiro (2012), who introduces frictional and endogenous transitions into informal self-employment in a business cycle model with labor search frictions in salaried employment.

The friction to move into self-employment in the model is based on the search for capital that is needed to make self-employment projects productive. This is a reduced-form way of capturing the fact that the self-employed often rely on informal credit to finance and sustain their business ventures. We expand the model to have informal salaried employment and UB conditional on participation in training programs. The latter are available to all unemployed workers. Formal workers can also enter training, either directly after being separated from their jobs or after spending one period in formal (protected) unemployment. In our model, training is only available for one period, and we make no assumption on its effect on productivity. Participation would prevent people from working in the informal sector and simultaneously receiving UB, simply because the program requires a fixed time commitment. Hence, the introduction of unemployment protection in our setup can be seen as a conditional transfer program.

To model training programs, we follow the setup of Felix Reichling (2005). His framework relies on idiosyncratic training quality to endogenize the probability of transitions into training.[3] In our setup, this

[3] We can interpret idiosyncratic training quality, loosely, as the quality of the match between the unemployed individual and the training program. To provide a practical example, note that the attractiveness of the program to recently separated workers is likely to depend on whether individuals consider the program to fit their tastes and preferences for training. For example, if a separated worker wanted to become a chef and the training program happens to offer cooking courses, then we would consider the training program to be of high quality, since it meets the person's needs. In the model, training quality affects the effective cost of participating in the program.

probability is affected by the generosity of UB for unemployed workers in training programs (referred to hereafter as training UB). Also, by allowing for idiosyncratic quality, the decision to join the program becomes a voluntary decision, based on the potential benefits from being in training relative to being in formal or unprotected unemployment. The modeling approach herein does not rely on specific assumptions about the effectiveness of training on productivity prior to finding employment, which, in our view, makes the results of the paper more general. Furthermore, the fact that we make no assumptions in this regard establishes a lower bound for the policy changes we explore.[4]

From a macroeconomic point of view, including self-employment in the analysis of unemployment protection is important for several reasons. First of all, for many individuals, self-employment often represents an attractive option, given the institutional and regulatory environment in the economy. In addition, self-employed workers exhibit different cyclical dynamics (Bosch and Maloney, 2008) and face different tradeoffs and frictions relative to salaried workers. Furthermore, self-employment flows may have implications for the fiscal sustainability of safety net programs, especially if policy responses in the labor market manifest themselves through changes in the share of self-employment. One advantage of the framework herein is that it allows us to consider the general equilibrium implications, both static and dynamic, of particular labor market policies.

Very few papers, in the spirit of the Mortensen and Pissarides (1994) labor search and matching framework, introduce informal self-employment explicitly alongside frictional salaried employment. There are three exceptions, all of which are in partial equilibrium: Narita (2010), Bargain et al. (2012), and Margolis, Navarro, and Robalino (2012). The first assumes that entry into self-employment depends on experience in wage employment, whereas the last two assume that self-employment opportunities arrive randomly, after which individuals decide whether or not to enter self-employment. Kumar and Schuetze (2007) provide a tractable way to model frictional entry into self-employment in a partial equilibrium setup. However, their model implies procyclical entry into self-employment, which stands in contrast with the results for Brazil and Mexico in Bosch and Maloney (2008). The setup we use, in general, is equilibrium, and the frictional transitions into self-employment are endogenous in the sense that unemployed individuals must find input suppliers to become self-employed. The basic idea is that individuals may lack the resources and inputs to transition into self-employment immediately after being separated from their jobs, and hence may have to search for resources in order to become self-employed. These constraints are likely to play an important role in determining transitions from unemployment into self-employment over the business cycle. As in Finkelstein Shapiro (2012), the model can capture several cyclical characteristics of self-

[4]In reality, the worst case scenario is that participation in training does nothing to enhance skills. We plan to more thoroughly explore the issue of skill enhancement through training in future work.

employment that are absent from existing models, suggesting that our approach to modeling frictional and endogenous entry into self-employment provides a reasonable theoretical structure to analyze labor market interventions.

We calibrate the benchmark economy to Mexico. Focusing on the steady state of the economy, we find that increasing training UB can improve labor market outcomes; in particular, raising training UB from 9 percent of formal wages to 40 percent increases formal salaried employment by more than 3 percentage points and informal salaried employment by 1.5 percentage points, and decreases informal self-employment by more than 5 percentage points. These changes imply that total informal employment falls by more than 3 percentage points. More generous benefits also imply that unprotected unemployment falls by 1.5 percentage points. These changes take place with little variation in total unemployment, since the economy experiences a reallocation of formal and unprotected unemployment towards training (protected) unemployment. We also observe an increase in the probabilities of finding employment in both the formal and informal salaried sectors, as well as a fall in salaried employment volatility in the economy.

The key mechanism behind these results works as follows: changes in training UB affect the threshold quality above which individuals decide to participate in training. Higher benefits increase the probability that workers will enter training unemployment (a state of unemployment in which the worker is unemployed, but also participating in a training program) when they lose their jobs. This higher probability, in turn, determines how much formal UB and training UB affect formal wages. On one hand, a higher probability of an unemployed worker entering a training program reduces the influence of formal benefits and puts downward pressure on wages. On the other, this higher probability increases the influence of training benefits and puts upward pressure on wages. In addition, a more attractive outside option in training effectively reduces the option to enter self-employment, thereby putting downward pressure on formal wages. The net impact results in marginally lower formal wages. This effect is enough to increase the salaried firms' surplus from hiring formal workers, which pushes firms to increase formal vacancy postings.

Since formal and informal salaried employment are assumed to be imperfect substitutes in the salaried employment sector, higher formal employment raises the marginal product of informal salaried labor, which pushes firms to increase informal salaried postings. Thus, salaried employment expands. At the same time, training UB for unemployed workers reduce the salaried firms' benefit of supplying capital to the self-employed, and thus they reduce their supply of capital outside the firm, causing a contraction in the availability of funding for the self-employed. In turn, this reduces the probability of entry into self-employment, and drives down the share of self-employment in the economy. Since there are more salaried

vacancies, and total unemployment changes marginally, there is a higher probability of finding salaried employment. Finally, the increased probability of entering training unemployment reduces the inflow into unprotected unemployment and ends up decreasing the steady-state stock of unprotected unemployment. While increasing the stipend for unemployed workers in training programs has generally positive steady-state effects, the volatility of unprotected unemployment is positively related to the level of training UB. However, the overall volatility of the economy falls.

The inclusion of idiosyncratic training quality and endogenous frictional entry into self-employment are crucial to obtain the benchmark results. We consider random program quality to be closer to what we see empirically and a reasonable reduced-form way of accounting for the factors that affect people's decisions to enter training programs during unemployment. After all, some individuals may decide to forego training because they consider the program to be of low quality or simply not a good match for the types of skills they are looking to acquire. In addition, it is important to account explicitly for self-employment to capture the change in the composition of employment due to changes in the replacement rate in training unemployment. While informal salaried employment does respond to policy changes, the brunt of the adjustment to policy interventions in the informal sector comes from self-employment. In fact, a similar model with no self-employment would predict a small fall in informality, marginal changes in formal salaried employment, and higher total unemployment when unemployment benefits for unemployed workers in training are higher. The fact that entry into self-employment changes endogenously and affects aggregate labor market conditions is important to characterize the aggregate impact from policy changes.

This paper is structured as follows. Section 2 offers a brief overview of particular unemployment protection schemes and active labor market policies that have been implemented in the LAC region. Section 3 outlines the key features of the theoretical framework we propose. Section 4 describes the calibration of the model. Section 5 presents the simulation results for the benchmark model economy. Section 6 discusses the results from increasing UB in training unemployment. Section 7 concludes.

2 Some Evidence on Unemployment Insurance Schemes and Active Labor Market Policies

We briefly outline a number of relevant papers in the empirical literature on active labor market policies.[5] Several countries in the LAC region have already implemented a variety of unemployment protection schemes. Most countries have focused on active labor policies, that is, programs that seek to increase

[5]This is merely meant to set the stage for the model and is by no means a full overview of the literature.

employability through training and skill development (for example, PLANE in Bolivia or Jóvenes en Acción in Colombia). Fewer countries have included passive labor policies, such as unemployment insurance and severance payments, into their social safety nets. In particular, only Argentina, Barbados, Brazil, Chile, Colombia, and Uruguay have implemented at least one type of transfer program for workers that transition into unemployment (Kaplan and Robertson, 2011; Vodopivec, 2009). Despite the fact that these transfer programs specifically target the unemployed who are separated from formal jobs, the programs vary widely in their eligibility criteria, the size of their payments, their duration, and, in general, their implementation mechanisms. For instance, Chile's unemployment insurance uses individual savings accounts from which beneficiaries can withdraw when they are separated from their job. Beneficiaries can receive the equivalent of one month's pay per each year saved (Murillo et al., 2011). In Brazil, UB are calculated as a function of the wage received during the last three months of the individual's employment, and the duration of the benefits is typically four months for people who had worked during at least 15 months in the previous two years (Cunningham, 2000). Conversely, Colombia's unemployment insurance is funded with a portion of the 4 percent payroll tax and provides half a monthly minimum wage for six months (Medina et al., 2011).

Regardless of the differences in implementation procedures highlighted above, impact evaluations have shown that unemployment insurance programs share several effects on labor market outcomes across LAC countries. Not surprisingly, the impact assessments have found that these programs increase the duration of unemployment. González-Rozada et al. (2011) show that, in Argentina, the increase in unemployment duration due to UB collection is closely related to a reduction in job finding rates. Along the same lines, Medina et al. (2011) find that the Colombian unemployment insurance program had no effect on employment rates among the treated group. What is even more revealing is the fact that, across all the countries studied, unemployment insurance has not been a vehicle for more productive job search, in the sense of achieving higher paying jobs after reentering employment. In particular, while Amarante et al. (2011) find that unemployment transfers in Uruguay have no effect on earnings after reemployment, Medina et al. (2011) find that beneficiaries in Colombia actually end up earning less and take on formal jobs less frequently than the people who did not participate in the insurance program. Cunningham (2000) finds that unemployment insurance does not increase formal sector participation in Brazil. On the contrary, treated individuals exhibit a higher likelihood of transitioning into self-employment. This last point is particularly relevant for the type of framework propose herein.

The results summarized thus far show that informality, in terms of both salaried and nonsalaried employment, is a rational choice, even with the existence of UB programs. Such findings make the proposed analytical framework particularly relevant, due to the fact that no LAC country has yet made

informal workers—whether salaried or self-employed— eligible for unemployment protection. In light of these results,it is crucial to include both informal salaried workers and informal self-employed workers in any theoretical analysis to fully understand the effects of different unemployment protection schemes on LAC labor markets and on welfare in the region.

3 Model Structure

We expand the framework in Finkelstein Shapiro (2012) to include two types of salaried employment and an unemployment protection scheme based on conditional transfers.[6] Consider a real business cycle economy with two sectors: a salaried sector and a self-employment sector. The salaried sector is populated by firms that hire formal and informal salaried workers in frictional labor markets and accumulate physical capital. There is no entry or exit of salaried firms. Salaried firms also decide how much capital to use in-house and how much to rent to potential self-employed individuals, where the rental market for physical capital is subject to search and matching frictions. Thus, firms in the salaried sector act as input suppliers to potential self-employed individuals.[7] A potential self-employed individual requires one unit of capital from salaried firms to make his or her business venture productive.[8] Households send their unemployed members to search for salaried employment and, also, post self-employment projects to attract salaried firms that supply capital.

Posting projects is necessary but not sufficient to enter the self-employment sector, since individuals must also match with a salaried firm to obtain capital. Frictions in finding capital to operate self-employment projects prevent individuals from instantaneously transitioning from unemployment to self-employment. These matching frictions embody the barriers that the self-employed face to start and maintain small business ventures (IDB, 2005a; Cull, McKenzie, and Woodruff, 2008). While small firms often rely on the household's own savings as startup capital, the ability to cover day-to-day expenditures and meet expected demand may be intimately tied to a stable external source of informal financing and inputs, and this is where salaried firms come in. Since trade or supplier credit often grows from long-term relationships with suppliers and other members of the community that are willing and able to supply inputs, search frictions are particularly well suited to capture the fact that instantaneous transitions into

[6]The description of the model, as well as the motivation for some of the main assumptions regarding frictional endogenous self-employment, borrow heavily from Finkelstein Shapiro (2012). Please see this paper for more detailed evidence behind some of the assumptions in the model herein.

[7]Access to formal financing sources by the informal self-employed would be inconsistent with the limited breadth and reach of formal financial markets in the LAC region.

[8]Most microfirms in the self-employment sector are operated by the owner and employ no salaried workers (Rogg, 2000; IDB, 2005b; Chavis, Klapper and Love, 2010, 2011).

self-employment may not be a possibility due to external financing needs. Two illustrative examples of the kind of independent workers we aim to capture with capital search and matching frictions are provided in the Appendix herein.

Formal UB are available to formal workers for a single period. Additionally, we introduce training programs that offer a stipend (training UB) conditional on participation. These programs are available for a single period to formal and informal workers, including self-employed workers, who have recently separated from their jobs. We follow Reichling (2005) in modeling training programs, taking into account that the quality of the training program is idiosyncratic and affects individuals' transitions into training unemployment. In particular, training quality affects the effective cost of participating in the programs, where higher quality reduces the effective cost of training. Individuals can transition directly into training unemployment when separations take place, or transition into alternative unemployment states. Transitions into training are determined by a threshold level of idiosyncratic training quality that depends on the level of training UB. If individuals happen to transition into unprotected unemployment, they can no longer transition into training unemployment unless they become employed and subsequently separate from their new job. Figure A1 in the Appendix shows the structure of the model economy.

The timing of the model is as follows. At the beginning of period t, the aggregate technology shock z_t affecting both sectors is realized. Separations in the salaried sector and the self-employment sector take place. Unemployment is determined. Firms post vacancies to hire workers. Firms then choose the capital stock next period and decide how much capital to use in-house. By choosing capital used within the firm, they simultaneously choose the capital devoted to matching with potential self-employed individuals. Unemployed individuals (in formal, unprotected, and training unemployment) search for employment, and households post self-employment projects. Matches that take place in period t produce in period $t + 1$ if they survive separations at the beginning of next period. Current matched firms and workers bargain over wages, and firms and self-employed matches bargain over the rental rate of capital. The quality of the program is revealed for those in training unemployment.

Production takes place. Workers receive their wages and the self-employed pay the rental rate on self-employment capital to salaried firms. Unemployed individuals participating in training programs or in formal unemployment receive their unemployment benefits. Figure A2 in the Appendix describes the timing of the model.

3.1 Households

As in Andolfatto (1996), we assume a large representative household with many members and perfect risk-sharing among the members. The household's problem is to choose consumption, total capital demand for self-employment projects next period (where each self-employed household member uses one unit of capital to produce), and projects for the self-employed $\left\{c_t, k^h_{SE,t+1}, v_{SE,t}\right\}_{t=0}^{\infty}$ to

$$\max_{\left\{c_t, k^h_{SE,t+1}, v_{SE,t}\right\}_{t=0}^{\infty}} E_0 \sum_{t=0}^{\infty} \beta^t \left\{U(c_t)\right\} \tag{1}$$

subject to the budget constraint given by

$$\begin{aligned} c_t + \psi_{SE}\phi(v_{SE,t}) + \frac{\kappa}{a_{T,t}} u_{T,t} &= k^h_{SE,t}\left(z_t - r_{SEt}\right) + n_{I,t} w_{I,t} + \\ & \quad n_{F,t} w_{F,t}(1-\tau^h) + \Pi_{S,t} + b_T u_{T,t} + b_F u_{F,t} + T_t \end{aligned} \tag{2}$$

and the law of motion for capital used by the potential self-employed from the perspective of the household

$$k^h_{SE,t+1} = (1-\delta^{SE})(k^h_{SE,t} + v_{SE,t} p(\theta_{SE,t})) \tag{3}$$

where $\phi(v_{SE,t})$ is a convex function of vacancy postings, $\phi'(v_{SE,t}) > 0, \phi''(v_{SE,t}) > 0$.[9] $n_{F,t}$ and $n_{I,t}$ are the measures of formal and informal salaried employment, respectively. For simplicity, we assume that all separations are exogenous. In the case of training unemployment, the idiosyncratic quality of the training program, $a_{T,t}$, affects the effective cost of participation, $\frac{\kappa}{a_{T,t}}$. The household is subject to labor income taxes that only apply to formal salaried employment. The second term on the left-hand side of the budget constraint denotes the resource cost of posting self-employment projects, which we interpret as the total cost of the resources that the household needs to spend in order to find capital suppliers and make project postings productive. The first term on the right-hand side represents total production in the self-employment sector. In particular, z_t is the aggregate technology shock and $k^h_{SE,t}$ is the measure of self-employed individuals. Since we assume constant returns to scale (CRTS) in the self-employment sector, $k^h_{SE,t}$ is also the amount of capital used in self-employment. In other words, we assume that each self-employed individual uses a single unit of capital to undertake his or her project.[10] The second term on the right-hand side of the budget constraint is simply the total cost of renting capital from capital

[9] A convex cost of posting projects is needed to avoid convergence problems.

[10] The assumption of CRTS in the self-employment sector proves particularly useful in capturing the fact that we observe a large number of micro-firms that are operated by the owner only.

suppliers (i.e., salaried firms). $b_T u_{T,t}$ represents total training UB. $b_F u_{F,t}$ captures total UB received by individuals who were separated from formal salaried positions and did not transition into training. Households receive profits $\Pi_{S,t}$ from salaried firms and T_t is a lump-sum transfer.

As suggested above, since each self-employed individual uses one unit of capital, we can write the law of motion for self-employment as

$$n_{SE,t+1} = (1-\delta^{SE})(n_{SE,t} + v_{SE,t} p(\theta_{SE,t})) \tag{4}$$

Total employment is then defined as

$$n_t = n_{F,t} + n_{I,t} + n_{SE,t} \tag{5}$$

If we normalize the total labor force to one, total unemployment is defined as

$$u_t = u_{T,t} + u_{I,t} + u_{F,t} = 1 - n_{F,t} - n_{I,t} - n_{SE,t} \tag{6}$$

where $u_{I,t}$ denotes unprotected unemployment. Note that those individuals participating in training programs, $u_{T,t}$, are counted as unemployed as well. Taking first-order conditions and rearranging them, we get the following self-employment project posting condition:

$$\frac{\psi_{SE}\phi'(v_{SE,t})}{p(\theta_{SE,t})} = E_t\left\{\beta\frac{U_c(c_{t+1})}{U_c(c_t)}(1-\delta^{SE})\left(z_{t+1} - r_{SE,t+1} + \frac{\psi_{SE}\phi'(v_{SE,t+1})}{p(\theta_{SE,t+1})}\right)\right\} \tag{7}$$

The left-hand side denotes the expected marginal cost of posting an additional project to attract capital, while the right-hand side denotes the expected marginal benefit, given by self-employment earnings next period and the continuation value of the capital relationship. Since firms in the economy are owned by households, we define $\Xi_{t+1|t} \equiv \beta\frac{U_c(c_{t+1})}{U_c(c_t)}$ as the stochastic discount factor.

Given the structure of UB in formal unemployment and training unemployment, $u_{F,t}$, $u_{T,t}$, and $u_{I,t}$ evolve in the following way:

$$u_{F,t} = \delta^F n_{F,t-1} F(\widetilde{a}_{T,t}) \tag{8}$$

$$\begin{aligned} u_{T,t} \;=\; & \left[\delta^F n_{F,t-1} + \delta^I n_{I,t-1} + \delta^{SE} n_{SE,t-1}\right](1 - F(\widetilde{a}_{T,t})) + \\ & \left[1 - \left(\begin{array}{c} p(\theta_{F,t-1})(1-\delta^F) + p(\theta_{I,t-1})(1-\delta^I) \\ + \left(\frac{1}{u_{t-1}}\right) m_{SE,t-1}(1-\delta^{SE}) \end{array}\right)\right](1 - F(\widetilde{a}_{T,t}))u_{F,t-1} \end{aligned} \tag{9}$$

$$u_{I,t} = \left[\delta^I n_{I,t-1} + \delta^{SE} n_{SE,t-1}\right] F(\widetilde{a}_{T,t}) + (u_{I,t-1} + F(\widetilde{a}_{T,t}) u_{F,t-1} + u_{T,t-1}) \times \left[1 - \left(\begin{array}{c} p(\theta_{F,t-1})(1-\delta^F) + p(\theta_{I,t-1})(1-\delta^I) + \\ \left(\frac{1}{u_{t-1}}\right) m_{SE,t-1}(1-\delta^{SE}) \end{array}\right)\right] \tag{10}$$

where m_{SE} is the matching function for self-employment (defined in detail below); $a_{T,t}$ is an *i.i.d.* random variable that captures the quality of the training program (see Reichling, 2005); and $F(\widetilde{a}_{T,t}) = \int_0^{\widetilde{a}_{T,t}} f(a_T) da_T$ gives the conditional probability that the quality of the program is below $\widetilde{a}_{T,t}$.[11] If individuals are separated from their salaried positions or their self-employment ventures, they can either move directly into unemployment training, if the quality of the training program is high enough, with probability $(1-F(\widetilde{a}_{T,t}))$, or move into unemployment (which happens if $a_{T,t}$ is below $\widetilde{a}_{T,t}$) with probability $F(\widetilde{a}_{T,t})$. Within this last category, individuals who were separated from formal salaried positions receive formal UB b_F, while individuals who were separated from informal positions (whether salaried or not) and do not transition into the training programs do not receive UB and enter the state of unprotected unemployment. Unemployed individuals in training receive training UB b_T. Transitions from unprotected unemployment to the training programs are not allowed.

3.2 Production

Salaried firms hire formal and informal workers, accumulate capital, and make a capital allocation decision. Capital accumulated by these firms can be used within the firm, or they can be matched with potential self-employed individuals. Devoting capital outside the firm is subject to search and matching frictions, analogous to labor search and matching, and is meant to proxy for supplier input credit. The firm's production function is CRTS and given by

$$y_{S,t} = z_t f(n_{F,t}, n_{I,t}, \omega_t k_{S,t}) \tag{11}$$

Production in the salaried sector is subject to an aggregate productivity shock, z_t, and $f(n_{F,t}, n_{I,t}, \omega_t k_{S,t}) = \left[\alpha_n (n_{F,t})^{\gamma_n} (1-\alpha_n)(n_{I,t})^{\gamma_n}\right]^{\frac{1-\alpha_S}{\gamma_n}} (\omega_t k_{S,t})^{\alpha_S}$ where $0 < \alpha_n, \alpha_S < 1$ and $\gamma_n \leq 1$. Firms choose a sequence of vacancies for formal and informal employment; formal and informal labor next period; capital next period; the fraction of the capital stock used in the period; and capital lent out to the self-employed next

[11] Note that $p(\theta_{j,t}) = \frac{m_j(v_{j,t}, u_t)}{u_t}$ for $j = F, I$.

period $\left\{v_{F,t}, v_{I,t}, n_{F,t+1}, n_{I,t+1}, k_{S,t+1}, \omega_t, k^f_{SE,t+1}\right\}_{t=0}^{\infty}$ to

$$\max E_0 \sum_{t=0}^{\infty} \Xi_{t|0} \left\{ \begin{array}{c} z_t f(n_{F,t}, n_{I,t}, \omega_t k_{S,t}) - n_{F,t} w_{F,t}(1+\tau^p) \\ -n_{I,t} w_{I,t} - \psi_F v_{F,t} - \psi_I v_{I,t} \\ -i_t + k^f_{SE,t} r_{SE,t} - \delta^F S n_{F,t-1} \end{array} \right\} \tag{12}$$

subject to the laws of motion for formal and informal salaried employment

$$n_{F,t+1} = (1-\delta^F)(n_{F,t} + v_{F,t} q(\theta_{F,t})) \tag{13}$$

$$n_{I,t+1} = (1-\delta^I)(n_{I,t} + v_{I,t} q(\theta_{I,t})) \tag{14}$$

the evolution of the supply of capital used in self-employment

$$k^f_{SE,t+1} = (1-\delta^{SE})(k^f_{SE,t} + (1-\omega_t) k_{S,t} q(\theta_{SE,t})) \tag{15}$$

and the evolution of total capital accumulated within the firm[12]

$$k_{S,t+1} = (1-\delta)\omega_t k_{S,t} + [(1-\delta)(1-\omega_t)k_{S,t} - (1-\delta^{SE})(1-\omega_t)k_{S,t} q(\theta_{SE,t})] + i_t + (\delta^{SE} - \delta) k^f_{SE,t} \tag{16}$$

The firm is subject to a payroll tax τ^p whenever it hires workers with a formal contract. It also faces a firing cost S when formal workers separate from the firm. For simplicity, we assume that both are paid to the government. $q(\theta_{F,t})$ and $q(\theta_{I,t})$ are the job-filling probabilities for formal and informal employment positions. $q(\theta_{SE,t})$ is the probability that the firm finds a potential self-employed individual. The cost of posting vacancies for formal workers, ψ_F, is higher than the cost of informal salaried vacancies, ψ_I.[13] Going back to the law of motion for the capital stock, we assume that for those relationships that did survive separations at the beginning of time t, firms must cover any depreciation that took place between periods t and $t+1$. This is captured by $\delta k^f_{SE,t}$. Also, any capital that was not matched in period t, and hence remained idle is carried over to period $t+1$, net of depreciation, and is part of the salaried firm's capital stock next period.

[12]Adding the law of motion for capital accumulation by salaried firms and the law of motion for k_{SE} yields a standard law of motion for total capital in the economy.

[13]One could introduce a cost devoting capital to matching with potential self-employment projects, akin to the cost of posting vacancies, with little change in the results.

Taking first-order conditions, we obtain two standard job creation conditions:

$$\frac{\psi_F}{q(\theta_{F,t})} = E_t \left\{ \Xi_{t+1|t}(1-\delta^F) \left(z_{t+1} f_{n_{F,t+1}} - w_{F,t+1}(1+\tau^p) - \delta^F \Xi_{t+2|t+1} S + \frac{\psi_F}{q(\theta_{F,t+1})} \right) \right\} \tag{17}$$

$$\frac{\psi_I}{q(\theta_{I,t})} = E_t \left\{ \Xi_{t+1|t}(1-\delta^I) \left(z_{t+1} f_{n_{I,t+1}} - w_{I,t+1} + \frac{\psi_I}{q(\theta_{I,t+1})} \right) \right\} \tag{18}$$

a standard Euler equation for capital k_S:

$$1 = E_t \Xi_{t+1|t} \left\{ z_{t+1} f_{\omega k_{S,t+1}} + (1-\delta) \right\} \tag{19}$$

and a capital supply condition for capital allocated to matching with self-employed individuals:

$$\frac{z_t f_{\omega k_{S,t}} + (1-\delta^{SE}) q(\theta_{SE,t})}{q(\theta_{SE,t})} = E_t \left\{ \Xi_{t+1|t}(1-\delta^{SE}) \left(\begin{array}{c} r_{SE,t+1} + \delta^{SE} - \delta + \\ \frac{\left(z_t f_{\omega k_{S,t+1}} + (1-\delta^{SE}) q(\theta_{SE,t+1}) \right)}{q(\theta_{SE,t+1})} \end{array} \right) \right\} \tag{20}$$

The job creation conditions equate the expected marginal cost of posting a vacancy to the expected marginal benefit of matching with a worker. The capital Euler equation is standard. The capital supply condition shows the following: the left-hand side captures the expected cost of allocating part of the firm's capital to matching with self-employed individuals. Note that this expected cost includes the opportunity cost of not devoting the capital to production within the firm and the opportunity cost of setting aside the matched capital this period, since it becomes productive next period. The first term on the right-hand side captures the fact that if the relationship survives with probability $(1-\delta^{SE})$, the firm receives the rental rate for those physical capital units that survive destruction, net of depreciation, as well as the continuation value from the match. For future reference, note that in equilibrium we must have $k^f_{SE,t} = k^h_{SE,t} = k_{SE,t}$.

3.3 Labor Market Search, Capital Search, and Nash Bargaining

The following subsection describes the value functions for workers and firms, which we use to characterize salaried wages and the self-employment capital rental rate in the model.

3.3.1 Household Value Functions

Define $\widetilde{\mathbf{W}}_{T,t+1}(a_{T,t+1}) = \int_{\widetilde{a}_{T,t+1}}^{\infty} \mathbf{W}_T(a_T)\frac{f(a_T)}{1-F(\widetilde{a}_{T,t+1})}da_T$. The value to a worker of being employed with a formal contract, $\mathbf{W}_{F,t}$ is given by

$$\mathbf{W}_{F,t} = (1-\tau^h)w_{F,t} + E_t\Xi_{t+1|t}\left\{(1-\delta^F)\mathbf{W}_{F,t+1} + \delta^F[F(\widetilde{a}_{T,t+1})\mathbf{W}_{UF,t+1} + (1-F(\widetilde{a}_{T,t+1}))\widetilde{\mathbf{W}}_{T,t+1}]\right\} \tag{21}$$

Note that if a formal worker gets separated from the firm with probability δ^F, the threshold quality of the training program will affect his or her transition to formal unemployment, $\mathbf{W}_{UF,t+1}$, or to the training program, $\mathbf{W}_{T,t+1}$.[14] The value to worker of being employed with an informal contract, $\mathbf{W}_{I,t}$, is given by

$$\mathbf{W}_{I,t} = w_{I,t} + E_t\Xi_{t+1|t}\left\{(1-\delta^I)\mathbf{W}_{I,t+1} + \delta^I[F(\widetilde{a}_{T,t+1})\mathbf{W}_{U,t+1} + (1-F(\widetilde{a}_{T,t+1}))\widetilde{\mathbf{W}}_{T,t+1}]\right\} \tag{22}$$

In this case, if a separation takes place, the worker can transition to unprotected unemployment, if the threshold quality of the training program is low enough, or can transition directly to training unemployment. In a similar manner, the value function for a self-employed individual, $\mathbf{W}_{SE,t}$, is given by

$$\mathbf{W}_{SE,t} = z_t - r_{SE,t} + E_t\Xi_{t+1|t}\left\{\begin{array}{c}(1-\delta^{SE})\mathbf{W}_{SE,t+1}+ \\ \delta^{SE}[F(\widetilde{a}_{T,t+1})\mathbf{W}_{U,t+1} + (1-F(\widetilde{a}_{T,t+1}))\widetilde{\mathbf{W}}_{T,t+1}]\end{array}\right\} \tag{23}$$

To write the value functions for the three unemployment states, we introduce $v^u_{SE,t} = \frac{v_{SE,t}}{u_t}$, which is the number of projects per unemployed individual. Thus, $v^u_{SE,t}p(\theta_{SE,t})$ gives the probability of matching with a capital supplier for each unemployed individual. The value function for an unemployed individual who was separated from a formal salaried position, $\mathbf{W}_{UF,t}$, is given by

$$\mathbf{W}_{UF,t} = b_F + E_t\Xi_{t+1|t}\left\{\begin{array}{c}(1-\delta^F)p(\theta_{F,t})\mathbf{W}_{F,t+1} + (1-\delta^I)p(\theta_{I,t})\mathbf{W}_{I,t+1} \\ +(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})\mathbf{W}_{SE,t+1} \\ +[1-(1-\delta^F)p(\theta_{F,t}) - (1-\delta^I)p(\theta_{I,t}) \\ -(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})]\times \\ [F(\widetilde{a}_{T,t+1})\mathbf{W}_{U,t+1} + (1-F(\widetilde{a}_{T,t+1}))\widetilde{\mathbf{W}}_{T,t+1}]\end{array}\right\} \tag{24}$$

Formal unemployment benefits b_F last for a single period, after which those in formal unemployment who have not found employment in period t can move to training unemployment or unprotected unemployment, depending on the conditional probability of entering training unemployment, $(1-F(\widetilde{a}_{T,t+1}))$. Benefits

[14] We show how the threshold training quality value is determined below.

last one period because they are meant to capture the severance payment given to formal workers who separate from their jobs. The value function for an unemployed worker without unemployment insurance, $\mathbf{W}_{U,t}$, can be written as

$$\mathbf{W}_{U,t} = E_t \Xi_{t+1|t} \left\{ \begin{array}{c} (1-\delta^F)p(\theta_{F,t})\mathbf{W}_{F,t+1} + (1-\delta^I)p(\theta_{I,t})\mathbf{W}_{I,t+1} \\ +(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})\mathbf{W}_{SE,t+1} \\ +[1-(1-\delta^F)p(\theta_{F,t}) - (1-\delta^I)p(\theta_{I,t}) \\ -(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})]\mathbf{W}_{U,t+1} \end{array} \right\} \tag{25}$$

3.3.2 Training Programs for Unemployed Workers

Following Reichling (2005), we assume that the cost of being in the training program is affected by the quality of the program, $a_{T,t}$, which follows an *i.i.d.* process. If the resource cost of participation is κ, then the effective resource cost of participating in training is given by $\frac{\kappa}{a_{T,t}}$. Thus, we can write the value of being unemployed in the training program $\mathbf{W}_{T,t}(a_{T,t})$ as

$$\mathbf{W}_{T,t}(a_{T,t}) = b_T - \frac{\kappa}{a_{T,t}} + E_t \Xi_{t+1|t} \left\{ \begin{array}{c} (1-\delta^F)p(\theta_{F,t})\mathbf{W}_{F,t+1} + (1-\delta^I)p(\theta_{I,t})\mathbf{W}_{I,t+1} \\ +(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})\mathbf{W}_{SE,t+1} \\ +[1-(1-\delta^F)p(\theta_{F,t}) - (1-\delta^I)p(\theta_{I,t}) \\ -(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})]\mathbf{W}_{U,t+1} \end{array} \right\} \tag{26}$$

In the case of $\mathbf{W}_{T,t}(a_{T,t})$, and following Reichling's (2005) setup, the higher the quality of the training program (i.e., the higher $a_{T,t}$ is), the lower the effective cost of participating in the program, $\frac{\kappa}{a_{T,t}}$. Also, we assume that individuals can only be in training programs for a single period, after which those in training unemployment who have not found employment must move to unprotected unemployment.[15] Finally, we assume that if formal workers who separate from their firms move directly into training unemployment, they cannot receive the full amount of formal UB alongside the training UB. Otherwise, these workers would be receiving both benefits simultaneously, which would increase the fiscal burden of unemployment protection substantially. Figure A3 in the Appendix illustrates the different employment states that a given individual can transition to from a given employment state.

[15] This assumption is in line with the average time it takes to acquire training in existing programs in Mexico. See, for example, http://www.empleo.gob.mx/en_mx/empleo/busco_capacitacion.

3.3.3 Threshold Value for Training Program Quality

To obtain the threshold values for idiosyncratic quality, we set the value of being in training such that $\mathbf{W}_{T,t}(\widetilde{a}_{T,t}) - \mathbf{W}_{U,t} = 0$ is satisfied. Evaluating this condition at $\widetilde{a}_{T,t}$, we obtain a simple relationship between the threshold value of idiosyncratic quality and training UB:[16]

$$b_T = \frac{\kappa}{\widetilde{a}_{T,t}} \tag{27}$$

3.3.4 Firm Value Functions

The salaried firm's value of having a formal worker, $\mathbf{J}_{F,t}$, is given by

$$\mathbf{J}_{F,t} = z_t f_{n_{F,t}} - w_{F,t}(1+\tau^p) + E_t \Xi_{t+1|t} \left\{ (1-\delta^F)\mathbf{J}_{F,t+1} - \delta^F S \right\} \tag{28}$$

We can write the firm's value of having an informal worker by $\mathbf{J}_{I,t}$ as

$$\mathbf{J}_{I,t} = z_t f_{n_{I,t}} - w_{I,t} + E_t \Xi_{t+1|t} \left\{ (1-\delta^I)\mathbf{J}_{I,t+1} \right\} \tag{29}$$

The value function of lending a unit of capital to a self-employed household member is

$$\mathbf{J}_{SE,t} = r_{SE,t} + (\delta^{SE} - \delta) + E_t \Xi_{t+1|t} \left\{ (1-\delta^{SE})\mathbf{J}_{SE,t+1} \right\} \tag{30}$$

Where the firm takes into account that it receives δ^{SE} units of separated capital, that it has to cover depreciation δ of matched capital at the end of the period, and that the credit relationship will survive to the next period with probability $(1-\delta^{SE})$. For future reference, the firm's value of having idle capital is given by $\mathbf{J}_{u_k,t} = (1-\delta)$.

[16] In principle, there should be two quality thresholds in our setup—one for formal workers and one for informal salaried workers and self-employed workers—because the threat point in the Nash bargaining problem for formal workers depends on W_{UF} and W_T, while the threat point for informal workers depends on W_U and W_T. There are several reasons why we only assume a single threshold. First, it makes the setup simpler. Second, introducing a second threshold requires us to assume two different distributions for training quality (or alternatively, different explicit resource training costs for participants). In our opinion, introducing a second threshold seems more arbitrary than the current setup. Moreover, the only role that the convex combination of outside value functions plays in the Nash bargaining problem for formal workers is to account for the uncertainty that determines ex-post severance payments for formal workers. In an alternative setup, we have introduced two different thresholds, such that formal workers receive the same net contemporaneous amount in training unemployment or in formal unemployment. The general steady-state results presented in the sections below remain qualitatively similar, except that unemployment is more sensitive to changes in the replacement rate, thereby reducing the salaried job finding rates as the replacement rate rises.

3.3.5 Nash Bargaining: Wage and Rental Rate Determination

We assume that wages and the rental rate are determined through Nash bargaining. The formal wage $w_{F,t}$ solves

$$\max_{w_{F,t}} \left\{ \left(\mathbf{W}_{F,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{UF,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]\right)^{\nu_F} (\mathbf{J}_{F,t})^{1-\nu_F} \right\} \tag{31}$$

where $(\mathbf{W}_{F,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{UF,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})])$ is the worker's surplus, $\mathbf{J}_{F,t}$ is the firm's surplus, and ν_F is the worker's bargaining power. We assume that the threat point for the worker depends on the weighted average of the value of formal unemployment and the value of training unemployment. In particular, this threat point is meant to capture the fact that, in many instances, formal workers who separate from a job do not receive the full severance payment.[17] Therefore, a realistic threat point for the worker is $[F(\widetilde{a}_{T,t})\mathbf{W}_{UF,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]$ and not the full option value in formal unemployment.[18] As illustrated below, increasing training UB reduces $F(\widetilde{a}_{T,t})$, thus placing more weight on $\mathbf{W}_{T,t}(a_{T,t})$. If training programs are an attractive outside option for workers, and this is common knowledge in the economy, then the value of formal unemployment would have a lower weight on agents' decisions , and hene, on the threat point during bargaining.

In the benchmark policy we consider, the payment that salaried firms incur when a formal workers separates from the firm remains in place. A part of the proceeds from the severance payment is used to finance training UB, which formal workers have access to as well, and the rest goes directly to the formal worker. Thus, as the shift in weights in the worker's threat point changes due to the rise in training UB, formal workers are more likely to move into training unemployment and receive the training UB, and less likely to receive the full formal UB. Clearly, this assumption indicates a reduction in the total UB that formal workers currently receive when they separate from their jobs. Thus, the policy is not meant as simply a conditional transfer program to unemployed workers who participate in training. Indeed, it also represents an attempt to reduce the difference in UB between formal and informal workers. However, note that those formal workers who were separated and move directly into training unemployment still receive a share of formal benefits, implying that their net UB are still higher than the benefits that informal salaried and self-employed workers receive.

The Nash bargaining problem for informal wages is given by:

$$\max_{w_{I,t}} \left\{ \left(\mathbf{W}_{I,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]\right)^{\nu_I} (\mathbf{J}_{I,t})^{1-\nu_I} \right\} \tag{32}$$

[17]For evidence on the enforcement of labor laws in Mexico, see, for example, Kaplan and Sadka (2007) and Kaplan, Sadka, and Silva Mendez (2008).

[18]The results remain qualitatively the same if we do not assume that the threat point is a convex combination of the value of both formal unemployment and training unemployment.

where $(\mathbf{W}_{I,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})])$ is the worker's surplus, $\mathbf{J}_{I,t}$ is the firm's surplus, and ν_I is the bargaining power for informal workers. The threat point now depends on the value of unprotected unemployment, $\mathbf{W}_{U,t}$, and the value of training unemployment, $\mathbf{W}_{T,t}(a_{T,t})$.

The Nash bargaining problem in the self-employment capital market is given by

$$\max_{r_{SE,t}} \left\{ (\mathbf{W}_{SE,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})])^{\nu_{SE}} \left(\mathbf{J}_{SE,t} - \mathbf{J}_{u_k,t}\right)^{1-\nu_{SE}} \right\} \tag{33}$$

where $(\mathbf{W}_{SE,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})])$ is the self-employed household member's surplus, and $(\mathbf{J}_{SE,t} - \mathbf{J}_{u_k,t})$ is the firm's surplus.

The implicit equations for formal wages, informal wages, and the rental rate are given by the following first-order conditions:

$$(\mathbf{W}_{F,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]) = \frac{\xi^F}{1 - \xi^F}(\mathbf{J}_{F,t}) \tag{34}$$

where $\xi^F = \frac{\nu_F}{\nu_F + (1-\nu_F)\frac{(1+\tau^p)}{(1-\tau^h)}}$ is the effective bargaining weight for formal workers,

$$(\mathbf{W}_{I,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]) = \frac{\nu_I}{1 - \nu_I}(\mathbf{J}_{I,t}) \tag{35}$$

and

$$(\mathbf{W}_{SE,t} - [F(\widetilde{a}_{T,t})\mathbf{W}_{U,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]) = \frac{\nu_{SE}}{1 - \nu_{SE}}\left(\mathbf{J}_{SE,t} - \mathbf{J}_{u_k,t}\right) \tag{36}$$

For expositional purposes, we do not present the full wage and rental rate expressions. We note that the functions for each of the wages and the rental rate on capital for the self-employed depend on, among other things, market tightness in each of the employment states, the average quality of the training programs, the probability of participating in training, and the explicit UB in formal and training unemployment. In particular, the following facts, which are evident when replacing the value functions in the first-order conditions above, are important to keep in mind once we analyze changes in b_T:

An increase in training UB lowers the threshold quality of the training programs and increases the probability of entering training unemployment. This is clear when considering the condition that determines the threshold training quality $\widetilde{a}_{T,t}$. For a fixed resource cost κ, a higher b_T implies a lower $\widetilde{a}_{T,t}$ and a lower $F(\widetilde{a}_{T,t})$.

The total impact of formal and training UB on formal wages changes with the level of training UB. Similar to standard labor search models, wages are affected by the outside option of unemployment. In our model, formal wages include a weighted average of formal and training UB, where the weights are given by the probabilities of entering formal and training unemployment when separations from formal employment take place. In particular, replacing the value functions in the first-order conditions above shows that UB enter the formal wage equation through the term $\left[F(\widetilde{a}_{T,t})\,(b_F) + (1 - F(\widetilde{a}_{T,t}))\left(b_T - \frac{\kappa}{H(\widetilde{a}_{T,t})}\right)\right]$. Given the first fact above, higher training UB, b_T, reduce $\widetilde{a}_{T,t}$ as well as $F(\widetilde{a}_{T,t})$, thereby reducing the weight on formal UB, b_F, and increasing the weight on the net value of training UB.

Ceteris paribus, higher training UB reduce the effective value of formal UB in formal wages. Going back to the term $\left[F(\widetilde{a}_{T,t})\,(b_F) + (1 - F(\widetilde{a}_{T,t}))\left(b_T - \frac{\kappa}{H(\widetilde{a}_{T,t})}\right)\right]$ in the formal wage equation, this particular fact becomes clear since a higher b_T reduces $F(\widetilde{a}_{T,t})$ for a given level of b_F. This effectively amounts to a fall in formal UB, and hence a reduction in the value of formal UB in formal wages.

Ceteris paribus, higher training UB increase formal and informal wages and decrease the rental rate on self-employment capital and the probability of entry into self-employment. The result for wages is typical in standard labor search models. Since training UB affect both formal and informal wages, an increase in the value of the outside option of unemployment, holding everything else constant, puts upward pressure on wages. The result for the rental rate on self-employment capital is intuitive: an increase in the value of the outside option in training unemployment allows potential self-employed individuals to negotiate a lower capital rental rate. In turn, the supply of capital by salaried firms decreases, as does the probability of entering self-employment.

Ceteris paribus, a lower probability of entry into self-employment puts downward pressure on formal and informal wages. Since self-employment is one of the possible employment states—and therefore one of the outside options for salaried workers—a lower probability of matching with a capital supplier implies that it is harder to find employment as an own-account worker. This effect leads to a decrease in equilibrium wages , all other things being equal, which is similar to the effect of lower UB.

Ceteris paribus, higher market tightness in salaried employment puts upward pressure on wages and downward pressure on the rental rate. The first part of this claim is also standard in labor search models. Since higher labor market tightness in formal and informal salaried employment implies that unemployed workers have a higher chance of finding salaried employment, this makes equilib-

rium wages in formal and informal salaried employment higher, all other things being equal. Similar to the case of more generous training UB, higher salaried labor market tightness implies that individuals have a higher probability of entering salaried employment, and therefor, an increased likelihood of entering one of the outside options from the point of view of a potential self-employed individual. This puts downward pressure on the negotiated rental rate on self-employment capital. Note that a lower rental rate makes salaried firms less willing to supply capital to the self-employment sector.

3.4 Government

The government budget constraint is given by

$$T_t + b_T u_{T,t} + \varphi u_{T,t} + b_F u_{F,t} = n_{F,t}(\tau^h + \tau^p) w_{F,t} + \delta^F S n_{F,t-1} \tag{37}$$

where φ is the resource cost of the training program per unemployed trainee. The left-hand side captures expenditures, while the right-hand side captures revenue from taxes.

3.5 Total Output and Market Clearing

Total output, y_t, is given by the sum of output from firms with workers, $y_{S,t}$, and output from the self-employed, $y_{SE,t}$:

$$y_t = y_{S,t} + y_{SE,t} \tag{38}$$

The costs of posting vacancies and projects and participating in training are resource costs, and therefore enter explicitly in the economy's resource constraint. Thus, the aggregate resource constraint is given by

$$y_t = c_t + i_t + \psi_F v_{F,t} + \psi_I v_{I,t} + \psi_{SE} \phi(v_{SE,t}) + \varphi u_{T,t} + \frac{\kappa}{H(\widetilde{a}_{T,t})} u_{T,t} \tag{39}$$

Where total output y_t and investment i_t are defined above.

3.6 Competitive Equilibrium

Definition *Taking the stochastic process* $\{z_t\}_{t=0}^{\infty}$ *as given, a competitive equilibrium consists of allocations* $\{c_t, n_{F,t}, n_{I,t}, n_{SE,t}, \theta_{F,t}, \theta_{I,t}, \theta_{SE,t}, k_{S,t}, k_{SE,t}, \omega_t, u_{F,t}, u_{I,t}, u_{T,t}, u_t, T_t, \widetilde{a}_{T,t}\}_{t=0}^{\infty}$ *and prices* $\{w_{F,t}, w_{I,t}, r_{SE,t}\}_{t=0}, ^{\infty}$ *which satisfy the Euler equation for capital (19); the self-employed's demand decision for capital (7); the law of motion for self-employment (4); the definition of unemployment (6); the law of motion for capital used in self-employment (3); the laws of motion for formal, training, and unprotected unemployment (8),*

(9), and (10); the law of motion for formal employment (13); the firm's formal job creation condition (17); the law of motion for informal salaried employment (14); the firm's informal job creation condition (18); the firm's supply decision for self-employed capital (20); the threshold idiosyncratic quality value (27); the implicit Nash formal and informal wage equations (34) and (35); the implicit Nash self-employment rental rate equation (36); the government budget constraint (37); and the economy's resource constraint (39).

4 Calibration

We calibrate the benchmark economy to Mexico, since it has reliable surveys that provide quality information on the labor market. We use standard calibration techniques to analyze the quantitative implications of the model by matching specific data moments from Mexico. The literature on informality and labor markets already offers both specific moments, which the model should be able to match, as well as values for specific parameters in labor search and matching models of informality. For example, Bosch and Maloney (2008) document the behavior of job-finding rates, separations rates, and transition rates across employment states for Brazil and Mexico. The recent empirical work on worker flows in these countries provides a wealth of information that can be readily used to assign reasonable values to the parameters of the model.

4.1 Functional Forms and Stochastic Processes

The aggregate technology shock z_t follows a standard AR(1) process

$$\ln z_t = \rho_z \ln z_{t-1} + \varepsilon_t^z \tag{40}$$

With $\varepsilon_t^z \overset{iid}{\sim} N(0, \sigma_z)$ and $0 < \rho_z < 1$. For simplicity, and similar to Reichling (2005), the idiosyncratic quality of training programs follows a uniform distribution with support [0,1] so that $a_{T,t} \sim U[0,1]$. The function $\phi(v_{SE,t})$ for self-employment projects is given by $\phi(v_{SE,t}) = (v_{SE,t})^{\eta_{SE}}$, $\eta_{SE} > 1$. The matching functions in the labor market for each sector are CRTS, so we assume $m_j(u_t, v_{j,t}) = M_j(u_t)^{\xi} v_{j,t}^{1-\xi}$, $0 < \xi < 1$, where M_j denotes the sectoral matching efficiency parameter, and $v_{j,t}$ denotes vacancies for $j = F, I$. The job-finding rate is $p(\theta_{j,t}) = \frac{m_j(u_t, v_{j,t})}{u_t}$, and the job-filling rate is given by $q(\theta_{j,t}) = \frac{m_j(u_t, v_{j,t})}{v_{j,t}}$ for $j = F, I$. Then, we can write $\frac{p(\theta_{j,t})}{q(\theta_{j,t})} = \theta_{j,t}$. The matching function in the capital market is also CRTS, so that $m_{SE}((1-\omega_t)k_{S,t}, v_{SE,t}) = M_{SE}((1-\omega_t)k_{S,t})^{\xi_{SE}}(v_{SE,t})^{1-\xi_{SE}}$, $0 < \xi_{SE} < 1$. The probability of finding a self-employed individual from the point of view of the firm is $q(\theta_{SE,t}) = \frac{m_{SE}((1-\omega_t)k_{S,t}, v_{SE,t})}{(1-\omega_t)k_{S,t}}$ and the probability of finding a capital supplier for a self-employed individual is $p(\theta_{SE,t}) = \frac{m_{SE}((1-\omega_t)k_{S,t}, v_{SE,t})}{v_{SE,t}}$.

4.2 Parametrization and Calibration Targets

Parameters Taken from Existing Literature The capital share in salaried sector production is set to 0.33, consistent with the DSGE literature. The model is calibrated to a quarterly frequency, so $\beta = 0.98$. The level of training UB is set to 0.10 as a starting point. The quarterly depreciation rate of capital is set to 0.02. The separation rates for each of the employment states are taken from Bosch and Maloney (2007), who use quarterly data from Mexico's *National Survey of Urban Employment (Encuesta Nacional de Empleo Urbano, or ENEU).*

Table 1. Benchmark Parametrization

Parameter	Value	Parameter description	Parameter source
α_S	0.33	Capital share in production function	DSGE literature
β	0.98	Discount factor	DSGE literature
b_T	0.10	Training UB	Benchmark assumption
δ	0.02	Depreciation rate of capital	DSGE literature
δ^F	0.0296	Formal salaried separation rate	Bosch and Maloney (2008)
δ^I	0.070	Informal salaried separation rate	Bosch and Maloney (2008)
δ^{SE}	0.0374	Separation rate in self-employment	Bosch and Maloney (2008)
ν_F	0.50	Formal worker bargaining power	Search and matching literature
ν_I	0.50	Informal worker bargaining power	Search and matching literature
ν_{SE}	0.50	Self-employed bargaining power	Benchmark assumption
ρ_z	0.90	Autocorrelation of TFP	DSGE literature
τ^h	0.045	Labor income tax rate	OECD taxing wages Mexico
τ^p	0.121	Payroll tax rate	OECD taxing wages Mexico
ξ	0.50	Matching elasticity, labor market	Search and matching literature
ξ_{SE}	0.50	Matching elasticity, capital market	Search and matching literature

We set the separation rate for informal salaried workers to 0.07, which is slightly higher than twice the formal salaried employment separation rate, based on evidence from Bosch and Maloney (2008) and other studies. The bargaining power in all three employment states and the elasticity of the matching function are set to 0.50, consistent with the search and matching literature.[19] Labor income and payroll taxes are taken from the Organisation for Economic Co-operation and Development (OECD) for years 2000 through

[19]Given the presence of labor taxes for formal employment, the effective bargaining power for formal salaried workers is slightly below 0.50.

2008. The autocorrelation of TFP is set according to the DSGE literature, while the standard deviation of the total factor productivity (TFP) shock is calibrated to match the volatility of output in Mexico.

Calibrated Parameters The parameters that are jointly calibrated by solving for the steady state of the model are: $\alpha_n, b_F, \eta_{SE}, \gamma_n, \kappa, M_F, M_I, M_{SE}, \varphi, \psi_F, \psi_I, \psi_{SE}, S$, and σ_z. The calibration targets in Table 2 are expressed in quarterly terms, so that w_F in the table refers to three months of formal wages, since one period in the model represents one quarter. Except for the cyclical moments used to calibrate certain parameters, all targets refer to steady-state variables in the model. All parameters, except for b_T, will be held at their benchmark values when we perform the policy experiments.

We use the wage differential between formal and informal employment from Alcaraz et al. (2008) to set α_n. The value for this wage differential is a lower bound when compared to other estimates in the literature. Since formal workers receive a severance payment when they separate from firms, we set b_F to three months of formal wages. The curvature of project postings is chosen to match the volatility of the transition rate from unemployment into self-employment for Mexico (as reported in Bosch and Maloney, 2008), which we denote by $p^u(\theta_{SE})$. Estimates of the elasticity of substitution between skilled and unskilled labor in developing countries vary widely across the literature. Behar (2009) offers a way to reconcile some of the parameters and finds that, on average, the elasticity of substitution is around 2, which is close to the value for the United States, as estimated by Katz and Murphy (1992). Manacorda, Sánchez-PáRamo, and Schady (2007) suggest that the elasticity can be anywhere between 3 and 5 for Mexico. We take an elasticity of substitution of 2 as our benchmark target to calibrate γ_n and experiment with higher elasticities. Except for values near the upper bound of 5, the results are qualitatively similar.

We use the average shares of formal salaried employment, informal salaried employment, and informal self-employment from the ENEU 1987-2004 to calibrate the matching efficiencies in each of the employment states. We normalize the labor force to one, which yields the targets presented in Table 2.[20] The cost of training per unemployed trainee is set to five times the average formal wage in the model.[21] Posting costs per formal vacancy are set to 3.5 percent of formal wages, as reported in Levy (2007). Since no estimates are available for informal vacancy posting costs, we set the target for the posting cost per informal vacancy to be 3.5 percent of informal wages. What matters is that the cost of posting informal vacancies is lower than the cost of posting formal ones. The cost of posting self-employment projects is set to three months

[20] Shares of informal salaried employment and informal self-employment differ from those reported in Bosch and Maloney (2010). Our targets are obtained by looking at the ENEU and other empirical studies on Mexico by the International Labour Organization (ILO).

[21] While studies on training programs in Mexico have documented much higher costs of training, sometimes close to 10 times the average wage, we run into convergence problems when using higher values for φ.

of informal wages, which corresponds to the startup cost in the construction and personal services sectors in Mexico, as documented by McKenzie and Woodruff (2006).

Table 2 – Calibrated Parameters for Benchmark Targets

Parameter	Value	Parameter description	Target	Target source
α_n	0.674	Formal empl. prod. share	$\frac{w_F}{w_I} = 1.13$	Alcaraz et al. (2008)
b_F	0.923	Formal UB	$b_F = w_F$	Montes-Rojas, Santamaría (2007)
η_{SE}	1.12	Curvature of project postings	$\sigma_{p^u(\theta_{SE})} = 0.094$	Bosch and Maloney (2008)
γ_n	0.500	Elast. of subst., sal. empl.	$\frac{1}{1-\gamma_n} = 2$	Behar (2009)
κ	0.076	Cost of training, household	$u_T = 0.20u$	Delajara et al. (2006)
M_F	0.086	Formal matching efficiency	$n_F = 0.50$	ENEU 1987-2004, ILO
M_I	0.337	Informal matching efficiency	$n_I = 0.22$	ENEU 1987-2004, ILO
M_{SE}	0.041	SE matching efficiency	$n_{SE} = 0.23$	ENEU 1987-2004, ILO
φ	4.616	Cost of training, gov.	$\varphi = 5w_F$	Benchmark Assumption
ψ_F	0.032	Formal vacancy cost	$\psi_F = 0.035w_F$	Levy (2007)
ψ_I	0.029	Informal vacancy cost	$\psi_I = 0.035w_I$	Benchmark Assumption
ψ_{SE}	0.817	Project posting cost	$\psi_{SE} = w_I$	McKenzie, Woodruff (2006)
S	0.923	Firing cost	$S = w_F$	Montes-Rojas, Santamaría (2007)
σ_z	0.0164	Standard dev. of TFP	$\sigma_y = 0.0217$	Lama and Urrutia (2012)

The firing cost is set to three monthly formal wages, following the evidence on severance payments in Montes-Rojas and Santamaría (2007). This firing cost finances formal UB. The standard deviation of TFP is set to match the volatility of total output for Mexico, as reported by Lama and Urrutia (2012). Delajara, Freije, and Soloaga (2006) find that, during 1999 and 2000, around 20 percent of the unemployed workers in Mexico were in training programs. We set κ, such that 20 percent of the unemployment rate is comprised of unemployed individuals in training.

5 Simulation Results

We log-linearize the model around the non-stochastic steady state and compute a first-order approximation of the equilibrium conditions, where we perform all simulations using the software platform, Dynare. For the dynamic simulations, the model economy is simulated for 188 periods. We eliminate the first 100 periods and use the Hodrick-Prescott (HP) filter, with smoothing parameter 1600, to filter the simulated

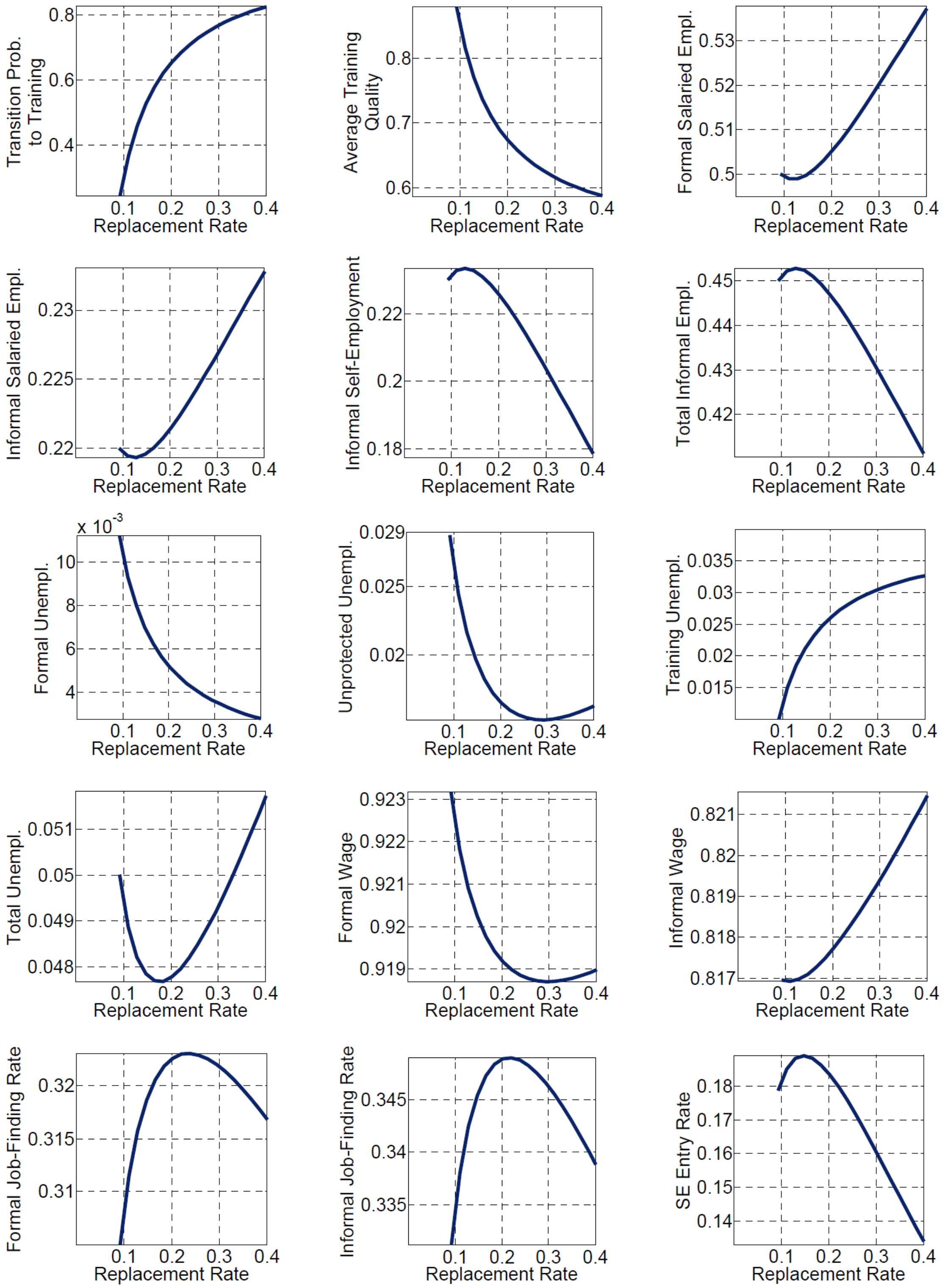
data and compute the moments of interest. The main experiments we perform are changes in b_T. This parameter takes values between 0.10 and 0.42, which correspond to replacement rates of roughly between 9 percent and 40 percent of formal wages in the model. These replacement rates are in line with the rates documented in Vodopivec (2009) for developing countries.

5.1 Steady State of the Model

Figure 1 shows how the steady state of particular labor market variables can vary in response to changes in the replacement rate in training unemployment. The replacement rate in Figure 1 is expressed as a share of formal wages. Employment and unemployment are expressed as a percent of the labor force. Note that changes in b_T are first reflected in wages and the rental rate on capital for the self-employed. Changes in sectoral wages and the rental rate affect certain values: the surplus value of a match for both households and firms; the value of hiring workers and supplying capital from the salaried firms' perspectives; and the household's value of posting projects.

Impact of b_T on formal wages and formal employment Increasing training UB leads to a reduction in the formal wage and to higher steady-state formal employment. This result stands in contrast with the standard effect that higher UB have on wages in search and matching models. To understand the intuition behind the impact of b_T on formal wages, it is useful to take a look at each of the elements comprised in the formal wage separately, and consider the partial equilibrium effect of each of these components on formal wages. Recall that the threshold value for idiosyncratic program quality is given by $b_T = \frac{\kappa}{\widetilde{a}_{T,t}}$, where κ is a fixed parameter. Thus, an increase in b_T decreases $\widetilde{a}_{T,t}$. The figures above show that a fall in $\widetilde{a}_{T,t}$ increases the conditional probability of moving into training and decreases the average quality of the training program, where the latter is given by $H(\widetilde{a}_{T,t})$. This last fact implies that the average participation cost in the training program, $\frac{\kappa}{H(\widetilde{a}_{T,t})}$, increases with b_T. Then, the impact on formal wages, due solely to an increase in b_T, is smaller than the increase in b_T itself because of the simultaneous increase in the effective participation cost in the program, $\frac{\kappa}{H(\widetilde{a}_{T,t})}$. This follows directly from the fact that the net contemporaneous benefit in training is given by $\left(b_T - \frac{\kappa}{H(\widetilde{a}_{T,t})}\right)$.

Figure 1: Steady State and Replacement Rate in Training Unemployment



Since the threat point for formal workers is $[F(\widetilde{a}_{T,t})\mathbf{W}_{UF,t} + (1 - F(\widetilde{a}_{T,t}))\mathbf{W}_{T,t}(a_{T,t})]$, the net training

UB will be given by $(1-F(\widetilde{a}_{T,t}))\left(b_T-\frac{\kappa}{H(\widetilde{a}_{T,t})}\right)$. In the simulations, this last term is increasing in b_T, which puts upward pressure on formal wages. Ceteris paribus, this decreases the surplus from hiring salaried workers and pushes firms to reduce formal vacancies, and therefore to decrease formal salaried employment.

The fact that the threat point is a weighted average of $\mathbf{W}_{UF,t}$ and $\mathbf{W}_{T,t}(a_{T,t})$ also implies that formal UB enter the formal wage equation through the term $[F(\widetilde{a}_{T,t})b_F]$. Since an increase in b_T reduces $F(\widetilde{a}_{T,t})$, the effective value of formal UB in the formal wage equation—given by $F(\widetilde{a}_{T,t})b_F$— falls. Holding everything else constant, this puts downward pressure on formal wages, thereby pushing firms to increase formal vacancies and expand formal salaried employment.

The discussion so far suggests that the partial equilibrium impact of changes in b_T that arise from the term $\left[F(\widetilde{a}_{T,t})(b_F)+(1-F(\widetilde{a}_{T,t}))\left(b_T-\frac{\kappa}{H(\widetilde{a}_{T,t})}\right)\right]$ in formal wages is ambiguous. To understand why an increase in b_T ultimately reduces formal wages and increases formal employment, note that formal vacancies are more sensitive to changes in b_F relative to changes in b_T. In other words, the increase in formal vacancies that results from a fall in $F(\widetilde{a}_{T,t})b_F$ more than offsets the fall in formal vacancies coming from an increase in $(1-F(\widetilde{a}_{T,t}))\left(b_T-\frac{\kappa}{H(\widetilde{a}_{T,t})}\right)$. This is the case for two reasons. First, the value for b_F is very high, so any effective decrease in the influence of b_F on formal wages will lead to a larger response by salaried firms. Second, the rise in b_T is partially offset by the increase in the effective resource cost of participating in the program, $\frac{\kappa}{H(\widetilde{a}_{T,t})}$. The net rise in formal vacancies suggested above increases formal and informal labor market tightness, but only initially, since unemployment falls with low values of the replacement rate as salaried employment increases. However, it begins to rise again as the fall in self-employment offsets the rise in salaried employment for higher values of the replacement rate.

The initial surge in vacancies also reduces the marginal product of formal labor as formal employment expands. This puts downward pressure on wages. Furthermore, the increase in formal vacancies, coupled with the downward pressure on the self-employment capital rental rate due to a higher b_T, pushes salaried firms to devote less physical capital to matching, thereby reducing the probability of entering self-employment. This effectively reduces the availability of the self-employment outside option for workers, and hence puts downward pressure on wages. This creates two effects: (1) a direct effect of b_T on formal wages through changes in the effective value of formal and training UB and (2) an indirect effect that comes from the impact of b_T on the self-employment capital rental rate, which in turns affects the firm's decision to supply capital , and thus the ease of entry into self-employment for the unemployed. The change in the likelihood of becoming self-employed alters one of the possible outside options for salaried workers, and hence affects formal wages. In the end, firms decide to supply less capital to the self-employment

sector (and hence use more capital in production) since the self-employment capital rental rate falls with b_T, which raises the marginal product of salaried labor in the salaried sector. This result further bolsters formal and informal salaried vacancy postings.

Note that even as the value of training unemployment rises with b_T, the negative relationship between formal wages and the replacement rate begins to revert slowly for high levels of b_T. Even though wages begin to rise after initially falling with b_T, formal vacancies are still above their initial value when the replacement is 40 percent of formal wages, which evidences that formal employment and the replacement rate are positively related.

Impact of b_T on informal wages and informal employment The direct effect of b_T that was just described for formal wages is no longer present for informal wages. An increase in b_T puts upward pressure on informal wages, even as the effective cost of participation in training, $\frac{\kappa}{H(\widetilde{a}_{T,t})}$, increases with b_T. To see why informal wages are increasing in b_T, note that training benefits enter explicitly in the informal wage equation through $\left[(1-F(\widetilde{a}_{T,t}))\left(b_T-\frac{\kappa}{H(\widetilde{a}_{T,t})}\right)\right]$, since the threat point in the bargaining problem is a weighted average of the value of both unprotected and training unemployment. More importantly, this term no longer includes formal UB. Holding everything else constant, higher training UB will put upward pressure on informal wages. This is only one of the effects behind the positive relationship between informal wages and b_T. As perviously mentioned, labor market tightness in each type of salaried employment is initially increasing in b_T, which puts additional pressure on wages. For informal wages, both b_T and labor market tightness go in the same direction and lead to an increase in the wage. In principle, we would expect informal vacancies to fall. However, the higher level of formal employment generated by a higher b_T causes the marginal product of informal labor to increase, and this more than offsets the higher informal wage, so the contemporaneous value of an informal worker rises with b_T. This is further bolstered by the fact that, as we pointed out above, firms use more capital in the salaried sector, since they supply less capital to the self-employment sector. This explains the increase in informal salaried employment, even though informal wages are higher. The fact that formal and informal salaried employment enter jointly in the production function as imperfect substitutes also explains why informal salaried employment increases with b_T.

Impact of b_T on self-employment earnings and self-employment Even though we observe a positive relationship between self-employment earnings and b_T—an effect that is solely due to a drop in the Nash rental rate—households decide to post less self-employment projects. This takes place because salaried firms have increased formal salaried employment, which pushes firms to reduce their supply of

capital for matching. In turn, the probability of finding a capital supplier decreases and the expected cost of posting self-employment projects increases. Furthermore, training UB put downward pressure on the rental rate, since an increase in this policy parameter effectively raises the outside value for individuals facing self-employment. Finally, the falls in both postings of self-employment projects and the supply of capital to the self-employed reduce the share of informal self-employment in the economy.[22] Those who remain in self-employment enjoy higher earnings.

Impact of b_T on formal unemployment Since the rise in b_T decreases formal wages initially and increases the value of having formal workers in the firm, formal employment expands. For a fixed formal separation rate, this would increase formal unemployment. However, note that the probability of transitioning to training also affects the inflow into formal unemployment. Since b_T increases this probability, the steady-state level of formal unemployment will decrease, as more separated formal workers transition directly into training unemployment and move away from formal unemployment.

Impact of b_T on unprotected unemployment One of the most interesting effects of changes in UB is their effect on unprotected unemployment. Increasing b_T leads to a fall in unprotected unemployment. Thus, without assuming anything about the success of training programs in terms of raising productivity, the model shows that unprotected unemployment will fall as training UB increases. This fall—which is due to the higher probabilities of both entering training unemployment and finding a job in salaried employment, arising from higher salaried labor market tightness—generates a reallocation within total unemployment from unprotected unemployment to training unemployment. Note that the fall in unprotected unemployment holds even though it is now more difficult for the unemployed to transition into self-employment.

Impact of b_T on training unemployment and total unemployment Unsurprisingly, raising b_T leads to an increase in training unemployment, as the net contemporaneous value of training UB increases. Finally, consider what happens to total unemployment. For low levels of the replacement rate, the initial increase in formal and informal salaried employment more than offset the fall in informal self-employment, which explains why total unemployment drops when the replacement rate increases to 20 percent of formal wages. Eventually, however, the response of informal self-employment is much stronger than the change in formal salaried employment, such that total unemployment begins to rise. Naturally,

[22]This result is similar to the one in Kumar and Schuetze (2007), who show that increasing standard UB reduces self-employment entry, and hence also reduces self-employment rates. In contrast to their results, earnings in self-employment rise, and as evidenced below, unemployment changes only marginally.

the increase in total unemployment, albeit small, is due to the inflow of separated workers into training unemployment. However, the composition of unemployment has shifted from having a large fraction of individuals in unprotected unemployment—close to 60 percent of those unemployed—to having a large fraction in protected unemployment.

Impact of b_T on job-finding probabilities As suggested above, increasing b_T leads to an initial increase in the job-finding rates for both formal and informal employment. The case for formal employment is clear. An increase in b_T increases the value of posting formal vacancies and decreases unemployment, which in turn leads to an rise in formal market tightness, and therefore increased formal job-finding rates. The case for informal employment is more subtle. There are two effects working to raise the job-finding rate when we increase b_T. The first comes from the higher value of posting informal vacancies. While this seems counterintuitive, since informal wages are higher, the fact that formal employment and the amount of capital used in production are higher increases the marginal product of informal salaried employment. The net effect is a rise in the value of having an informal salaried worker. The quantitative response of salaried vacancies to changes in training UB becomes more subdued as the replacement rate rises. While total unemployment initially falls, it eventually starts rising as more people move into training unemployment. This leads to a fall in the job-finding probabilities for salaried employment. Finally, the probability of entry into self-employment is explained by the behavior of the supply of capital. As we increase b_T, the value of devoting capital to matching falls, which pushes salaried firms to devote less capital to outside ventures, and consequently the probability of finding a capital supplier falls.

The importance of idiosyncratic training quality To determine the impact of idiosyncratic training program quality, we shut down the link between training UB and the threshold value for idiosyncratic training quality, $\widetilde{a}_T$. This effectively fixes $F(\widetilde{a}_T)$ and $H(\widetilde{a}_{T,t})$. As it turns out, allowing for changes in the threshold quality of the training program due to b_T is critical to account for the steady-state results when we vary b_T in the benchmark simulation. This is immediately clear if we revisit how changes in b_T affect vacancy postings, job-finding probabilities, and formal employment creation. Indeed, one of the key mechanisms through which b_T lowers formal wages and bolsters vacancy postings would be absent if $\widetilde{a}_T$ is fixed. In this case, we would still observe a fall in the entry rate into self-employment, as well as an increase in total unemployment and a decrease in job-finding rates for salaried employment.

The importance of accounting for informal self-employment To determine the role of self-employment in the model, we shut down the self-employment channel and combine the measure of self-

employed with that of informal salaried workers. The general results remain qualitatively similar for certain variables. However, it is important to account for self-employment to identify changes in the composition of employment in the economy in response to policy variations. Indeed, without self-employment, increasing the replacement rate leads to a very small rise in formal salaried employment and to a drop in informal salaried employment. The net effect on total unemployment is different in the two models. The model without self-employment yields an increase in unemployment of 0.6 percentage points, which contrasts with the small change in total unemployment in the benchmark model. Recall that in the version with self-employment, we observe a larger rise in formal salaried employment, a small increase in informal salaried employment, and a large fall in informal self-employment. Hence, higher benefits in the benchmark model yield an economy with higher steady-state formality, and a much lower measure of total informal employment, which is due mainly to a reduction in self-employment. Conversely, a model without self-employment would predict a small fall in informal salaried employment and a marginal rise in formal employment. Formal wages still fall, but they are no longer influenced by the probability of entry into self-employment. This last element helps keep formal wages below their initial level as we increase the replacement rate.

Summary of results The main results of the benchmark simulations can be summarized as follows. Changes in training UB have two effects. The first is a direct effect on formal wages by changing the effective value of formal and training UB in the formal wage expression. The second is an indirect effect on the rental rate of self-employment capital, which affects the use of capital in the salaried sector, and hence the self-employment outside option. A higher stipend in training unemployment lowers the rental rate on self-employment capital, pushes firms to reduce the supply of capital to the self-employed, and increases the use of capital in the salaried sector. This raises the marginal productivity of formal and informal salaried labor, and at the same time reduces the entry rate into self-employment. The latter puts downward pressure on wages, while the former bolsters vacancy postings. Changes in formal wages and the productivity of salaried labor affect the value of hiring workers in salaried positions, as well as the value of allocating capital outside of the salaried sector. Firms increase vacancy postings and reduce capital supply to the self-employed, thereby causing a rise in salaried employment , and thus an increase in job-finding probabilities for salaried employment and a decrease in informal self-employment, which causes a fall in total informal employment. In the end, formal wages exhibit a slight fall, while earnings in informal salaried employment and informal self-employment are higher when the stipend in training unemployment rises. Overall, the policy change leads to positive labor market outcomes in the economy.

5.2 Volatility of Key Labor Market Variables

This section provides a brief discussion of the implications of increasing UB for the volatility of particular labor market variables in the model. It highlights particular results that may be relevant to consider when thinking about modifying the generosity of UB for those in both formal and training unemployment.

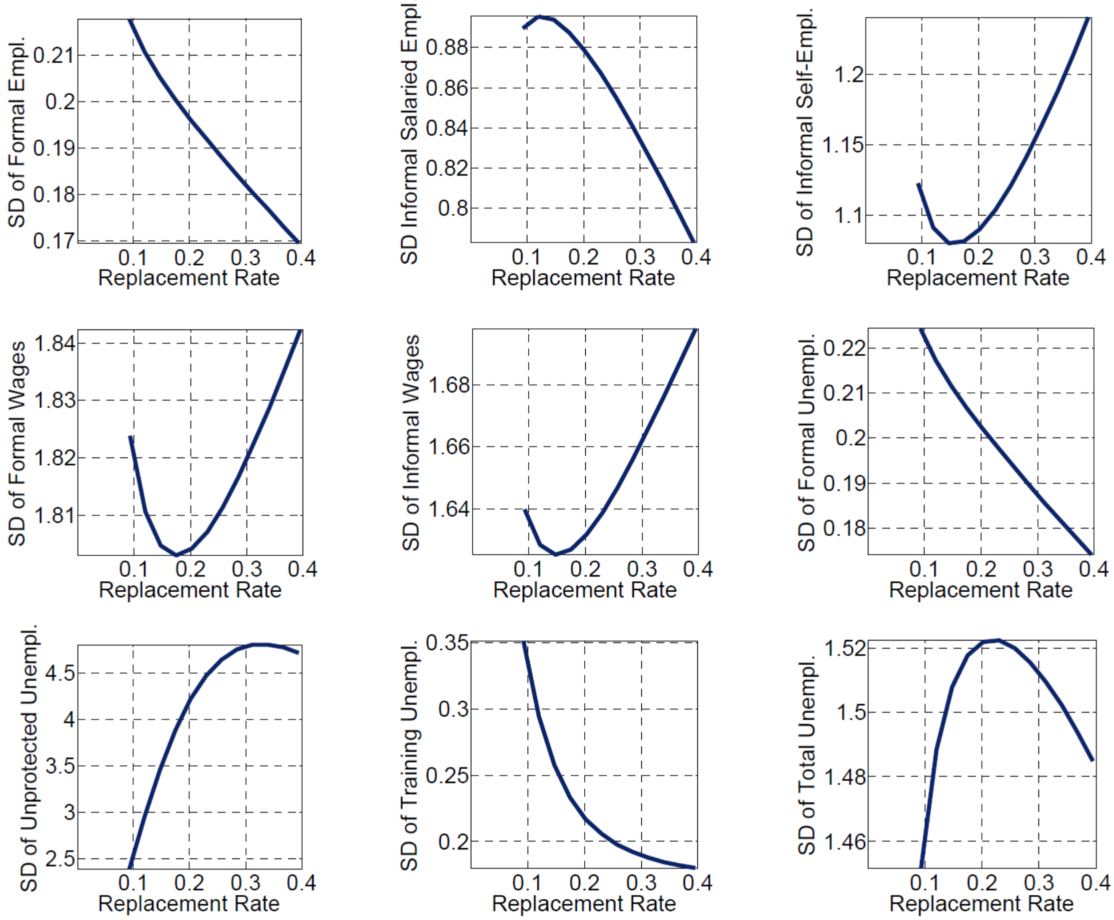
Impact on formal salaried employment volatility Consider the impact of changes in b_T on the volatility of formal employment. As the results in the steady-state analysis suggest, increasing b_T leads to a reduction in formal wages. This leads to an increase in the value of a formal match and pushes firms to post more formal vacancies. In turn, firms become less responsive to productivity shocks. Higher training UB lead to lower volatility in formal vacancies and to lower formal employment volatility. We have not explicitly addressed the consequences of the volatility of labor and capital market tightness on wage and employment volatility. The volatility of capital and salaried labor market tightness is decreasing in b_T. However, recall that capital market tightness and formal wages are inversely related. Thus, the impact of lower capital market tightness and lower labor market tightness go in opposite directions. In the benchmark calibration, the latter more than offsets the former, such that formal salaried employment volatility falls. For the replacement rates considered in this experiment, the volatility of formal salaried employment falls by 23 percent.

Impact on informal salaried employment volatility As suggested in the steady-state analysis, the value of informal salaried workers from the firm's perspective is increasing in b_T due to the influence of formal employment on the marginal product of informal labor. This directly affects the value of a match. As was the case for formal salaried employment, the volatility of informal salaried employment is decreasing in the replacement rate, leading a reduction in volatility of 11 percent.

Impact on self-employment volatility Recall that increasing b_T leads to higher self-employment earnings (or equivalently, a lower rental rate) in steady state. This implies that the value of a capital match from the firm's perspective is lower, which makes self-employment project postings and the supply of capital more volatile for a given set of productivity shocks. Hence, the volatility of informal self-employment is increasing in b_T and rises by 10 percent when the replacement rate changes from 10 percent to 40 percent of wages.

Impact on the volatility of unemployment The main focus of this paper is to investigate the consequences of unemployment protection schemes on unprotected unemployment. Thus, an analysis of

Figure 2: Volatility of Key Variables for Different Levels of the Replacement Rate in Training Unemployment



the effect of policy changes on the variation in unprotected unemployment for different levels of UB may be relevant for policymakers. Also, understanding the changes in the volatility of training unemployment, depending on the generosity of benefits, might help determine the variation in expenditures on training programs over the business cycle. This would also allow us to get a sense of the short-run or cyclical fiscal consequences of policy changes.

The model shows that increasing b_T unambiguously increases the volatility of unprotected unemployment and decreases the volatility of training unemployment. The relationship between b_T and the volatility of unprotected unemployment can be explained by the rise in the volatility of self-employment, as well as the covariance terms among the three different types of employment. Even though the model cannot quantitatively capture the volatility of unemployment in the data, the numerical experiments we perform by changing b_T are still informative. Increasing the replacement rate from 9 percent to close to 40 percent

of formal wages almost doubles the volatility of unprotected unemployment and halves the volatility of training unemployment. Thus, the impact of changes in the level of training benefits on training and unprotected unemployment volatility may not trivial. Overall, there is no clear monotonic relationship between the replacement rate in training unemployment and aggregate unemployment volatility, but we can assert that the change in total unemployment volatility is negligible.

5.3 Impulse Response Functions

One of the main objective of training in our model is to protect workers against unemployment risk. In this regard, it is useful to analyze whether the dynamic response of aggregate unemployment, as well as its components, respond differently to a negative aggregate productivity shock to the economy. Figure 3 presents the impulse responses of total unemployment, training unemployment, and unprotected unemployment for three different levels of b_T.

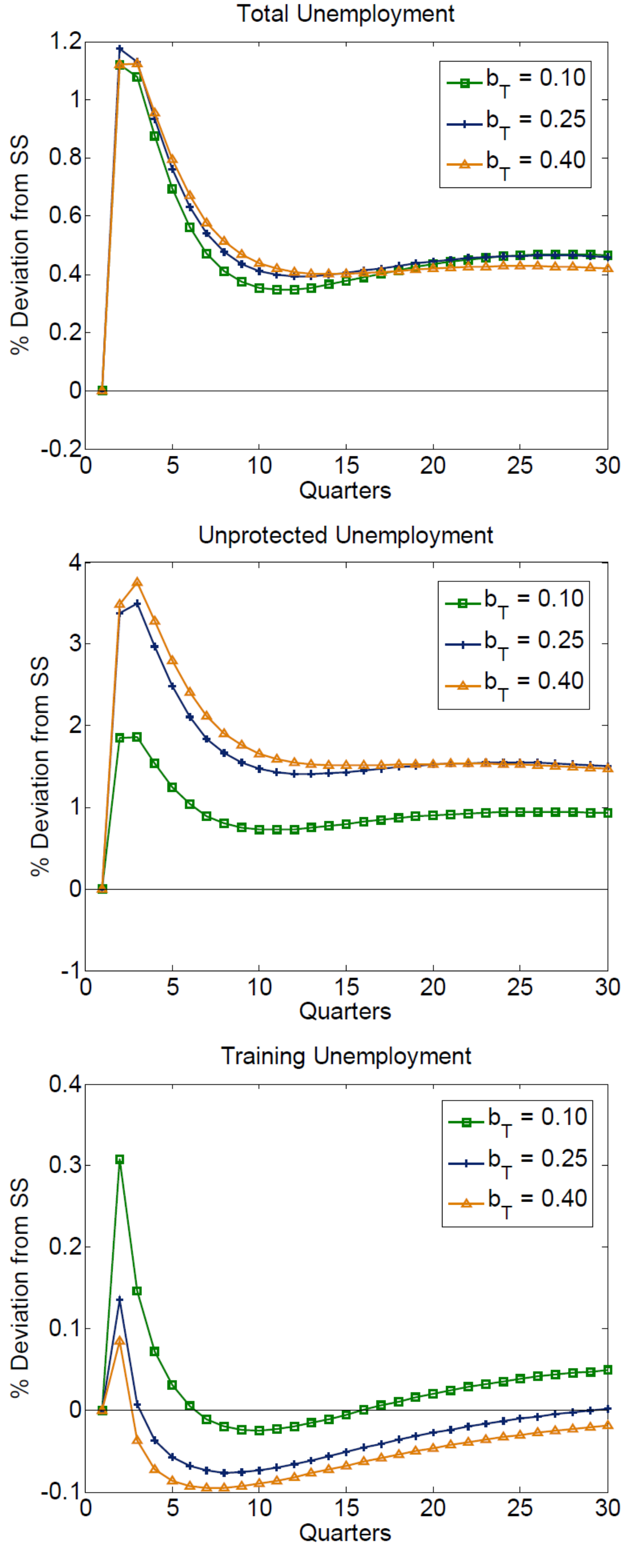
The impact responses are in line with the results from the previous section. The volatility of total unemployment barely changes with the replacement rate, while the volatility of unprotected unemployment rises with the replacement rate in training unemployment. Conversely, the volatility of training unemployment falls with the replacement rate in training. Note, that the response of total unemployment in the aftermath of the shock is virtually identical across simulations. However, there are important differences in the responses of the varied components of total unemployment. The sharp reversal of the rise in training unemployment after the shock simply reflects the fact that training only lasts for a single period. Given this fact, those workers who spent a period in training unemployment, but could not match with a salaried firm, move into unprotected unemployment, thereby making the rise in unprotected unemployment more persistent.

5.4 Some Robustness Tests

Changes in the variance of idiosyncratic training quality The main results of the paper depend critically on the way we introduce training quality into the model. To determine how sensitive the steady-state results are to the assumption that $a_{T,t}$ is uniformly distributed over the range $[0, 1]$, we simulate the model using a range of $[0, 4]$.[23] The steady-state results remain qualitatively the same. One of the major differences is in the quantitative response of the variables to changes in UB. The model with $a_{T,t} \sim U[0, 4]$ is somewhat more sensitive to changes in b_T, thereby yielding slightly larger quantitative changes. One of

[23] Assuming that $a_{T,t} \sim U[0, 2]$ yields quantitative results that are virtually identical to those from the benchmark simulation.

Figure 3: Impulse Response Functions: Negative Aggregate Productivity Shock



the key mechanisms in the model—mainly, the effect of b_T on wages—is unaltered, since, when we increase b_T, we still obtain an increase in formal employment; falls in unprotected unemployment, informal self-employment, and total informal employment; and an increase in training unemployment.

Longer training programs In the benchmark model, we assume that workers can stay in training unemployment for a single period. We can modify the model and allow them to stay in training if they fail to find employment, depending on the threshold training quality next period. This effectively makes the probability of staying in training for more than one period non-zero. In other words, the value of training becomes[24]

$$\begin{aligned}
\mathbf{W}_{T,t}(a_{T,t}) &= b_T - \frac{\kappa}{a_{T,t}} \qquad (41)\\
&+E_t\Xi_{t+1|t}\left(\begin{array}{c}
(1-\delta^F)p(\theta_{F,t})\mathbf{W}_{F,t+1} + (1-\delta^I)p(\theta_{I,t})\mathbf{W}_{I,t+1} \\
+(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})\mathbf{W}_{SE,t+1} \\
+[1-(1-\delta^F)p(\theta_{F,t}) - (1-\delta^I)p(\theta_{I,t}) \\
-(1-\delta^{SE})v^u_{SE,t}p(\theta_{SE,t})][F(\widetilde{a}_{T,t+1})\mathbf{W}_{U,t+1} + (1-F(\widetilde{a}_{T,t+1}))\widetilde{\mathbf{W}}_{T,t+1}]
\end{array}\right)
\end{aligned}$$

The steady-state results are qualitatively similar to those in the benchmark model, except for the impact of total unemployment and formal wages. The total unemployment rate is more responsive to changes in the replacement rate, increasing from 5 percent to 5.6 percent. Also, while formal wages do fall, the fall as the replacement rate increases is not monotonic. This causes salaried vacancies to exhibit an inverted U-shaped response to an increase in b_T. Thus, for low values of b_T, the probabilities of finding salaried jobs do increase with the replacement rate. Finally, given the steady-state behavior of formal wages, the volatility of training unemployment and total unemployment are increasing in the replacement rate.

Allowing formal workers to keep the full severance payment One key assumption in the bargaining process for formal workers is that the threat point is a convex combination of the values of both formal and training unemployment. As argued above, we consider this to be a reasonable assumption to capture the fact that, in the real world, the threat point of workers may change depending on the value of social protection (in this case, training programs). If we were to use the value of formal unemployment as the threat point (as opposed to the convex combination), the quantitative impact of changes in training UB on formal wages (and hence on formal employment) would be weakened. Higher training UB would

[24]The laws of motion for each unemployment state would change accordingly.

still push salaried firms to reduce the supply of capital to the self-employment sector, since the outside option of the self-employed rises, but one important element that determines formal wages is the outside option in unemployment. By modifying the threat point of workers, we affect the level of influence the change in benefits would exert on formal wage determination. Hence, while the threat point for formal workers in the benchmark model appears to be reasonable, it should not be considered to be fully robust to alternative assumptions. However, the effect of changes in training UB on self-employment would remain qualitatively intact.

6 Conclusions

This paper analyzes the static and dynamic consequences of increasing unemployment protection to workers through conditional transfers programs based on training programs for the unemployed. To do so, we use a business cycle search and matching model with formal salaried employment, informal salaried employment, and frictional and endogenous entry into informal self-employment. We consider training programs to be particularly well-suited to implement conditional UB transfers to informal workers, since they provide a simple way to avoid giving such benefits to individuals who may simultaneously work in the informal sector. Based on existing evidence, these programs tend to have a positive impact on the labor market by increasing job-finding rates, leading unemployed workers to more stable employment opportunities, and reducing the exposure of workers to unemployment risk. Following Reichling (2005), we allow for idiosyncratic training quality, such that responses to changes in training UB affect the probability of unemployed workers transitioning into training.

Calibrating the model to match particular features of the Mexican labor market, we show that increasing training UB can increase the probabilities of finding a job in salaried employment. The increase can also lead to higher steady-state levels of formal employment and lower levels of total informal employment, which are driven by a fall in informal self-employment. The mechanism through which changes in training UB yield these results resides in the way these benefits affect formal wages, the return to lending capital to the self-employment sector, and in turn the value of posting vacancies for salaried positions. We find that increasing training UB causes a small decrease in formal wages and an increase in the marginal product of salaried labor, as salaried firms tend to reduce the capital rented to the informal self-employed. Both changes increase the value of posting formal vacancies and foster formal job creation. An increase in the replacement rate in training unemployment from 10 percent to 40 percent of formal wages leads to an increase in formal employment of more than 3 percentage points and to a reduction in total informal

employment of 3.5 percentage points, where the fall in the latter is driven by a large reduction in informal self-employment. Furthermore, a more generous stipend in training decreases unprotected unemployment by more than 1.5 percentage points, with negligible changes in total unemployment.

Overall, expanding unemployment protection to informal workers through training programs offers a way to improve labor market outcomes, and at the same time offers protection to informal workers. While the numerical experiments suggest that increasing training UB can yield positive labor-market outcomes, in terms of higher job-finding probabilities in formal and informal salaried employment; more formality; and relatively small changes in unemployment, we find that implementing this policy sharply increases the volatility of unprotected unemployment. However, this increase is accompanied by a reduction in the volatility of salaried employment, as well as in both formal and training unemployment. The changes in volatility that result from expanding unemployment protection to informal workers may be important for policymakers to consider, since these policy changes have clear implications for the volatility of expenditures on training programs and the aggregate volatility in the economy.

The model abstracts from many features that may modify the main conclusions of this paper. Thus, a number of important caveats are in order when thinking about using training programs as conditional transfer programs. Ultimately, the impact of training participation on wages is an empirical issue. However, the model does suggest a number of previously unexplored channels through which a scheme offering conditional UB could have positive labor market outcomes. In particular, the results highlight the importance of allowing for endogenous changes in informal self-employment in response to policy modifications. Hence, the simulations of the model suggest that more attention should be paid to the different employment states in the region, in particular informal self-employment. This is one of the most important messages of the paper. Outside options play a key role in determining how agents will respond to policy changes, so we also need to deepen our understanding of what implications the various outside options in the labor market, both in employment and unemployment, could have for the success of particular policy interventions. To keep the model tractable, we abstract from endogenous separations in salaried employment and self-employment. This arguably limits the model's strength in analyzing the impact of policy changes on the volatility of unemployment, since, as Bosch and Maloney (2008) suggest, the volatility of separation rates in the informal sector explains an important share of the total variation in unemployment. In this sense, the model may not give a complete picture of the impact of particular policy changes on unemployment volatility.

Moreover, the model in its current form cannot properly address the fiscal viability of expanding the training programs to offer a more universal and voluntary form of unemployment protection, since other

constraints on the side of the government may be at play. Indeed, we took as given the present fiscal structure based on payroll and labor income taxes. We consider this to be a weakness of the model, even though the focus of this paper is not to analyze the costs and benefits of different fiscal schemes that could support an expansion in unemployment protection programs. In this sense, introducing a more explicit role for the government in the model may be useful to determine whether the consequences of the types of unemployment protection schemes we study still hold in an environment where the government makes explicit decisions along with other agents in the economy. This extension would also allow us to explore the fiscal viability of these types of protection schemes in a more suitable environment.

Finally, our description of activity in the self-employment sector is very simple in order to have a clean picture of the labor market. The downside of this approach is that we abstract from the large degree of heterogeneity that characterizes self-employment. It may be the case that some self-employed workers rely less on external finance, and this would modify the results in the benchmark model. We plan to explore these issues, as well as other relevant modifications, in future work.

7 Appendix

7.1 Two Illustrative Examples of Self-Employment in the Model Economy

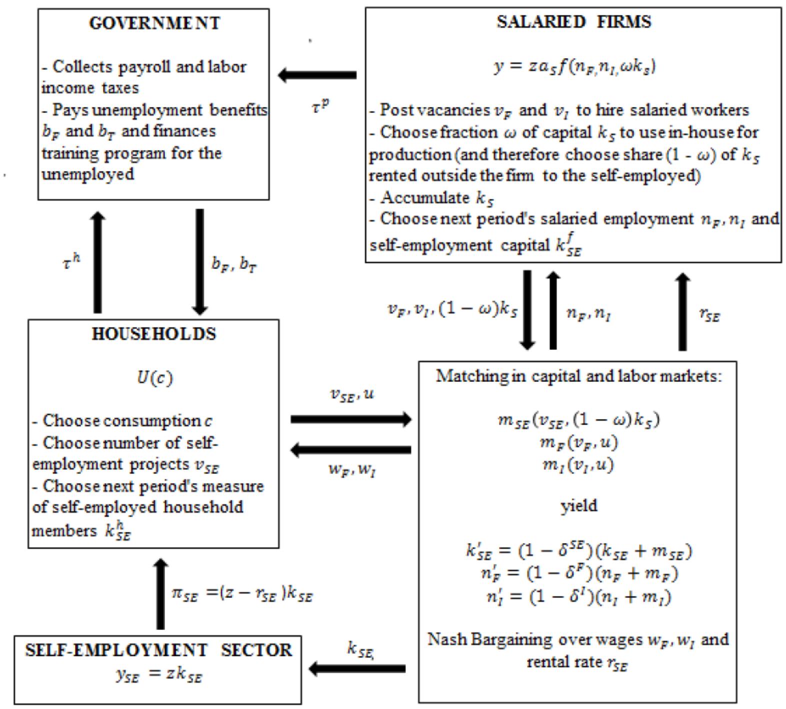
Example 1. Antonio is a middle-aged man living in Mexico City. Everyday, he wakes up early to run his small shop in the "Mercado de la Ciudadela,"where he sells all types of wooden craftworks and other artisan products to tourists and locals. Before becoming an artisan, Antonio worked at a small retail shop in the outskirts of the city. While working there, he accumulated enough savings to start his own artisan shop, which was a dream of his ever since he was young. Before opening his shop, though, he had to find an input supplier that was willing to support his small business venture by selling him the specific wood and other inputs he needed to start production. Everything was done on credit, since Antonio had spent part of his startup money trying to find a reliable supplier and the rest on the down payment for the space he found (after looking at various options) at la Ciudadela. Thus, Antonio receives wood and rents some of the equipment necessary to treat the wood from his suppliers. At the end of every month, he gives the suppliers a portion of his earnings to pay for the inputs. However, the agreements Antonio has with his suppliers may end for a variety of reasons, ranging from the state of the economy, to various idiosyncratic factors pertaining to the informal contracts he established with the suppliers when he decided to become an independent worker. Finally, we note that Antonio generally works on his own, as he is happy with his earnings and has no intention of expanding his business by hiring salaried workers. When there are seasonal spikes in tourism and, hence higher demand, Antonio's family members help him run the shop.

Example 2. During a downturn in economic activity, after only a few months on the job, María is laid off from her informal salaried job at a small hardware store in Bogota. Being a single mother, she cannot stay unemployed for long, so she asks her neighbors and family members for a small loan to start a business selling fresh fruit and juice downtown. Combining her savings and the loan, she looks for small firms in the same sector that would rent her a cart, as well as a wholesale supplier of fruit and other necessary inputs. Since María is financially constrained, and cannot ask for a bank loan without adequate income documentation, she has to find a reliable input supplier that is willing to establish a long-term buyer-supplier relationship (unreliable suppliers would make the business venture too risky, so investing in finding a good supplier is important). Once she finds a supplier, María and the small firm renting her the cart agree that María will pay rent for the cart at the end of each month. She will also be receiving the fruit she needs daily at wholesale prices, and will pay her supplier at the end of the month once she has enough earnings to cover costs. If María is unable to pay on time, or if the supplier finds a more

profitable alternative (or goes out of business), the buyer-supplier relationship will end, and María will have to either look for another input supplier, look for a salaried job (either formal or informal), or enter unemployment.

7.2 Structure of the Model Economy, Timing of the Model, and Transitions from Employment

Figure 4: Structure of the Economy



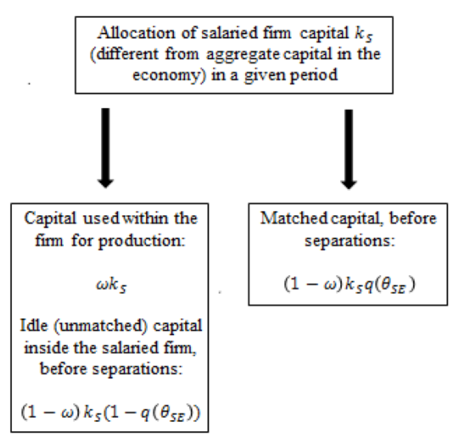


Figure 5: Timing of Events

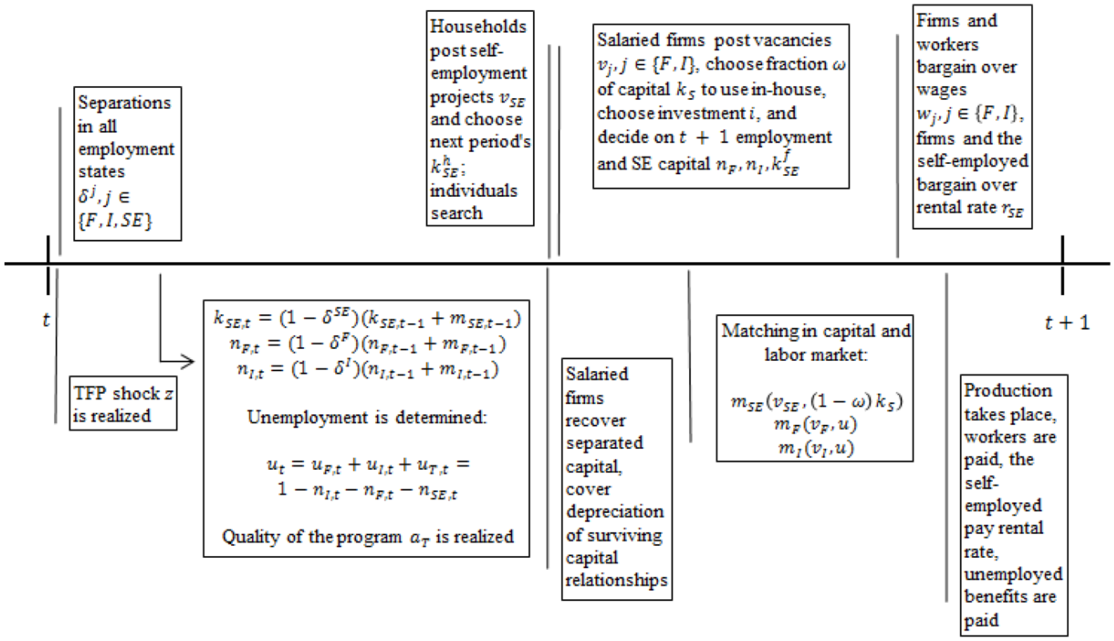
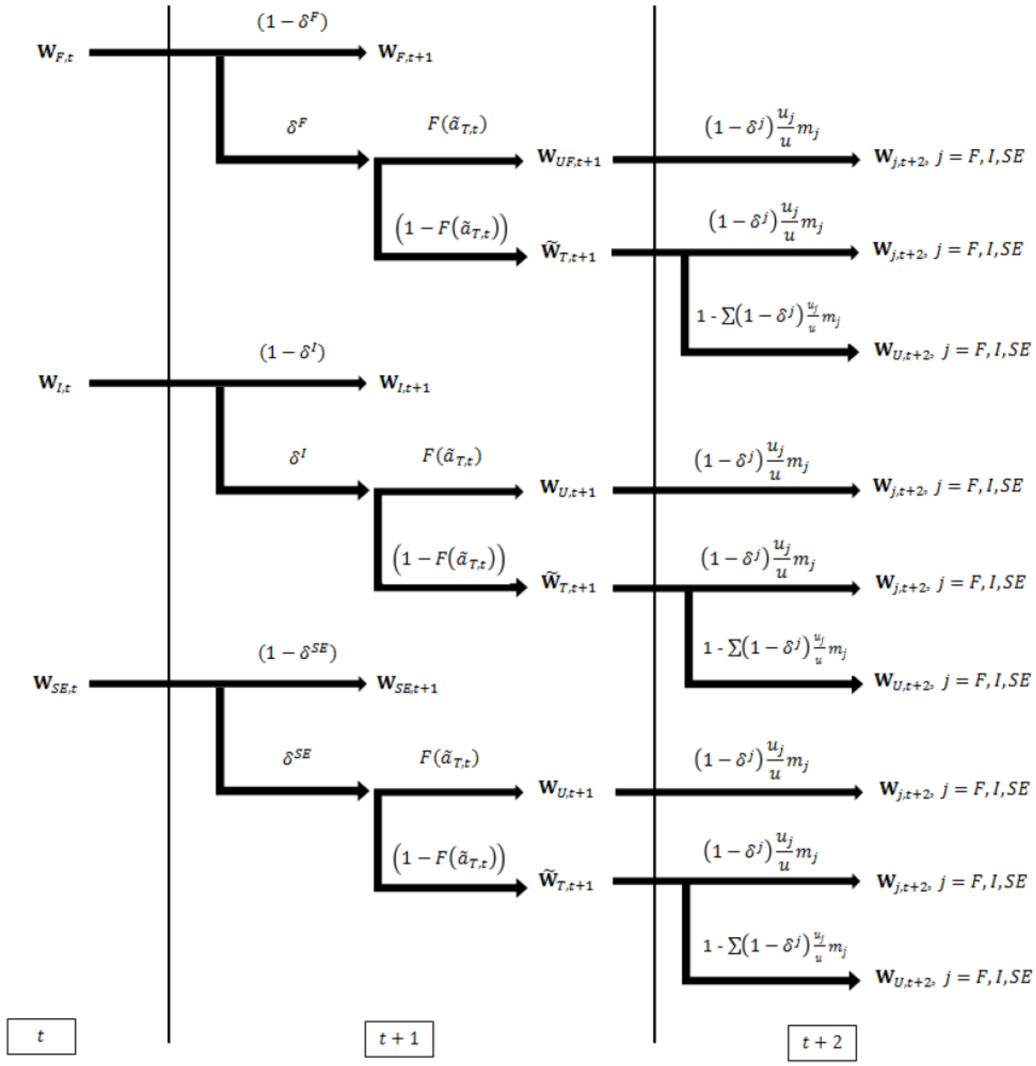


Figure 6: Example of Transitions from Employment



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