Product Market Regulation, Firm Selection and Unemployment*

Preliminary Version

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Abstract

We analyze the effect of Product Market Regulation (PMR) on unemployment in economies with search frictions and heterogenous multiple-worker firms. The analysis uncovers a new effect whereby regulation truncates the distribution of firm productivities and consequently affects the equilibrium rate of unemployment. Lower period-by-period regulatory costs increase the rate of unemployment through this novel *selection effect*, while they decrease it through the conventional *competition effect*. In contrast, lower sunk costs associated to entry regulation always diminish the rate of unemployment. We show econometric evidence consistent with the unemployment effect of sunk versus recurring PMR-induced costs. The calibration of the model uncovers a larger effect of PMR on unemployment than earlier studies, thereby rationalizing findings in cross-country empirical work.

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1 Introduction

It is now conventional wisdom that institutional rigidities bear a large part of the blame for the poor performance of European labor markets. Determining which institutions matter has been the focus of an extensive literature. Its original emphasis was on labor market flexibility. Empirical evidence based on cross-country comparisons shows, however, that the evolutions of unemployment rates over time cannot be explained by changes in labor market regulations. This is why attention has recently been shifted to the identification of other important institutions.[1] Product Market Regulation (PMR henceforth) quickly emerged as a natural candidate.

Empirical cross-country studies document a robust and significantly positive relationship between PMR and unemployment.[2] Theory links this finding to the *competition effect* of regulations: since barriers to entry discourage entrepreneurship, incumbent firms enjoy higher market power and therefore restrict output so as to maximize profits. This in turn depresses labor demand and raises the rate of unemployment (Blanchard and Giavazzi, 2003). Recently, Ebell and Haefke (2006) have introduced this feature into a dynamic search model of unemployment. Disappointingly, they find little support for a quantitatively strong PMR unemployment nexus mediated by the *competition effect*.

This paper reconciles the evidence with the theory by introducing firms with heterogenous productivities. This extension allows us to uncover an additional *selection effect* whereby PMR truncates the distribution of firms' productivities and consequently affects the level of employment. We show that aggregate labor demand is a positive function of the firms' average productivity because more efficient firms are better able to sustain important recruitment costs. For a given level of wages they post more vacancies, so that unemployment is lower when average productivity is higher.

In order to analyze this mechanism, we propose a dynamic equilibrium model with monopolistic competition in the goods market and search frictions in the labor market. To achieve maximum transparency on the novel elements of the model, the theoretical part of the paper is focused on the effect of PMR for firm selection rather than for market power. This allows us to show that the *selection effect* arises from a different origin than the *competition effect* previously analyzed in the literature. As in the standard Mortensen-Pissarides framework, search frictions are captured by an aggregate matching function.[3] An additional complication of the model is

[1] See Blanchard (2005) for an analysis covering the evolution over the last decades of research about the determinants of unemployment.

[2] See Bassanini and Duval (2006) for an extensive survey.

[3] This assumption distinguishes our approach from the recent paper by Egger and Kreickemeier (2006). They

due to the fact that firms enjoy market power. Thus marginal revenues are a decreasing function of the number of employees. As explained in Bertola and Caballero (1994) and Stole and Zwiebel (1996a), this generates an over-employment effect. Because of this additional mechanism, analyzing the problem of the firm in a stochastic environment quickly raises daunting difficulties.[4] Nevertheless, as shown by Ebell and Haefke (2006), when the idiosyncratic productivity remains constant over time, the problem of the firm remains tractable. Using similar derivations, we are able to solve the model in closed form and to derive clear-cut results.

Our model differs from the one laid-out in Ebell and Haefke (2006) because, for the *selection effect* to be relevant, we clearly need to introduce firm heterogeneity. We achieve this by embedding search frictions and individual wage bargaining into Melitz's (2003) model of industry equilibrium with heterogenous firms. As in Melitz (2003), firms are ex-ante identical, but differ ex-post with respect to their productivity. This hypothesis is supported by extensive empirical evidence substantiating the existence of significant and persistent productivity differences across firms.[5] The timing of the model is such that firms learn about their productivity only after developing a new variety. They first face the decision on whether to incur the sunk cost of inventing a new variety, and then, once uncertainty is resolved, whether to enter the market. The *selection effect* arises from the fact that only sufficiently productive firms will be active in equilibrium. Hence, two types of costs are important: (i) sunk *start-up costs*, related to the introduction of new varieties, and (ii) period-by-period flow *fixed costs* associated to the production process and red tape.

We find that these two types of PMR have opposite effects on employment. On the one hand, the *selection effect* is stronger, the larger the *fixed costs* are. Hence they need not be bad for employment. On the other hand *start-up costs* have a negative *selection effect* because they alleviate the congestion of the labor market. By lowering the competition between incumbent firms, barriers to entry allows inefficient producers to avoid bankruptcy. This implies that the impacts of start-up and fixed costs on the rate of unemployment are positive and negative, respectively.

Following the theoretical analysis of the selection effect, we embed our model in a more general formulation where firms' market power is a function of the number of competitors. We

do not consider search frictions but instead introduce efficiency wages into Melitz's (2003) model. Their analysis focuses on the effect of trade liberalization on wage inequality. In their framework, unemployment is invariant to changes in PMR.

[4]See Bertola and Garibaldi (2001), Cahuc et al. (2004) and Koeniger and Prat (2006).

[5]See, for example, Cabral and Mata (2003), and in the context of international trade, Del Gatto et al. (2006).

calibrate the model to the US economy and show that PMR affect unemployment outcomes mainly through the selection channel. This finding complements the work by Ebell and Haefke (2006), who show that the PMR affects unemployment only marginally through the competition effect.

Finally, we provide some evidence from cross-country regressions. Using data on administrative regulatory costs compiled by Conway et al. (2005), we are able to show that sunk regulatory startup costs positively affect unemployment rates, while we do not find any influence of flow fixed costs (proxied by red-tape costs). This finding is in line with our model. Considering the partial derivatives of unemployment rates with respect to flow fixed costs we uncover an inversely U-shaped pattern, which is consistent with our theory.

The remainder of the paper is organized as follows. Section 2 introduces the theoretical setup, section 3 characterizes the simultaneous equilibrium on product and labor markets and offers comparative statics, section 4 calibrates the model towards U.S. data, section 5 provides some econometric cross-country evidence, and section 6 concludes.

2 The model

2.1 Setup

Final output producers. There is a single final consumption good, Y. Labor is the unique factor of production. It is inelastically supplied by a mass of worker-consumers that we normalize to unity without loss of generality. The agents utility is linear in Y. Using a continuum of intermediate inputs, a large number of firms produce the final consumption good under conditions of perfect competition.

Denoting the quantity of such an input $q(\omega)$, we posit the following production function

$$Y = \left[M^{-(1-\rho)} \int_{\omega \in \Omega} q(\omega)^{\rho} \, d\omega \right]^{\frac{1}{\rho}}, 0 < \rho < 1, \tag{1}$$

where the measure of the set Ω is the mass M of available intermediate inputs. The normalization by $M^{-(1-\rho)}$ implies that an increase in the variety of intermediate inputs does not improve the efficiency of the production process. This assumption is necessary to rule out scale effects which would generate a negative correlation between unemployment and the size of the economy. Since empirical evidence does not document such a relationship, scale effects are not a desirable property of the model. Notice that the production technology would be identical to the one considered in Blanchard and Giavazzi (2003), if we allowed ρ to be an increasing function of the number of producers. We will consider this extension in section 5.2, but until then we focus on the *selection effect* by neutralizing the potential interactions between market power and firm entry. The price index associated to (1) is

$$P = \left[\frac{1}{M} \int_{\omega \in \Omega} p(\omega)^{1-\sigma} d\omega \right]^{\frac{1}{1-\sigma}}, \tag{2}$$

where $\sigma \equiv 1/(1-\rho)$ denotes the elasticity of substitution between any two varieties of inputs, and $p(\omega)$ is the price of input ω. We choose the final output good as the numéraire good so that $P = 1$. Given this normalization, the profit maximizing quantities of intermediate inputs is given by

$$q(\omega) = \frac{Y}{M} p(\omega)^{-\sigma}. \tag{3}$$

Intermediate inputs producers. At the intermediate inputs level, a continuum of monopolistically competitive firms produce each a unique variety. Hence, we may index firms by ω. Firms differ with respect to their labor productivity $\varphi(\omega)$. Production features increasing returns to scale, with $l(\omega) = q(\omega)/\varphi(\omega)$ the conditional labor demand of firm ω. Following Blanchard and Giavazzi (2003), we assume that each period firms incur two types of flow fixed costs: f_T, which denotes a minimum input required for positive production values and which is essentially a parameter of technology, and f_R, which is related to administrative regulatory costs. These costs are identical across firms and take the form of the final output good (the numéraire). Analytically, both types of costs have similar economic effects; hence, we lump them together into a single parameter $f = f_T + f_R$. Denoting $w(\omega)$ the wage rate of firm ω in terms of the numéraire, total production costs are given by

$$c(\omega) = w(\omega) \frac{q(\omega)}{\varphi(\omega)} + f. \tag{4}$$

Labor market. We introduce search frictions into the labor market. Following the search-matching literature, we postulate that marginal recruitment costs are increasing at the aggregate level because of congestion externalities. From the point of view of the firm, however, the cost of recruiting a worker is constant. We assume that the aggregate matching function exhibits constant returns to scale so that the contact rates between firms and workers solely depend on the ratio θ of vacancies, v, to job seekers, u. Firms post vacancies which are filled at the rate $m(\theta)$. The vacancy filling rate $m(\theta)$ is a decreasing function of the tightness parameter θ. The cost of posting vacancies is proportional to the parameter c. Increasing employment by $\triangle$ entails spending $\triangle(c/m(\theta))$ in recruitment cost. The adjustment cost function for labor is therefore linear and depends on aggregate condition through $m(\theta)$.

2.2 Pricing behavior on product markets

Intermediate producers exit the market at the exogenous rate δ. Jobs are also destroyed because of match-specific shocks which occur at the rate χ. Under the assumption that these two sources of job separation are independent, the actual rate of job separation is equal to $\delta + \chi$. When bargaining over the wage of a new worker, firms act as monopsonist. They take into account how the marginal worker affects the wages of workers already employed. The market value of an intermediate producer with productivity φ is therefore given by

$$\begin{aligned} J(l,\varphi) &\equiv \frac{\pi(l,\varphi)}{r+\delta} = \frac{p[q(l)]\,q(l) - w(l)\,l - \left(\frac{c}{m(\theta)}\right)\chi l - f}{r+\delta} \\ &= \frac{\left(\frac{Y}{M}\right)^{\frac{1}{\sigma}}(\varphi l)^{\rho-1} - w(l)\,l - \left(\frac{c}{m(\theta)}\right)\chi l - f}{r+\delta}, \end{aligned} \tag{5}$$

where $\pi(l,\varphi)$ is firm φ's profits, r is the exogenous discount rate and the dependence of l on φ is understood. The second line takes into account the firm's production and demand function. We can now write the asset value of a marginal worker as

$$\frac{\partial J(l,\varphi)}{\partial l} = \frac{1}{r+\delta}\left[\rho\varphi\left(\frac{Y}{M}\right)^{\frac{1}{\sigma}}(\varphi l)^{\rho-1} - \left(\frac{c}{m(\theta)}\right)\chi - w(l) - w'(l)\,l\right]. \tag{6}$$

The first term in the square brackets corresponds to marginal revenues, the second term to steady-state mobility costs, while the third and fourth term give the marginal costs of expanding the labor force. The cost of the marginal worker differs from the wage since the firm takes into account the effect of additional employment on the wage of inframarginal workers. As explained in Bertola and Caballero (1994) and Stole and Zwiebel (1996a; 1996b), this will lead to "over-employment" relative to the benchmark case where the firm takes the wage as given.

Finally, notice that profit maximization implies that the firm sets the asset value of the marginal worker equal to the recruitment cost. Hence,

$$p(l,\varphi) = \frac{1}{\rho\varphi}\left[w(l) + w'(l)\,l + \left(\frac{c}{m(\theta)}\right)(r+\delta+\chi)\right], \tag{7}$$

where $p(l,\varphi) = \left(\frac{Y}{M}\right)^{\frac{1}{\sigma}}(\varphi l)^{\rho-1}$. Without search frictions and local monopsony power of the firm, marginal costs would just be w/φ. In the present case, this term is augmented by the over-employment effect and recruitment costs.

2.3 Wage bargaining

Let $E(\varphi)$ and U denote the asset values of a worker employed at a firm with productivity φ and of an unemployed worker, respectively. The advantage of holding a job over unemployment is equal to the difference between the wage rate and the opportunity cost of unemployment rU. The surplus from being employed by a firm with productivity φ is therefore given by

$$E(\varphi) - U = \frac{w(\varphi) - rU}{r + \delta + \chi}. \tag{8}$$

The firm negotiates individually with each of its employees. The alternating offer game is analyzed in Stole and Zwiebel (1996a). They show that its equilibrium is given by the Nash-bargaining solution

$$(1-\beta)(E(\varphi) - U) = \beta \left(\frac{\partial J(l, \varphi)}{\partial l} - V \right), \tag{9}$$

where V is the value of an unfilled vacancy and $\beta \in [0,1]$ is the bargaining power of the worker.[6] Individual bargaining implies that each employee is treated as the marginal worker. This is why the value of the job is equal to the derivative of the firm's market value with respect to employment. In equilibrium, all profit opportunities are exploited and so firms post vacancies until $V = 0$. Reinserting (6) and (8) into (9), and solving for the first-order condition yields

$$w(\varphi, l) = \beta\rho\varphi p(\varphi, l) + (1-\beta)rU - \beta \frac{\partial w(\varphi, l)}{\partial l} l, \tag{10}$$

where the notation has been changed in order to emphasize the nature of the conditioning. The first and second terms of the above expression is the Nash-weighted average of the worker's outside option rU and the average revenue per worker of the firm. The third term reflects the fact that (as long as $\sigma < \infty$), the marginal revenue being bargained upon declines as more and more workers are employed.

Equation (10) is a linear differential equation in l whose solution is given by[7]

$$w(\varphi) = (1-\beta)rU + \beta\varphi p(\varphi) \left(\frac{\sigma - 1}{\sigma - \beta} \right).$$

Reinserting this expression into (7), we obtain

$$w(\varphi) = p(\varphi)\varphi \left(\frac{\sigma - 1}{\sigma - \beta} \right) - (r + \delta + \chi) \frac{c}{m(\theta)}. \tag{11}$$

This equation is the counterpart of the *Job Creation Curve* in the standard search-matching model. Combining the two previous equations, we find that wages are constant across firms and

[6] Explicitly modelling the bargaining game allows one to endogenize the bargaining power. As in Binmore et al. (1986), β is equal to the ratio of workers' to firms' discount factors.

[7] See Ebell and Haefke (2006) for a detailed solution of this ODE by the method of variation of parameters. Note also the similarity of expression (10) to equation (17) in Bertola and Caballero (1994).

equal to

$$w = rU + \left(\frac{\beta}{1-\beta}\right)(r+\delta+\chi)\frac{c}{m(\theta)}. \tag{12}$$

This equation is the counterpart of the *Wage Curve* in the standard search-matching model. Let us mention for future reference that equations (11) and (12) imply that prices are a linear function of φ, so that $p(\varphi_1)\varphi_1 = p(\varphi_2)\varphi_2$.

2.4 Firm entry and exit

The timing of the entry process is as follows: first, prospective entrants have to develop a new intermediate good variety. By sinking f_I units of the final output good, they acquire a new blueprint with certainty. We may refer to f_I to the cost of innovation, which is essentially a technological parameter. Once f_I is paid, firms set up shop. To do so, they have to pay an entry fee f_R, related to regulatory requirements. Only then do they learn about the productivity associated to their variety. Both f_I and f_R are sunk costs. Since their respective roles in the model are identical, we set $f_E = f_I + f_R$ the total cost of entry. Sinking f_E give access to two things: a blueprint and a productivity draw. Baldwin (2005) suggests to "think of the entry-cum-lottery as a single innovation process".

As in Melitz (2003), the firm-specific value of φ is constant through time and uncorrelated to the destruction rate δ, which is identical across firms. Firms draw their productivity from a sampling distribution with c.d.f. $G(\varphi)$ and p.d.f. $g(\varphi)$. This distribution is known to prospective entrants. Free entry therefore requires that *expected* profits be zero. Since f_E is sunk, firms which happen to draw a low realization of φ will find it optimal not to start production at all. This gives a second relation, the *zero cutoff profit* (ZCP) condition, which ensures that the marginal entrant makes zero profits. Before turning to an analysis of these conditions, we need to define the average productivity level.

Let $\mu(\varphi)$ denote the ex-post distribution of productivity of active firms, i.e., conditional on a productivity draw that makes entry into the market worthwhile. Denote the productivity of the marginal entrant by φ^*. Following Melitz (2003), we define an average productivity level $\tilde{\varphi}$, which has the property that the quantity $q(\tilde{\varphi})$ is equal to average output per firm Y/M. Given the demand function (3), this choice implies $p(\tilde{\varphi}) = P = 1$. Using the proportionality of optimal prices to simplify the aggregate price index given in (2), we obtain an explicit expression for the average productivity level

$$\tilde{\varphi}(\varphi^*) = \left[\int_0^{+\infty} \varphi^{\sigma-1}\mu(\varphi)\, d\varphi\right]^{\frac{1}{\sigma-1}} = \left[\frac{\int_{\varphi^*}^{+\infty} \varphi^{\sigma-1} g(\varphi)\, d\varphi}{1-G(\varphi^*)}\right]^{\frac{1}{\sigma-1}}. \tag{13}$$

where the second equality follows from the definition of $\mu(\varphi)$. The above expression gives a mechanical link between the average and the cutoff productivities, $\tilde{\varphi}$ and φ^*, respectively. We have $d\tilde{\varphi}(\varphi^*)/d\varphi^* > 0$ iff $\tilde{\varphi} > \varphi^*$, which is a regularity assumption that always holds in the present model. We may now use the definition of $\tilde{\varphi}$ to analyze the *zero cutoff profit* and *free entry* conditions.

The market value of firms with a productivity above φ^* is positive. At the margin, the cutoff productivity φ^* is such that

$$\frac{\pi(\varphi^*)}{r+\delta} - \frac{cl(\varphi^*)}{m(\theta)} = 0, \tag{14}$$

since $\pi(\varphi^*)$ is the stream of operating profits and $l(\varphi^*)c/m(\theta)$ is the firm's expected recruitment costs at the time of startup. Given the demand function (3) and the equilibrium wage rate w paid by all firms, the operating profit of a firm with productivity φ is

$$\pi(\varphi) = l(\varphi)\left(\tilde{\varphi} - w - \left(\frac{c}{m(\theta)}\right)\chi\right) - f \tag{15}$$

The proportionality of prices enables us to relate the operating profits of the cutoff firm φ^* and of the average firm $\tilde{\varphi}$

$$\frac{\pi(\tilde{\varphi})+f}{\pi(\varphi^*)+f} = \frac{l(\tilde{\varphi})}{l(\varphi^*)} = \left(\frac{\tilde{\varphi}}{\varphi^*}\right)^{\sigma-1}$$

Reinserting this expression into (14) yields the *zero cutoff profit* (ZCP) condition

$$\pi(\tilde{\varphi}) = (r+\delta)\left(\frac{c}{m(\theta)}\right) l(\tilde{\varphi}) + f\left(\left(\frac{\tilde{\varphi}}{\varphi^*}\right)^{\sigma-1} - 1\right). \tag{ZCP}$$

The *free entry* condition (FE) ensures that the expected discounted stream of profits of firms participating in the entry stage match the entry cost f_E. Thus free entry is satisfied when

$$f_E = \int_{\varphi^*}^{+\infty} \left(\frac{\pi(\varphi)}{r+\delta} - \frac{cl(\varphi)}{m(\theta)}\right) g(\varphi)\, d\varphi = (1 - G(\varphi^*)\left(\frac{\pi(\tilde{\varphi})}{r+\delta} - l(\tilde{\varphi})\left(\frac{c}{m(\theta)}\right)\right). \tag{FE}$$

Combining (ZCP) and (FE) we find that in equilibrium

$$\left(\frac{\tilde{\varphi}}{\varphi^*}\right)^{\sigma-1} = (r+\delta)\frac{f_E/f}{1-G(\varphi^*)} + 1. \tag{16}$$

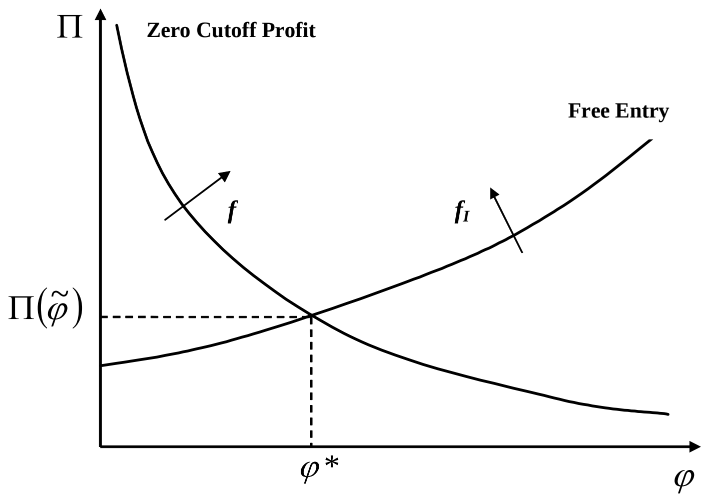

Figure 1: Equilibrium threshold productivity.

This condition is similar to equation (12) in Melitz (2003). It implies that, given the average productivity $\tilde{\varphi}$, there exists a unique cutoff productivity φ^* such that (FE) and (ZCP) are simultaneously satisfied. One can now use the definition of the average productivity given in (13) and combine it with (16) to jointly determine $\tilde{\varphi}$ and φ^*.

The cut-off productivity is independent of the labor market tightness. On the other hand, it directly depends on both sunk entry costs and the flow fixed costs of production. To interpret their effects, it is useful to represent the equilibrium in the $\{\tilde{\varphi}, \pi(\tilde{\varphi})\}$ space. Higher entry costs shift the *free entry* condition up. The new equilibrium moves along the downward-sloping (ZCP) locus so that $\tilde{\varphi}$ decreases. Symmetrically, higher fixed costs of production raise the (ZCP) condition. But this has an opposite effect on $\tilde{\varphi}$ since the (FE) locus is weakly increasing.[8] Hence, fixed costs of production increase the average productivity while entry costs decrease it.

The *selection effect* of fixed costs is quite intuitive: they reduce profits so that firms with a low productivity are forced to exit the market. The adverse *selection effect* of entry costs is not as straightforward. It arises because of a reduction in the competition between firms. The higher the entry costs, the less attractive it is for firms to try entering the market. Once the

[8] When the sampling distribution is Pareto, as in section 5, the (FE) locus is actually horizontal. This, however, does not change the mechanisms analyzed in this paragraph.

entry costs are sunk, however, barriers to entry alleviate the competition between incumbent firms and so allows inefficient producers to remain in operation. As shown below, these opposite effects on $\tilde{\varphi}$ have unambiguous implications for the rate of unemployment: the higher the fixed costs and the lower the entry costs, the smaller is the equilibrium rate of unemployment.

2.5 The equilibrium

We have the following set of equilibrium conditions. First, the definition of the average productivity given in (13) together with (16) determines $\tilde{\varphi}$ and φ^* as a function of exogenous parameters only. Given $\tilde{\varphi}$, the wage and job creation curves displayed in (11) and (12) can be solved jointly to yield equilibrium values of the wage rate w and labor market tightness θ.

In order to express the equilibrium tightness as a function of the fundamental parameters, we decompose the asset equations for E and U

$$rU = b + \theta m(\theta) \int_{\varphi^*}^{+\infty} \left(E\left(\varphi\right) - U\right) \mu\left(\varphi\right) d\varphi,$$
$$rE\left(\varphi\right) = w + \left(\delta + \chi\right)\left(U - E\left(\varphi\right)\right).$$

where b is the flow value of non market activity. Combining these two equations and noticing that $\partial J\left(l, \varphi\right)/\partial l = (r + \delta)c/m(\theta)$, we can solve for the opportunity cost of employment

$$rU = b + \left(\frac{\beta}{1-\beta}\right) c\theta.$$

Reinserting its value into (11), (12) and recognizing that the job creation curve simplifies further since our normalization lead to $p(\varphi)\varphi = \tilde{\varphi}$, we finally obtain

$$\begin{array}{ll} W: & w\left(\varphi\right) = b + \left(\frac{\beta}{1-\beta}\right) c\theta + \left(\frac{\beta}{1-\beta}\right)\left(r + \delta + \chi\right)\frac{c}{m(\theta)}, \\ JC: & w\left(\varphi\right) = \tilde{\varphi}\left(\frac{\sigma-1}{\sigma-\beta}\right) - \left(r + \delta + \chi\right)\frac{c}{m(\theta)}. \end{array} \tag{17}$$

The *Job Creation* (JC) condition is a decreasing function of θ whereas the *Wage* (W) curve is increasing. Thus, as long as $b < \tilde{\varphi}\left(\frac{\sigma-1}{\sigma-\beta}\right)$, there exists a unique equilibrium labor market tightness. Once θ is known, the unemployment rate can be solved for via the standard Beveridge curve

$$u = \frac{\delta + \chi}{\delta + \chi + \theta m\left(\theta\right)}. \tag{18}$$

The JC curve provides a relationship between average productivity and the wage rate, thereby allowing changes in the composition of firms to affect the equilibrium tightness. A higher average productivity $\tilde{\varphi}$ shifts the JC curve up and leaves the W curve unchanged. It

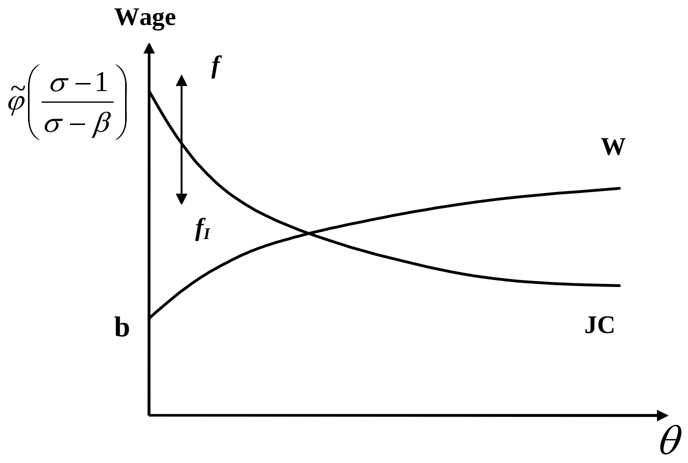

Figure 2: Equilibrium labor market tightness.

follows that $\tilde{\varphi}$ raises θ and so lowers the rate of unemployment. The economics behind this finding is intuitive: as the average productivity increases, active firms post more vacancies.[9] This selection effect naturally leads to a higher equilibrium tightness.

On the other hand, the labor share of aggregate output does not directly depend on the firms' composition. To see this, multiply both sides of (W) by $(1-u)$. Recognizing that $\tilde{\varphi}(1-u) = Y$, we find that the sum of wage payments equals a share, $(\sigma-\beta)/(\sigma-1)$, of total revenues net of recruitment costs. When workers have no bargaining power, the labor share is equal to $(\sigma-1)/\sigma = \rho$ as in model without search frictions. For general values of β, the labor share is superior to ρ, because of the over-employment effect.

We close the characterization of the equilibrium by deriving the equilibrium mass of operating firms. First, we use the ZCP condition to solve for the average value of employment. Reinserting the expression of firm's profits (15) into (14), we obtain

$$l(\varphi^*)\left(\tilde{\varphi} - w - (r+\delta+\chi)\frac{c}{m(\theta)}\right) = f.$$

[9]Notice that this mechanism is similar to the effect of an increase in the match productivity in the standard search-matching model (see Pissarides, 2000; page 20). Yet, it does not lead to the same undesirable negative correlation between growth and unemployment.

Inserting the JC condition (17) and recognizing that $l(\varphi) = (\varphi/\varphi^*)^{\sigma-1} l(\varphi^*)$, we find

$$l(\varphi) = \left(\frac{\varphi}{\varphi^*}\right)^{\sigma-1} \left(\frac{f}{\tilde{\varphi}}\right) \left(\frac{\sigma-\beta}{1-\beta}\right). \tag{19}$$

Finally, we can determine the mass of operating firms by exploiting the labor market equilibrium condition $Ml(\tilde{\varphi}) = 1-u$. Note that we need not worry about the resource constraint of the economy, since market clearing on the market for final output goods is taken care of by Walras law plus our normalization assumption.

3 Quantitative analysis

In this section, we parametrize the model to match the statistics of interest for the U.S. economy. Then we perform some comparative statics in order to analyze the effect of PMR. Finally we extend the production technology for the final good so that inputs diversity increases the elasticity of substitution. This general specification allows us to compare the relative strength of the competition and selection effects.

3.1 Baseline calibration

Productivity distribution. We assume that firms sample their productivity from a Pareto distribution, so that

$$G(\varphi) = 1 - \left(\frac{\overline{\varphi}}{\varphi}\right)^{\gamma}.$$

The shape parameter γ measures the rate of decay of the sampling distribution and $\overline{\varphi} > 0$ is the minimum possible value of φ. This parametric assumption is standard in the literature on heterogenous firms. It is justified by the observation that the log-density of firms' log-sizes is well approximated by an affine function.

Reinserting the expression of $G(\varphi)$ into (13) yields

$$\widetilde{\varphi} = \left(\frac{\gamma}{\gamma+1-\sigma}\right)^{\frac{1}{\sigma-1}} \varphi^*. \tag{20}$$

As expected, the average productivity $\widetilde{\varphi}$ is an increasing function of the cut-off productivity φ^*. Notice that this expression implies that, for the the average productivity to be bounded, the rate of decay γ has to be higher than $\sigma - 1$. The shape parameter γ is inversely related to the degree of productivity dispersion and, hence, to the importance of firm heterogeneity in the economy. Clearly, a higher degree of dispersion (lower γ) strengthens the effect of truncation on average productivity.

Using this expression to simplify the equilibrium condition (16), we obtain

$$\varphi^* = \left(\left(\frac{\sigma-1}{\gamma+1-\sigma}\right)\left(\frac{1}{r+\delta}\right)\frac{f}{f_E}\right)^{\frac{1}{\gamma}}\overline{\varphi}.$$

By definition, φ^* has to be greater than $\overline{\varphi}$, so that the term on the right-hand side should be greater than one. For reasons explained before, φ^* is increasing in f and decreasing in f_E. The effect of f/f_E on average productivity is larger the higher the elasticity of substitution σ. The reason for this is that a higher σ corresponds to a lower markup, which makes it more difficult for low productivity firms to earn the running fixed costs f. On the other hand, fewer finds find it optimal to pay f_E and participate in the productivity draw, so that profits are higher for every productivity level, allowing less productive firms to survive.

To parametrize $g(\varphi)$, we notice that the density of firm size $s(l)$ is given by[10]

$$s(l) = \mu(\varphi)\frac{d\varphi}{dl} = \frac{\gamma}{\varphi}\left(\frac{\varphi^*}{\varphi}\right)^{\gamma}\left(\frac{\varphi}{(\sigma-1)\,l}\right) = \left(\frac{\gamma}{\sigma-1}\right)\left(\frac{l^*}{l}\right)^{\frac{\gamma}{\sigma-1}}\left(\frac{1}{l}\right).$$

Thus employment levels are also Pareto distributed with a rate of decay equal to: $\gamma/(\sigma-1)$. Empirical evidence suggests that the Zipf distribution accurately approximates the dispersion of firm sizes. This implies that the rate of decay should be close to one. We target the value estimated by Axtell (2001) using the 1997 data from the U.S. Census Bureau, so that $\gamma = 1.098\,(\sigma-1)$.[11]

In order to pin down the value of the lower bound of the distribution, we notice that the absolute value of φ is intrinsically meaningless. Hence we set, without loss of generality, $\overline{\varphi}$ so as to normalize the mean of the sampling distribution to one. Since

$$E[\varphi] = \int_{\overline{\varphi}}^{+\infty}\varphi g(\varphi)d\varphi = \left(\frac{\gamma}{\gamma-1}\right)\overline{\varphi},$$

it follows that $\overline{\varphi} = \left(\frac{\gamma-1}{\gamma}\right)$.

Matching function. We normalize the time period to be one year. The matching function is assumed to be Cobb-Douglas, so that

$$m(\theta) = m_0\theta^{-\alpha} \tag{21}$$

[10]The expression of $l(\varphi)$ follows from reinserting (20) into (19) to obtain

$$l(\varphi) = \varphi^{\sigma-1}\left(\frac{f}{\widetilde{\varphi}^{\sigma}}\right)\left(\frac{\sigma-\beta}{1-\beta}\right)\left(\frac{\gamma}{\gamma+1-\sigma}\right).$$

[11]We use the estimate in Axtell (2001) for the restricted sample without self-employed workers.

We follow the standard practice in the search-matching literature and set the elasticity parameter α to 0.5. In the absence of well-established estimates, we set the bargaining power $\beta = \alpha$.[12]

To calibrate the scale parameter m_0, we use empirical estimates of the job finding and vacancy filling rates. Given the CRS property of the matching function, the equilibrium tightness must be equal to the ratio of these two rates. Shimer (2005) estimates the monthly rate at which workers find a job to be equal to 0.45. Hall (2005) finds an average ratio of vacancies to unemployed worker of 0.539 over the period going from 2000 to 2002. Accordingly, we target and equilibrium tightness of 0.5 and so set the monthly job filling rate to 0.9. Reinserting these values into (21), we find that $m_0 = 7.63$.

TABLE 1

Parameter Values

Parameter	*Interpretation*	*Value*	*Source*
r	Discount rate	.05	Standard
b	Value of non-market activity	.5	replacement ratio=42%
α	Elasticity of Matching function	.5	Standard
m_0	Scale of Matching function	7.63	Job finding rate=5.4
β	Bargaining power	.5	Standard
δ	Rate of firm exit	.11	Firm turnover rate=22%
χ	Rate of match-specific separation	.298	Job separation rate=0.4
σ	Elasticity of substitution	11	Mark-up=5%
γ	Decay of Prod. distribution	10.98	Decay of firm-size distribution=1.098
$\overline{\varphi}$	Support of Prod. distribution	.908	Normalization of E[φ] to 1
c	Cost of posting a vacancy	1.36	θ=0.5
f_E	Entry costs	.063	Entry costs=0.6 month of income
f	Flow fixed costs	.0054	Normalization of firm mass to 1

Note: All parameter values and statistics are for yearly time period.

Separation shocks. Job separations occur either because the firm leaves the market or because the match itself is destroyed. We consider that the first type of shock arrives at a Poisson rate of 0.11 per year. This implies that the annual gross rate of firm turnover is equal to 22%,

[12]The equality of the bargaining power and matching function elasticity is known as the “Hosios condition” in the search-matching literature. But in our case, the overhiring externality implies that the “Hosios condition” is not sufficient to ensure that the allocation is efficient.

as suggested by the estimates in Bartelsman et al. (2004). The match-specific shocks account for the job separations which are left unexplained by the firm-specific shock. Given that Shimer (2005) estimates the monthly rate of job separation to be 0.034, it follows that the rate of arrival of match-specific shock χ should be equal to 0.298 per year.

Elasticity of substitution. We use the implied mark-up to parametrize the elasticity of substitution σ. There exists some disagreement in the empirical literature about the actual value of the aggregate mark-up. Most of the estimates lie between 5% and 15%. We choose a conservative number and target an equilibrium mark-up of 5%. This value accords well with the estimates in Martins *et al.* (1996) and with the evidence discussed in Rotemberg and Woodford (1995) according to which aggregate real profits are close to zero. In the model, the mark-up over marginal costs is equal to: $(\sigma - \beta) / (\sigma - 1)$. For the values of β discussed before, this implies that the elasticity of substitution σ is equal to 11. This in turn yields a rate of decay γ of 10.98.

Cost parameters. As it is common in the real-business cycle literature, we set the interest rate to 4% per year. In order to calibrate the value of non-market activity, we follow Shimer (2005) and set b to match an earnings replacement ratio of 40%.

We still have to determine the value of three parameters: the cost of posting a vacancy, c, the entry costs, f_E, and the flow fixed costs, f. We use their values so as to pin down the following three moments. Firstly, we ensure that the equilibrium tightness $\theta = 0.45$. Secondly, we follow Ebell and Haefke (2006) and target an entry costs corresponding to 0.6 month of aggregate per capita income. Thirdly, we make use of the last normalization offered by the model and set the mass of operating firms to one, since this measure has no intrinsical meaning in the model. These three moments are perfectly matched for the set of parameters reported in Table 1.

The average recruitment costs, $c/m(\theta)$, is equal to 5.3 weeks of workers' earnings, as suggested by empirical estimates. At first sight, the calibrated fixed costs appear to be quite low. Yet, fixed costs they equivalent to 6% of the total revenues of the marginal entrant. This figure seems reasonable given our restrictive interpretation of fixed costs as red tape fees.

Results. The Job Creation and Wage curves are reported in the upper-panel of Figure 3. Given the high rate of vacancy filling, the effect of θ on average recruitment cost is quite low. This is why the JC curve is nearly horizontal. The impact of the labor market tightness is therefore almost entirely due to its positive effect on the workers' outside option.

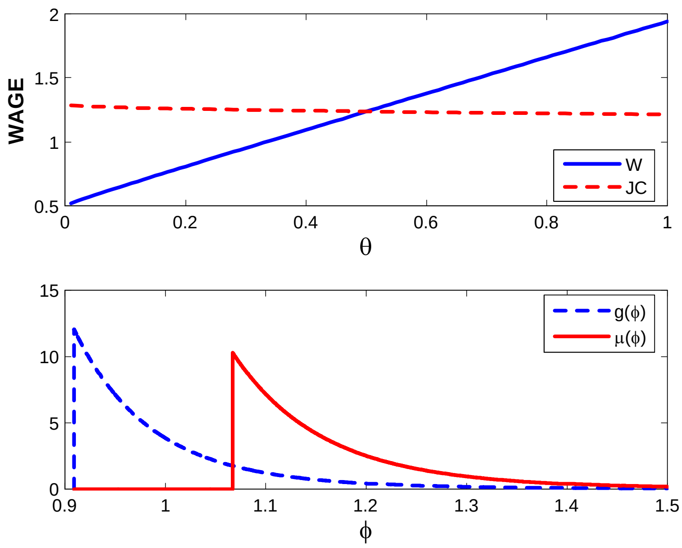

Figure 3: Equilibrium tightness and productivity distribution.

The lower-panel of Figure 3 reports the actual cross-sectional distribution of φ against the sampling distribution $g(\varphi)$. It illustrates that a substantial share of innovations do not lead to market entry. Actually, only 17.2% of the productivity draws are above the entry threshold φ^*. This implies that the expected cost of a successful innovation is equal to 30% of yearly income per capita.

The impact of PMR. Figure 4 reports the equilibrium unemployment rate as a function of f_E and f. As expected, the correlation between unemployment and the innovation costs is positive. Increasing innovation costs from 0.6 to 1 month of income per capita raises unemployment by 0.2%. This is not a negligible effect, since Ebell and Haefke (2006) suggest that 1978 entry costs in the US were as high as 5.2 months of income per capita. The impact of fixed costs is reported in the lower-panel of Figure 4. Their effect is of similar magnitude but of opposite sign than the effect of innovation costs. To see formally why the upper-panel is an inverted image of the lower-panel consider equation (16). The equilibrium value of φ^* is a function of the ratio f/f_E. This is why an increase in f_E has the same absolute effect but with opposite sign than a proportional decrease in f.

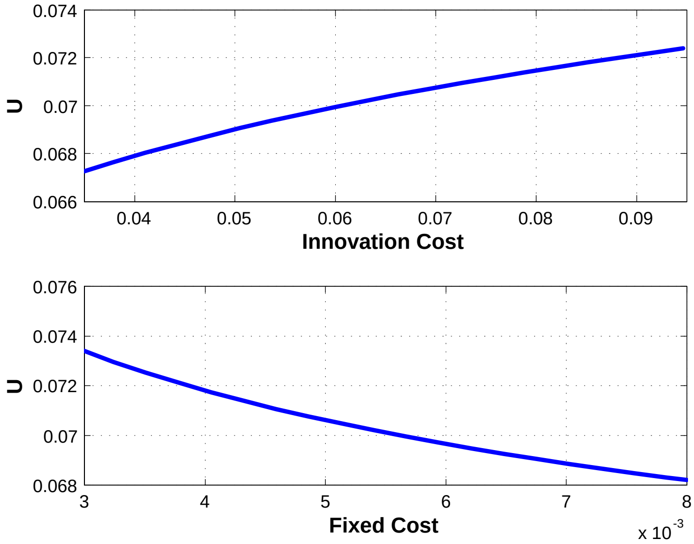

Figure 4: Effect of PMR on the unemployment rate.

3.2 Calibration with competition effect

The prediction that fixed costs always decrease unemployment might seem far-fetched. On the contrary, common sense suggests that prohibitive red tap costs should eventually hurt the demand for labor. It is easy to reconcile the intuition with the theory by reintroducing the *competition effect* considered in Blanchard and Giavazzi (2003). Accordingly, we extend the specification of the production function (1) by considering that the elasticity of substitution σ is increasing in the number of intermediate producers.

To solve the model with this extension, we can proceed as before. First of all, we fix the elasticity σ and compute the equilibrium mass of producers M. Given that a higher elasticity of substitution makes market entry less attractive, this yields a downward-sloping locus $M(\sigma)$. The equilibrium of the model is given by the point where this locus intersects the upward-sloping function $M^{-1}(\sigma(M))$. Hence the uniqueness of the equilibrium is preserved.

For the simulations, we restrict our attention to the case where the elasticity of σ with respect to M is constant. More precisely, we assume that $\sigma(M) = \bar{\sigma}M^{\eta}$. The quantitative assessment of the *competition effect* is complicated by the fact that there is no available estimates of the elasticity parameter η. Accordingly, we take a conservative perspective and choose a small elasticity $\eta = 10\%$ as a reference point. The value of the constant $\bar{\sigma} = 11$ follows from the

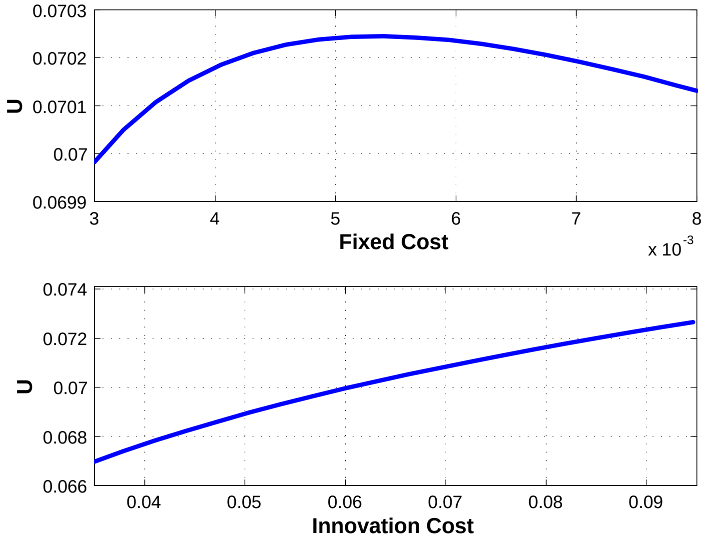

Figure 5: Effect of PMR with varying mark-up.

normalization of M to one in the benchmark calibration. Then we vary as before the fixed and innovation costs. The results of these experiments are reported in Figure 5.

The impact of fixed costs is plotted in the upper-panel of Figure 5. As economic intuition suggests, fixed costs are eventually detrimental to employment. This is because they reduce the number of producers and so increase the market power of incumbent firms.[13] For sufficiently high fixed costs, the *competition effect* offsets the *selection effect*. Interestingly, the simulation shows that this conclusion holds even for low value of the elasticity parameter η. Hence, the calibration of the extended model suggests that the empirical effect of red tape costs on unemployment is likely to be ambiguous or even weakly positive.

The lower-panel of Figure 5 reports the unemployment rate as a function of the innovation costs. The relationship between the two is always increasing. This should not be surprising because innovation costs lower the mass of producers. Thus the *competition effect* reinforces the *selection effect*. Comparing Figure 4 with Figure 5, one can see, however, that the correlation

[13]This can easily be shown formally by substituting the expression of firm size into the defintion of M to obtain

$$M = \left(\frac{\theta m(\theta)}{\delta + \theta m(\theta)}\right)\left(\frac{\gamma + 1 - \sigma}{\gamma}\right)^{\frac{1}{\sigma - 1}}\left(\frac{1-\beta}{\sigma - \beta}\right)\left(\frac{1}{f}\right). \quad (22)$$

is almost the same than in the model with constant mark-up. The *competition effect* of f_E is therefore quite weak. Although this result is partly due to our parametrization of η, such a finding is actually quite robust and analyzed in details by Ebell and Haefke (2006). They conclude that PMR deregulation cannot generate large improvement in labor market outcomes. The simulation confirms their finding when attention is restricted to the relationship between competition and firm entry. But in an economy with heterogenous firms, the additional *selection effect* is likely to be relevant so that the employment benefits from product market liberalization need not be marginal.

To take stock, we have found that: (i) red tape costs have an ambiguous effect on unemployment, (ii) entry barriers have a significantly positive effect on unemployment. Our analysis therefore calls for a detailed analysis of the underlying components of aggregate PMR indicators.

4 Empirical analysis

In this section we present tentative empirical evidence on the interplay between different components of PMR and unemployment that is consistent with our theoretical predictions. We do not attempt to structurally test our model which would require firm-level data. A crucial difficulty in the existing empirical literature is the scarcity of data both on labor market institutions and on PMR. We face the additional need to decompose PMR into two parts: one associated to sunk setup costs of firms and the other related to recurring fixed costs. Moreover, we have to separate cross-country administrative cost differentials induced by PMR from differences in technology.

Data For our purposes, the most adequate data set on PMR has been compiled at the OECD by Conway et al. (2005). The authors provide a hierarchical system of subindicators that build into an aggregate PMR index. They distinguish between economic regulation, such as antitrust policies, international trade and investment rules, or public ownership of firms, and administrative regulation, which the authors divide into two subindices: (i) regulatory and administrative opacity, and (ii) administrative burdens on startups. Focusing on administrative regulation, we proxy recurring (period-by-period) regulatory fixed costs by the subindex (i) and sunk regulatory startup costs to subindex (ii). We term the first measure $SETUPit$; it reflects the "administrative burden of interacting with the government", while the latter, $REDTAPEit$, relates to the "administrative burdens on the creation of corporations" and "sole proprietor firms" (Conway et al., 2005, p. 9). The data is based on questionnaires, and probably offers the cleanest way to distinguish between different types of PMR. The drawback is that the data is available for 1998 and 2003 only.

Other well known measures of PMR are available from the World Bank Doing Business data base and from the Fraser Institute's Economic Freedom of the World data base. However, these data bases do not allow to disentangle between sunk and recurring costs associated to PMR and are therefore less appropriate for our analysis. We do, however, offer some robustness checks using those sources.

TABLE 2

Summary Statistics

Variable	*Description*	*Mean*	*Std. Dev.*	*Time coverage*
u	Unemployment rate (percent)[a]	7.10	3.11	1998, 2003
$SETUP$	Administrative burdens on startup[b]	1.67	0.90	1998, 2003
$REDTAPE$	Regulatory and administrative opacity[b]	1.82	0.94	1998, 2003
$ECOREG$	Economic regulation[b]	1.38	0.34	1998, 2003
PMR	Overall product market regulation[b]	1.59	0.40	1998, 2003
EPL	Employment protection legislation[a]	2.04	0.90	1998, 2003
GAP	Output gap[a]	-0.67	1.40	1998, 2003
$UNDENS$	Union density (percent)[a]	35.55	21.50	1998, 2003
$SETUP2$	Licensing cost of new business[c]	3.54	0.66	2003
$REDTAPE2$	Time with government bureaucracy[d]	70.48	39.00	1998, 2003

Sources: [a]Bassanini and Duval (2006), [b]Conway et al. (2005), [c]Fraser Institute EFW Index, [d]World Bank (Doing Business)

Information on labor market outcomes and institutions comes from Bassanini and Duval (2006). These authors, also at the OECD, have compiled an extensive data set of different indicators of labor market policies, including variables on the incidence of minimum wages, collective bargaining, active labor market policies, employment protection legislation, and so on. Amongst other things, they provide country-specific estimates of the output gap, which allows to control for cyclical determinants of unemployment. That data is available for 20 high-income OECD countries.[14]

Table 2 shows summary statistics.[15] Note that all regulatory variables are scaled such that

[14]Australia, Austria, Belgium, Canada, Switzerland, Germany, Denmark, Spain, Finland, France, United Kingdom, Ireland, Italy, Japan, Netherlands, Norway, New Zealand, Portugal, Sweden, and United States.

[15]The full data and STATA batch files are available on demand.

higher values are associated with higher costs at the firm level.

Empirical strategy Bassanini and Duval (2006) provide an extensive survey of existing literature on the empirical explanation of cross-country unemployment patterns. We closely follow their empirical strategy and control for unobserved time-invariant cross-sectional heterogeneity by including country fixed effects.[16] In particular, this strategy accounts for unobserved differences in the relative importance of technology induce sunk to recurring fixed costs, or in the parameters governing the size distribution of firms across countries. In all specifications, the dependent variable is the rate of unemployment in the economically active population (aged 15 to 64). Our results are robust to defining the rate of unemployment over the prime age labor market (24 to 54 years) or the total population.

Our main specification is

$$u_{it} = \bar{u} + \beta_1 SETUP_{it} + \beta_2 REDTAPE_{it} + X_{it}\gamma' + \nu_i + \nu_t + u_{it}, \tag{23}$$

where $SETUP_{it}$ refers to administrative setup costs, $REDTAPE_{it}$ measures recurring administrative regulatory costs, X_{it} is a vector collecting labor market covariates, ν_i is a set of country dummies, ν_t is a time dummy (for 2003) and u_{it} is an error term with the usual properties. We are mainly interested by estimates of β_1 and β_2. From figure 5, we expect β_1 to be positive and β_2 to be non-significant.

Results We present our main results in TABLE 3. All regressions use country fixed effects. Standard errors are corrected for clustering at the country level. Our main findings are as follows:

(i) Labor market institutions do not matter. As in Bassanini and Duval (2006), variables such as employment protection legislation (EPL) or the union density ($UNDENS$) neither exhibit stable sign patterns consistent with theoretical predictions, nor are the estimated coefficients different from zero at conventional levels of significance. Other variables describing labor market regulation, such as unemployment benefits, replacement rates, or active labor market policies only marginally improve the F-statistic and do not work neither. Since degrees of freedom are scarce in our setup, we do not use these variables. This situation is invariant to including our variables of interest $SETUP$ or $REDTAPE$.

[16] Given that we have only two years of data, the fixed effects model is identical to a specification in first differences.

(ii) Aggregate conditions are important. We use a single variable, the output gap, to capture macroeconomic conditions. This variable turns out highly significant. A one standard deviation change in the output gap leads to a change in the unemployment rate of approximately one percentage point ($0.7 * 1.4 = 0.98$).

(iii) Product market regulation matters is highly relevant. In column (2) we include the aggregate measure of product market regulation into the regression. Remember, that measure lumps together economic and administrative regulation. Our results suggest that a one standard deviation improvement (i.e., reduction) in that index reduces the unemployment rate by 1.76 points ($-4.4 * 0.4$). This strong effect is known from the literature, see Bassanini and Duval (2006) for a survey.

(iv) Entry regulation increases unemployment. In columns (3) to (4), we use SETUP as an additional covariate. A one standard deviation improvement in the setup cost index leads to a reduction in unemployment rate of about 0.63 points ($-0.7 * 0.9$). The size and direction of this effect does not depend on the inclusion of the other type of administrative regulation costs, REDTAPE, which turns out statistically insignificant in column (5). The finding also survives dropping the insignificant labor market variables (column (5)), and inclusion of the OECD index of overall economic regulation (as opposed to administrative regulation). The latter variable turns out extremely important quantitatively: a one standard deviation improvement lowers the unemployment rate by 2.16 points $(6.352 * 0.34)$.

The overall picture emerging from our analysis of OECD data — tentative as it is — is consistent with the prediction of our model. Note that coefficients of interest are identified only by within variation. Hence, our results suggest that countries that have reduced administrative setup costs most aggressively have reduced unemployment rates most. By contrast, countries that have put emphasis on reducing regulatory costs for incumbent firms have gained little.

In figure 6 we plot the partial effect of SETUP and REDTAPE on the unemployment rate. The plots are obtained from running fixed effects regressions of the type discussed in TABLE 3, without labor market institutions, but including the output gap and a year dummy. Each plot corresponds to a separate regression with SETUP and REDTAPE, respectively, as additional covariates, respectively. The REDTAPE regression also contains a squared term. The plots include a fitted line obtained by simple OLS (with squares in the case of REDTAPE). The picture that emerges from this analysis shows a pattern that is strikingly similar to the results of our calibration exercise showed in Figure 5.

TABLE 3

Baseline fixed-effects regression results

Dependent variable: Unemployment rate in economically active population

	(1)	(2)	(3)	(4)	(5)	(6)
SETUP			0.697**	0.738**	0.652**	0.535*
			(0.28)	(0.28)	(0.27)	(0.33)
REDTAPE				0.307	0.288	-0.0722
				(0.46)	(0.44)	(0.31)
AGGPMR		4.382**				
		(1.70)				
ECOREG						6.352***
						(2.09)
GAP	-0.691***	-0.650***	-0.673***	-0.660**	-0.637***	-0.745***
	(0.23)	(0.19)	(0.23)	(0.23)	(0.17)	(0.18)
EPL	0.957	-0.513	1.215	1.062		-0.565
	(1.95)	(1.46)	(1.83)	(1.80)		(1.37)
UNDENS	0.0793	0.213	0.103	0.122		0.205
	(0.18)	(0.16)	(0.18)	(0.19)		(0.15)
YEAR=1998	1.756**	-0.796	1.390	1.095	1.351**	-1.307*
	(0.81)	(0.86)	(0.82)	(0.86)	(0.53)	(0.69)
Constant	0.985	-6.448	-1.346	-2.176	4.383***	-8.408*
	(3.70)	(4.54)	(3.82)	(4.19)	(0.92)	(4.44)
Observations	40	40	40	40	40	40
Adjusted R^2	0.53	0.66	0.55	0.55	0.55	0.70
RMSE	0.840	0.720	0.824	0.827	0.819	0.674

Robust standard errors in parentheses (corrected for within group clustering); *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

All regressions include country fixed effects (not shown).

Robustness In their literature overview, Bassanini and Duval (2006) find that PMR matter in an economically and statistically significant way. They seem to be more important than labor market institutions and turn up significant in almost all specifications. Whether our results are similarly robust needs to be seen. The key problem is that a neat decomposition of

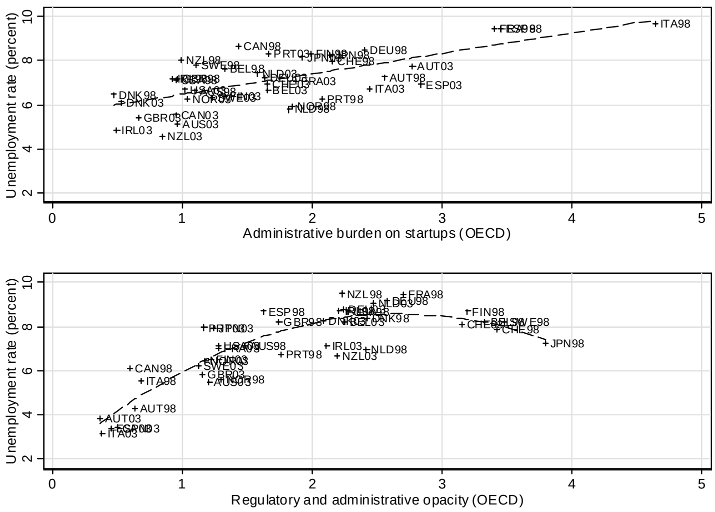

Figure 6: unemployment rate with respect to SETUP and REDTAPE.

administrative regulation into a sunk and a recurring part is possible only with Conway *et al.* (2005) data set.

We have nevertheless experimented with the World Bank Doing Business data set, which is available for the year of 2003, and with data provided by the Fraser Institute for the same year. We demonstrate two things: (i) the OECD measures SETUP correlates closely with similar measures produced by the World Bank and the Fraser Institute. And, (ii), when running cross-sectional analyses using the latter data, the overall conclusion remains intact: sunk setup costs always increase unemployment, while recurring fixed costs exhibit an ambiguous effect.

TABLE 4

Correlation with OECD SETUP measure	
Variable	Corr.
Time (days) needed for setup administration (World Bank)	0.53**
Cost (% of income per capita) needed for setup administration (World Bank)	0.70***
Minimum capital (% of income per capita) (World Bank)	0.36
Time (days) needed for licensing (World Bank)	0.63***
Easiness to start business (Fraser Institute)	0.67**

*** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

Table 4 shows correlation coefficients of our preferred measure of administrative setup costs with other indicators related to the easiness to start a business. With the exception of minimum capital requirements, the correlations are positive, strongly significant statistically, and large.

Finally, we run cross-sectional regressions of a parsimonious model that relates the unemployment rate to measures of SETUP and REDTAPE (including the output gap and a constant). Table 5 shows that positive effects for SETUP costs obtain, regardless of whether the OECD variable, the proxy from the Fraser Institute, or the World Bank data is used. However, the overall fit of the regression is reasonable only for column (1), which draws on the OECD statistics. Similarly, when employing REDTAPE measures of the Fraser Institute or the World Bank, we find non-significant results.

TABLE 5

Pooled OLS regressions

Dependent variable: Unemployment rate	(1)	(2)	(3)
SETUP (OECD)	1.792***		
	(0.59)		
SETUP (Fraser)		0.467**	
		(0.21)	
SETUP (World Bank)			0.0194*
			(0.011)
REDTAPE (OECD)	0.0362		-0.0742
	(0.52)		(0.49)
REDTAPE (Fraser)		-0.158	
		(0.26)	
Observations	20	20	20
Adjusted R^2	0.23	0.02	0.01
RMSE	2.735	3.110	3.090

Robust standard errors in parentheses; *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$

All regressions include output gap and a constant (not shown).

The empirical results offered in this section are not conclusive. Better data on sunk versus non-sunk components of administrative regulation will help to sharpen the econometrics. However, we are confident that setup costs are economically and statistically more important for unemployment rates than recurring fixed costs.

5 Conclusion

In this paper we offer an additional channel through which PMR matters for unemployment. We develop a monopolistic competition model with heterogenous firms, similar to Melitz (2003), and augment it with frictional unemployment. The model allows us to distinguish between regulation of startups on the one hand, and regulation of incumbent firms on the other. We find that the interaction between unemployment and firm selection depends on the type of PMR. Only sufficiently productive firms are able to afford flow fixed costs associated to production and regulation. Hence, the larger those costs, the higher is average productivity and the lower is the rate of unemployment. In contrast, sunk setup costs reduce the intensity of product market competition since fewer firms find it optimal to enter. In turn, less efficient firms survive, average productivity is lower, and unemployment is higher. Thus our analysis suggests that entry regulation matters more for unemployment than administrative regulation of incumbents. This result is politically important because the unemployment effect due to changes in red tape PMR is ambiguous while lower startup costs always lower unemployment. Accordingly, governments would be well-advised to focus on the latter type of PMR.

The implicit assumption in much of the literature following Blanchard and Giavazzi (2003) is that PMR is intrinsically worthless. This is certainly easier to justify for administrative than for economic regulation, since the latter is associated to the correction of market imperfections, such as the protection of consumers, the control of monopoly power, and so on. In our model, even if red tape administrative costs do not address those imperfections, they may nevertheless not be useless. They reduce the equilibrium number of firms, which represents an aggregate saving in spending on fixed cost. This strong result is due to the absence of external economies of scale in the aggregate production function. However, even if the number of varieties is relevant for aggregate productivity, there remains a potential for a beneficial effect from PMR as long as the variety effect is not too strong.

Our model lends itself naturally to several extensions. One obvious direction of research is to follow Melitz (2003) and allow for international trade. It would be interesting to study how the interaction of globalization scenarios with different PMR environments affects labor market outcomes. Another worthwhile extension would look at the transitional dynamics triggered by PMR reform. Finally, we see our empirical results as encouraging first steps towards more elaborated econometric studies on the empirical relevance of the selection effect. More disaggregate evidence on the interaction between PMR and the firm productivity distribution on the one hand, and average productivity and unemployment on the other hand would be clearly desirable. However, we see our empirical results as encouraging first steps.

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