The Microeconomic Implications of Input Market Regulations: Cross-Country Evidence from Within the Firm

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Abstract

We investigate the microeconomic implications of labor regulations that protect employment and are expected to increase rigidity in labor markets. We exploit a unique outlet-level dataset obtained from a multi-national food chain operating about 2840 retail outlets in over 48 countries outside the US. The dataset provides information on output, input costs and labor costs at a weekly frequency over a four year period, allowing us to examine the consequences of increased rigidity at a much more detailed level than has been possible with commonly available annual frequency or aggregate data. We find that higher levels of the index of labor market rigidity are associated with significantly lower output elasticity of labor demand, as well as significantly higher levels of hysteresis (measured as the elasticity of current labor costs with respect to the previous week's). Specifically, an increase of one standard deviation in the labor regulation rigidity index (i) reduces the response of labor cost to a one standard deviation increase in output (revenue) by about 4.7 percentage points (from 27.2 per cent to 22.5 percent); and (ii) increases the response of labor cost to a one standard deviation increase in lagged labor cost by about 9.6 percentage points (from 17.8 per cent to 27.4 per cent). Finally, we find evidence that the Company delayed entry and operates fewer outlets in countries with more rigid labor laws. Overall, the data implies a strong impact of rigid labor laws on labor input and related decisions at the micro level.

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1 Introduction

Labor market regulations that constrain the ability of firms to adjust employment levels are an important and controversial public policy issue in many countries across the world. Popular support for such regulation is quite high, and any proposed changes in such regulations often give rise to strong emotional reactions by both opponents and proponents. For example, a recent proposed relaxation of firing rules for younger workers in France had to be withdrawn in the face of mass demonstrations.

There is considerable variation in the amount of labor flexibility firms face across countries (see figure 1). Given this interesting variation in labor market regulations, their impact on growth and employment at the national level is an important and interesting question for research. While a number of papers have examined this question at a macro level (e.g. Botero, et al (2004), Lazear (1990)), there have been very few microeconomic cross-country empirical studies of the impact of labor market rigidities on firm level outcomes.

In this paper, we exploit a unique cross-country dataset to address the question of if and how labor regulations affect flexibility and choices at a microeconomic level. Our dataset, obtained from an international fast-food chain, provides us information on labor choices at a *weekly* frequency across 2840 outlets in up to 48 countries over a four year period. To our knowledge, ours is the first cross-country study to use establishment level data to examine the consequences of rigidity in labor market regulations on firm behavior.

The paper closest in spirit to ours is Cabellero, et al (2004), who use cross-country 3-digit ISIC UN data to test for the effects of labor regulation (from Botero, et al) on adjustment costs. They find that adjustment costs are greater in countries with more rigid labor regulation, and that these effects are stronger for countries that have better law enforcement. In recent work Haltiwanger et al (2006) also find that gross industry level job turnover is affected by labor regulations. [1]

Our data present some unique advantages. Most firm-level studies of labor rigidity and adjustment costs use annual data, which as pointed out by Hammermesh and Pfann(1996) hides a lot of turnover that occurs within the year.[2] Our data allow us to to examine weekly employment decisions, and hence capture changes in employment decisions within the year. Moreover, the data cover outlets of the same firm, and hence allows us to compare decisions at outlets that produce basically the same output using the same technology worldwide. Thus, cross-country comparisons of these outlets are unaffected by firm specific policy and technology differences that could confound other firm-level cross-country studies.

Confidentiality restrictions prevent us from disclosing the name of the company and also specific information on some of the variables in the dataset. Hereafter, we refer to the firm as the "Company" and its main product as "the product".[3]

[1] A large literature has examined the effect of labor regulation on overall employment levels, labor turnover and unemployment duration, using household survey data (see Heckman and Pagés, 2003 or Addison and Teixera (2001) for reviews of this literature). Petrin and Sivadasan (2006) and Aguiragabiria et al (2006) consider the effect of increasing labor regulation on firm behavior within a country. A separate literature has looked at various aspects of labor adjustment costs, including whether they are symmetric, convex (smooth) or non-convex (s, S) (see Bond and van Reenen (2003) for a review).

[2] Exceptions include Anderson 1994, who used weekly payroll data, and Hammersmesh 1989 who used monthly establishment level data.

[3] The product is a fairly common fast food item and for the purposes of thinking about our results, the

In what follows, we model the effect of an increase in the rigidity of labor regulation as an increase in the cost of adjusting labor levels. We first examine a simple model of optimal labor choice based on a Cobb-Douglas production function, combined with quadratic adjustment costs and quadratic costs of being off-equilibrium. This model yields two important implications which we bring to the data, namely: (1) increases in rigidity reduce the responsiveness of labor demand to changes in output (revenue), and (2) increases in rigidity increase the persistence of labor decisions, as reflected in an increased elasticity of labor demand with respect to lagged labor.[4]

Both of these implications are intuitive, and the former has been tested extensively in studies of the effects of labor regulation on labor demand (see Heckman and Pagés, 2003 for a review). However, as discussed in Heckman and Pagés, it is not obvious that these predictions would hold in the context of a more general dynamic model. In particular, we are concerned about whether the the predictions would hold if we assumed asymmetric rather than symmetric adjustment costs, and if we assumed that the productivity/demand shocks facing the firm were autocorrelated rather than IID. To address these concerns, we simulate data for outlets following optimal policy rules in a stochastic, dynamic programming framework. We test whether the predictions hold across four different scenarios: (i) symmetric quadratic adjustment costs with IID shocks; (ii) symmetric quadratic adjustment costs with autocorrelated shocks; (iii) asymmetric linear adjustment costs with IID shocks; and (iv) asymmetric linear adjustment costs with autocorrelated shocks. We find that our predictions hold across all four scenarios, and hence appear robust to assumptions about the nature of adjustment costs and the persistence of shocks.

Results from our baseline econometric specifications suggest a strong effect of labor regulations on labor choice at the outlet level. Using the labor regulation index developed by Botero et al, we find that the effect of a one standard deviation change in revenue on labor demand is lower by 4.67 percentage points (change from 27.15 percent to 22.48 per cent) in a country whose regulation index is one standard deviation above the mean. For lagged labor, our estimates imply that the effect of a one standard deviation change in lagged labor on current labor demand is higher by 9.63 percentage points (increased from 17.80 per cent to 27.43 per cent) in a country which has the regulation index one standard deviation above the mean. The statistical significance and the magnitude of the effects are very similar when we use an alternative measure of of hiring/firing inflexibility obtained from the Global Competitiveness Survey (2002).

To test the robustness of our results to potential biases, we adopt two strategies. First, we run the same specification for materials cost. We find that, unlike for the labor cost specification, the interaction terms are statistically insignificant and have a very small economic magnitude in the materials cost specification. Second, we adopt an instrumental variables approach similar to ones employed in the literature (e.g. Arellano and Bond, 1991). We use lags of the endogenous variables, as well as lags of the materials cost variable, as instruments. Our IV approach yields larger (and sharper) estimates of the coefficient on the interaction terms, suggesting that biases possibly attenuate the estimates in our baseline

reader may consider her favorite fast food item as the product here.

[4]We modify the model slightly so that the specification yields a regression of log labor costs on lagged log labor costs and log revenue. A number of potential omitted variables are controlled for using outlet/period specific fixed effects.

specification.

Given the large measured impact of labor regulation on weekly labor adjustment, we next look at how labor regulation affects the Company's decision to enter a country, and also the extent of its operations in the country. Consistent with the negative impact of rigid regulations on outlet level labor decisions, we find that the Company enters later and operates fewer outlets in countries where it faces more rigid labor regulations.

The rest of the paper is organized as follows. Section 2 describes briefly the theoretical motivation for our empirical analysis. Section 3 discusses the data and key variables. Section 4 reports results from the baseline specification and the robustness to using an alternative measure of the rigidity of labor regulations. Section 5 discusses potential identification issues and reports the results from robustness checks to address these issues. Section 6 focuses on the effect of the regulations on entry and size of operations. Section 7 concludes.

2 Theory and econometric specification

In this study, we are interested in understanding the microeconomic implications of national labor regulations that hinder the ability of firms to flexibly adjust their labor levels. The regulatory index that we rely on in our baseline analysis is the one constructed by Botero et al (2004). It measures the flexibility of labor laws by forming an average of indices measuring the ability of firms to use alternative employment contracts, the costs of increasing hours worked, the cost of firing workers, and the cost of dismissal procedures (see Appendix 1 for details). In theory, if the national labor regulations/institutions captured by the Botero index do have a practical impact on the day-to-day operations of firms, we expect the impact to be analogous to an increase in the adjustment costs for labor.

A standard test for the presence of labor adjustment costs in the literature is to examine hysteresis in labor demand (Abraham and Houseman, 1994, several studies in Heckman and Pagés, 2003). That is, increased adjustment costs are expected to increase the elasticity of labor demand with respect to labor level choices made in the prior period. The intuition behind this result is that with increased adjustment costs, firms facing demand or productivity shocks would not adjust fully from previously chosen labor levels.[5]

Similar reasoning suggests that the observed elasticity of labor demand with respect to output would be lower in the presence of adjustment costs. While small demand or productivity shocks would shift output levels, in the presence of adjustment costs we could expect relatively less change in labor, dampening the observed elasticity of labor demand with respect to output.

This intuition can be formalized in a simple model, which draws on Heckman and Pagés (2003) (who drew on the work of Holt, Modigliani, Muth and Simon (1958)), to which we now turn.

[5]Another interpretation is that when faced with adjustment costs, firms would not adjust at all unless the shocks are sufficiently large. The former (partial adjustment) occurs in models with symmetric strictly convex adjustment costs, while the latter (lumpy adjustment) is the case in models with fixed costs (and also in some asymmetric adjustment costs models). In either case, taking an average over a number of firms facing uncorrelated shocks, the correlation of current period labor with prior period labor would be higher when adjustment costs are higher.

2.1 A simple model of labor demand with adjustment costs

Let the optimal labor choice at date t be determined by a static theory. Assuming a Cobb-Douglas production function, firm level output is given by:

$$Y_t = \theta_t L_t^{\alpha} M_t^{\beta}$$

where Y_t is the quantity of output produced by the firm in period t, L_t is its level of labor used, and M_t represents materials used. This specification assumes that the capital stock is fixed, so that the productivity term θ can be considered a Hicks-neutral total factor productivity term augmented by firm specific capital stock.[6]

Assume the firm faces an iso-elastic demand curve:

$$P_t = \Lambda Q_t^{\frac{1}{\mu}}$$

where P_t is the price per unit of output in period t, Λ represents demand shifters, and μ is the price elasticity of demand.[7] The firm's profit function is given by:

$$\Pi_t = P_t Q_t - W_t L_t - S_t M_t$$

where W_t is the wage rate per unit of labor input in period t, and S_t is the price per unit of material input.

Assuming inputs are supplied competitively (i.e. elasticity of supply is infinite), the exogenous variables in the model are the production function parameters (α and β), productivity (Θ), output demand elasticity (μ), demand shifters (Λ) and the input prices (W_t and S_t). First-order conditions yield optimal labor and materials input demand functions in terms of these exogenous variables as follows:

$$l_t^* = \frac{1}{1-\alpha' - \beta'} \left\{ (1-\beta^{'})log\alpha^{'} + \beta^{'}log\beta^{'} + \phi - (1-\beta^{'})w_t - \beta^{'}s_t \right\} \quad (1)$$

$$m_t^* = \frac{1}{1-\alpha' - \beta'} \left\{ \alpha^{'}log\alpha^{'} + (1-\alpha^{'})log\beta^{'} + \phi - \alpha^{'}w_t - (1-\alpha^{'})s_t \right\} \quad (2)$$

where the small cap variables are the logarithms of the corresponding large cap variables (ie $l_t = logL_t, m_t = logM_t, w_t = logW_t$, and $s_t = logS_t$), $\phi = log\left(\Lambda\theta^{1+\frac{1}{\mu}}\right)$, $\alpha^{'} = \alpha(1+\frac{1}{\mu})$, and $\beta^{'} = \beta(1+\frac{1}{\mu})$. Equilibrium output is given by:

$$q_t^* = \frac{1}{1-\alpha' - \beta'} \left\{ \alpha log\alpha^{'} + \beta log\beta^{'} + (\alpha+\beta)\lambda + \theta - \alpha w_t - \beta s_t \right\} \quad (3)$$

where $q_t = logQ_t$, $\theta = log\Theta$, and $\lambda = log\Lambda$.

[6] That is, the actual production function may be a three input production function:

$$Q_t = \Theta_t^{'} L_t^{\alpha} M_t^{\beta} K_t^{\gamma}$$

Then in our two input production function, $\Theta_t = \Theta_t^{'} K_t^{\gamma}$.

[7] If μ is finite, then the firm faces a downward sloping demand curve and enjoys some market power. The case of a perfectly competitive output markets in this context corresponds to $\mu = \infty$.

The input demand equations 1 and 2 can be expressed conditional on output (sales revenue) and input prices as follows:

$$l_t^* = log\alpha^{'} + r_t - w_t \tag{4}$$
$$m_t^* = log\beta^{'} + r_t - s_t \tag{5}$$

where $r_t = \log(P_tQ_t)$ represents sales revenue. Since input prices and quantities are not separately observable in our data (see discussion in Section 3 below), we rewrite these equations in terms of labor and materials cost (which are observable). Denoting the log labor cost as $b_t = log(W_tL_t)$ and the log materials cost as $f_t = log(S_tM_t)$, we get:

$$b_t^* = log\alpha^{'} + r_t \tag{6}$$
$$f_t^* = log\beta^{'} + r_t. \tag{7}$$

Equations 6 and 7 represent the optimal input costs in a static equilibrium with no adjustment costs. In the presence of adjustment costs, however, at any time t the firm may not choose labor levels corresponding to the static (zero adjustment cost) equilibrium. Let the cost of being off the static optimum be quadratic in log labor costs:

$$c_t^o = \gamma_o(b_t^* - b_t)^2$$

where $\gamma_o > 0$. Thus this cost increases in the parameter γ_o and also in the magnitude of the difference between actual labor and optimal static labor choice at period t. Additionally, there is a cost of adjustment also assumed to be quadratic in log labor costs:

$$c_t^a = \gamma_a(b_t - b_{t-1})^2.$$

As discussed earlier, inflexibility in labor regulations would be expected to increase adjustments costs. So we expect the adjustment cost parameter in country j, γ_a^j to be an increasing function of the labor regulation index (i.e. $\gamma_a^j = f(\tau^j)$, $\frac{\partial f}{\partial \tau} > 0$, where $\tau^j =$ index of labor regulation in country j).

The optimal policy in the presence of adjustment costs minimizes the sum of the cost of being out of static equilibrium (c_t^o) and the adjustment cost (c_t^a). This yields the following equation for optimal labor cost in the presence of adjustment costs:

$$\begin{aligned} b_t &= \frac{\gamma_o}{\gamma_a^j + \gamma_o} b_t^* + \frac{\gamma_a^j}{\gamma_a^j + \gamma_o} b_{t-1} \\ &= (1 - \omega^j) b_t^* + \omega^j b_{t-1} \end{aligned} \tag{8}$$

where $\omega^j = \frac{\gamma_a^j}{\gamma_a^j + \gamma_o}$. Combining equations 6 and 8 yields:

$$\begin{aligned} b_t &= (1 - \omega^j) \left\{ log\alpha^{'} + r_t \right\} + \omega^j b_{t-1} \\ &= (1 - \omega^j) r_t + \omega^j b_{t-1} + (1 - \omega^j) log\alpha^{'}. \end{aligned} \tag{9}$$

Since ω^j is an increasing function of adjustment costs, we expect ω^j to be an increasing function of the index of labor regulation. We write down a first order approximation for ω^j as $\omega^j \simeq a_o + a_1\tau^j$. Then equation 9 yields the following econometric specification:

$$\begin{aligned} b_{it} &= (1 - a_0 - a_1\tau^j) r_{it} + (a_0 + a_1\tau^j) b_{i,t-1} + (1 - a_0 - a_1\tau^j) log\alpha' \\ &= \beta r_{it} + \gamma b_{i,t-1} + \delta_r \tau^j r_{it} + \delta_b \tau^j b_{i,t-1} + \eta_{is} + \varepsilon_{it} \end{aligned} \tag{10}$$

where b_{it} represents log labor cost in firm i in period t, r_{it} represents log revenue, and τ_j represents the index of labor regulation for country j, where outlet i is located. In this equation, the η_{is} are store, store-year or store-season fixed effects, while ε_{it} represents the residual error term.

The parameters of interest are the coefficients on the interaction terms, δ_r, and δ_b. Our theory implies that $\delta_r = -a_1 < 0$,and $\delta_b = a_1 > 0$.[8] Thus our model predicts that if the labor regulations increase the labor adjustments costs faced by firms, then in countries with a larger index of labor regulation: (i) the elasticity of total labor cost with respect to output would be lower; and (ii) the elasticity of labor cost with respect to last period's labor would be higher.[9]

2.2 An infinite horizon asymmetric cost dynamic model

One potential concern with the predicted effects in section 2.1 is that the specification and implied effects on labor demand may be driven by the assumption of symmetric, quadratic adjustment costs, and/or by the simplification of the complex dynamic labor choice problem to the simpler problem of minimizing the sum of adjustment and off the optimum path costs.

In this section, we examine a dynamic stochastic programming model with symmetric as well as asymmetric adjustment costs. While this model does not yield closed form solutions, optimal policy functions can be found for specified parameter values and assumptions regarding the adjustment cost and productivity/demand shock process. These optimal policy functions are used to simulate the actions of firms operating in different adjustment costs regimes, and we use the simulated data thus obtained to test whether the empirical specification in section 2.1 holds in this more complicated and realistic environment.

The stochastic dynamic model and the simulation procedure are discussed in detail in Appendix 2. We choose 45 different adjustment cost regimes and simulate data for 100 firms over 52 periods in each regime (to be somewhat consistent with our data, where we have weekly data on all relevant variables for about 45 countries, and a total sample comprising almost 3000 outlets).

We focus on two key assumptions that, as noted by Heckman and Pagés, 2003, could critically affect labor choice in the dynamic context. One assumption is related to the nature of adjustment cost; a large literature has looked at whether labor adjustment costs are symmetric or asymmetric, as this has important implications for firm behavior and for macro-economic models of the economy (see the review by Bond and Van Reenen, 2004 and references therein). The second assumption relates to the persistence of demand and

[8]Here note that $\delta_r = -\delta_b = -a_1$. However this would hold only if our model specification is exactly correct. In particular, if the adjustment costs or the cost of being off equilibrium are not quadratic, or if our first-order approximation for ω above is inexact, then this relation would not hold. In particular, see the results from our simulation reported in Section 2.2 below. In this simulation, we assume non-quadratic adjustment costs.

[9]The revenue term could be expanded as $r^j_{it} = q^j_{it} + p^j_{it}$. Then interaction terms with quantity and price would each be expected to be negative, i.e. the elasticity of labor demand with respect to output quantity and output price would be lower in regimes with higher index of labor regulation. We examined some econometric specifications where the revenue term is broken down into the price and quantity variables, and our results (available on request) were consistent with the theory. However, our data on sales revenues are of higher quality than our data on output quantity and price, leading us to focus on sales revenue in our analyses below.

productivity shocks faced by firms – if firms expect shocks to be persistent, they may be more willing to adjust labor towards the static optimum than if they expected no persistence.

To understand the impact of the nature of adjustment costs, and of the shock process, we obtain the optimal policy function and simulate data for four different scenarios:

(i) Symmetric, quadratic adjustment costs with iid shocks;

(ii) Symmetric, quadratic adjustment costs with autocorrelated shocks (i.e. a 50% chance of facing the same shock in the next period);

(iii) Asymmetric, linear adjustment costs with iid shocks; and

(iv) Asymmetric, linear adjustment costs with autocorrelated shocks (i.e. a 50% chance of facing the same shock in the next period);.

We then run a regression specification similar to equation 10 using the simulated data (see Appendix 2, section D for details) for each of the four scenarios. The results are presented in Table 1.

We find that, across alternative functional forms for the adjustment cost (symmetric and asymmetric) and across different levels of persistence of the shock process (iid versus strongly autocorrelated), the predictions of the simple model in section 2.1 hold also in our simulated data. Across all specifications, the coefficient on lagged labor is higher while the coefficient on revenue is lower when adjustment costs are higher. Interestingly, the reduction in the revenue elasticity with increases in adjustment cost does not vary much across different levels of persistence, but is greater when adjustment costs are asymmetric. The increase in hysteresis (elasticity with respect to prior period's labor cost) with adjustment costs is highest for the scenario where adjustment costs are symmetric and the shocks are IID across periods, but remains a feature of the data in the alternative scenarios nonetheless.

The main conclusion we draw from our simulation results is that the predictions in section 2.1 are not artifacts of our simple modelling framework, but are robust to modelling optimal responses is a more complex infinite horizon framework with different forms of adjustment costs and persistence for productivity/demand shocks.

3 Data description and definition of variables

The main data source for this study is an internal dataset from an international fast food chain, which operates in over 50 countries around the world. We have weekly outlet-level financial data on inputs and outputs. Specifically, we observe sales revenue, labor costs, material costs and number of "items" sold each week for every outlet in every foreign country for the four year period 2000-2003. [10]

In our empirical analyses, we need to ensure that we compare outcomes obtained under similar circumstances. For that reason, we eliminated all observations that pertain to potentially unusual situations, such as outlets in markets where the firm is barely present (less than 4 outlets), or outlets operating with a different type of facility (e.g. limited menu

[10] In addition, for 2002 and 2003, we have data on quality audits which are undertaken on average once every three months at every outlet.

facilities), or observations related to unusual time periods (i.e. at start-up or within a short time from the closing of an outlet). Specifically, we exclude those outlets in operation for less than one year by the time we observe them, and dropped those observations pertaining to outlets that closed within one year after a study year. We also removed outlets that changed ownership the year before or after the study years.

Our main measure of labor regulation inflexibility is an index of labor regulation constructed by Botero et al (2004). The different components that make up this index are detailed in Appendix 1. Since a common basis is used to evaluate the laws across all countries, this index has the advantage of being comparable across countries. One potential disadvantage of this measure is that the enforcement of legal rules may vary across countries, either due to lack of resources or deliberately. Also, in some countries, other factors (such as the strength of labor unions) may affect the flexibility in hiring and firing either directly or through stronger enforcement of labor statutes.

In this context, an alternative measure of the extent of flexibility in hiring and firing decisions that may capture the actual operational reality faced by managers is the index of hiring and firing inflexibility from the Global Competitiveness Survey (2002).[11] This survey polls executives regarding business conditions around the world. One of the questions asked is whether the hiring and firing of workers is impeded by regulations or flexibly determined by employers. The response is given on a scale from one to seven, with a higher score reflecting a higher degree of labor market flexibility. We use this to define an index of the inflexibility of the labor market, which is constructed for a particular country i as the minimum reported flexibility score, across all countries, divided by the flexibility score for country i. (Note that this sets the maximum value of the inflexibility index equal to one.) One potential drawback of this and similar measures based on surveys of managers in different countries is that the ratings across countries is not done on a common basis, and hence may suffer from pessimism or optimism biases.[12] A scatter plot of the two alternative measures of the rigidity in labor regulations for the 76 countries where data is available on both indices is presented in Appendix 3. As can be seen, the two measures are positively correlated but do differ importantly for many countries, possibly for the reasons just described.

Summary statistics for the key variables above are shown in Table 2. A number of other outlet characteristics are available also from the parent Company. In our analyses in Section 4, however, these characteristics are controlled for by store, store-year and store-season fixed effects as most are fixed over time, or only vary once every few months. For example, the form of corporate governance varies from outlet to outlet, but remains fixed over time. Hence these are absorbed by outlet-level fixed effects in our analyses below.

[11] The survey is used to prepare the Global Competitiveness Report (GCR), which is published by the World Economic Forum in collaboration with the Center for International Development (CID) at Harvard University and the Institute for Strategy and Competitiveness, Harvard Business School. We thank Richard Freeman for providing access to these data.

[12] For example, managers in one country may rate the flexibility of labor practices in their country low, even if it is higher than that in another country where managers rated their system as highly flexible. (The source of the bias could be cultural differences or could be recent macroeconomic events.) A truly standardized and comparable index could be constructed if the executives surveyed were able to relatively rank all the countries in the sample. This, however, requires that all respondents have experience of all countries, which is unlikely to occur.

4 Empirical Results: Baseline Specification

In our baseline regressions, we examine the specification in equation 10, using the Index of labor regulation constructed by Botero, et al (2004). Results, shown in Table 3, imply that the elasticity of labor demand with respect to revenue is significantly lower in countries with greater measured rigidity in labor regulation, as predicted by theory. Also consistent with the theory, we find evidence of greater hysteresis (a greater elasticity of labor demand in period t to labor demand in period t-1) in countries with more rigid labor regulation. All the effects are statistically significant (at the 5 per cent level or better).

The economic importance of the effects can be gauged using the coefficients combined with summary statistics as shown below Table 3. From column 1, where we control for store fixed effects, we see that in a country with the mean level of labor regulation (0.42), a one standard deviation increase in log revenue (0.70) is associated with a 23.65 per cent (0.70*[0.581 - 0.579*0.42]) increase in labor cost. By comparison, in a country with labor regulation one standard deviation above the mean (0.42+0.16), a one standard deviation increase in log revenue is associated with a 17.16 per cent (0.70*[0.581 - 0.579*0.58]) increase in labor cost. Thus, the estimates imply that a one standard deviation change in revenue on labor cost is lower by 6.48 percentage points in a country which has the regulation index one standard deviation above the mean. This effect is 5.52 percentage points (a reduction from 24.92 per cent to 19.39 per cent) under the specification in column 2, which includes store-year fixed effects, and 4.67 percentage points (a reduction from 27.15 per cent to 22.48 per cent) using column 3 estimates which are obtained using store-year-season fixed effects.

As to the influence of lagged labor, estimates in column 1 imply that the effect of a one standard deviation increase in lagged labor on current labor demand is higher by 14.23 percentage points (increase from 43.54 per cent to 57.77 per cent) in a country which has the regulation index one standard deviation above the mean. When we control for store-year fixed effects in column 2, the estimate is 12.71 percentage points (increased from 30.36 per cent to 43.08 per cent). Controlling for store-year-season fixed effects in column 3 yields an estimated effect of 9.63 percentage points (increased from 17.80 per cent to 27.43 per cent).[13]

Thus in all the specifications, labor regulation has a statistically significant and economically important impact on the elasticity of labor demand with respect to revenue, and contributes importantly to labor cost hysteresis. The proportional impact is higher for lagged labor (9.63 percentage point relative to an elasticity of 17.80 per cent at the mean), but is also large for sales revenue (4.67 per cent relative to 27.15 per cent). We interpret the results as strong evidence that labor market rigidities, measured by the index of labor regulation, have real effects on labor costs.

As mentioned in section 3, the index of labor regulation used in our baseline specifica-

[13] There is a half-life interpretation to the coefficients on lagged labor. The half life of a jump in labor in any period is defined as log(0.5)/log(coefficient on lagged labor). Here the half life estimates are quite low, ranging from less than half a week to 1.5 weeks. This is much lower than the half life estimates in the literature for manufacturing plants (e.g. 0.5 to 15 years in Fajnzylber and Maloney, 2000). This could be because of differences in labor demand and supply in the retail sector, or because annual frequency data used in most studies (including Fajnzylber and Maloney, 2000) hide considerable within year turnover that shows up in our higher frequency data. We suspect that both explanations are to some extent valid, reinforcing our sense that our data are particularly useful to analyze the issues we are interested in.

tion is from Botero et al (2004) who constructed it by examining the details of laws and regulations that affect the flexibility of hiring and firing employees (see Appendix 1 for details on the construction of the index). As we discussed earlier, this index has several advantages, most importantly the fact that it is assessed on a similar basis across countries. Not surprisingly then, several authors have relied on this measure of labor regulation in their analyses. Of course this index also suffers from some limitations. To address potential concerns with this measure, and in particular concerns associated with potential differences in enforcement levels across countries, we test the robustness of our results to an alternative measure, namely the index of hiring and firing inflexibility constructed from the Global Competitiveness Survey (2002).

Results obtained with this alternative measure, shown in Table 4, are consistent with those obtained with the Botero et al index (in Table 3). Here again, consistent with the theory, we find that in markets with higher perceived inflexibility in hiring and firing, the elasticity of labor demand with respect to revenue is lower, and the elasticity with respect to lagged labor is higher, than in markets with more flexibility in hiring and firing. Moreover, the magnitude of the effects we find with this alternative measure are comparable to, and in fact somewhat larger than, those in Table 3. Specifically, our estimates imply that the effect of a one standard deviation increase in revenue on labor demand is decreased – as a result of an increase in the index of hiring/firing inflexibility – by 8.36 percentage points (from 32.04 to 23.68 per cent) when we include store fixed effects, by 8.06 percentage points (from 33.64 to 25.58 per cent) when we include state-year effects, and by 7.09 percentage points (from 35.29 to 28.20 per cent) when we include state-year-season fixed effects. The equivalent calculations for lagged labor imply effects of 13.99, 12.92, and 10.07 percentage points respectively. Thus in all cases, the estimated impact of a one standard deviation increase the index of inflexibility is greater than for the index of labor regulation used in the baseline case (as reported in Table 3).

5 Identification issues

To understand the assumptions that are required so that our estimates above correctly identify the parameters of interest, we turn our attention to the error term in equation 10. Defining the full error term as $e_{it} = \eta_{is} + \varepsilon_{it}$, equation 10 implies that:

$$e_{it} = (1 - a_0 - a_1\tau^j) log\alpha_{it} = (1 - b_0 - b_1\tau^j) log\left(\alpha_{it}\left(1 + \frac{1}{\mu_{it}}\right)\right)$$

where we use j to index the country where outlet i is located. As stated, the production function parameter α, and the demand demand elasticity parameter μ could vary across countries, or even possibly between stores within a country. Under the reasonable assumption that these parameters are fixed within a store, however, or even simply within a store-year or store-year-season cell, our store-period fixed effects (η_{is}) will satisfactorily control for these omitted supply and demand parameters. Moreover, the same store-period fixed effects also control for differences in the regulation index (τ^j) across countries.

Another source of error, however, are unanticipated demand (λ) or supply (productivity) shocks (θ).[14] To understand the effects of unanticipated shocks, assume that the choice of

[14] An example of unanticipated demand shocks is poor weather affecting traffic to the store. An example

labor, output price, and materials for period t is made at some prior time $t-h$. Then the optimal labor cost in equation 9 is based on the expectation, formed at time $t-h$, of what will be optimal output at time t, namely $E_{t-h}[q_t]$. Assume that

$$q_{it} = E_{i,t-h}[q_t] + \epsilon_{it}^q$$

where the prediction error ϵ_{it}^q is orthogonal to the information available at time $t-h$. Then, the error term e_{it} in equation 10 includes the prediction error term. Specifically, equation 9 is modified to:

$$b_{it} = (1-\omega^j)r_{it} + \omega^j b_{it-1} + (1-\omega^j)log\alpha^{'} - (1-\omega^j)\epsilon_{it}^q. \tag{11}$$

Assuming that price also is set at or before time $t-h$, $cov(r_{it}, e_{it}) = cov(q_{it} + p_{it}, -(1-\omega^j)\epsilon_{it}^q) = -(1-\omega^j)Var(\epsilon^q)$. Thus, unexpected demand and productivity shocks induce a negative correlation between the error term and the revenue variable, biasing the coefficient on the revenue variable downward.[15] The intuition for this downward bias is straightforward – since labor is set early, when actual quantity is below predicted levels due to unanticipated negative demand and/or productivity shocks, the labor variable is "too high" for the low quantity and hence low revenue realization. Thus large positive residuals in labor costs are correlated with low revenue values and vice versa. Since lagged labor costs are set already by $t-h$, this variable is orthogonal to the prediction error term, however.

The assumption that prices are set at the same time (or before) the labor input choice implies that there is no prediction error for price in equation 6. If we relax this assumption, then adjustments in prices (in response to unanticipated demand or productivity shocks) would induce another error term which would lead to a further downward bias for the coefficient on revenue similar to the downward bias induced by the prediction error in quantity.[16, 17]

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of unanticipated productivity shocks is an unexpected breakdown in equipment used at the store.

[15] Actual transacted quantity would be lower than the expected quantity if there was a negative shock to either demand and/or productivity. However, for positive shocks, if we assume that price is fixed at the same time or prior to the choice of labor, the actual transacted quantity would be higher only if there were simultaneous positive shocks to productivity and demand. A positive demand (productivity) shock by itself will not induce a prediction error; the binding supply (demand) constraint will set the actual transacted quantity equal to the predicted quantity. Thus if there is a positive demand shock alone, some demand will go unmet as the firm would be unwilling to adjust inputs given the fixed prices. Similarly, if there is a productivity shock alone, the firm would be unable to utilize the additional capacity, as the demand would be low (given the set price).

[16] Let:

$$p_{it} = E_{t-h}[p_{it}] + \epsilon_{it}^p$$

Accordingly, equation 11 becomes:

$$b_{it} = (1-\omega^j)r_{it} + \omega^j b_{i,t-1} + (1-\omega^j)log\alpha^{'} - (1-\omega^j)(\epsilon_{it}^q + \epsilon_{it}^p) \tag{12}$$

where j again indexes the country where outlet i is located. Thus the prediction error in the price variable would also induce a downward bias on the revenue coefficient. If the two prediction errors (on quantity and price) are positively correlated, then the error in quantity could add to the downward bias on the price variable and vice versa. This would be the case if the prediction error in the quantity variable is driven largely by unanticipated demand shocks; the two error terms would be negatively correlated if prediction error on the quantity variable is driven predominantly by unanticipated productivity shocks. This is because demand shocks drive quantity and prices in the same direction, while productivity shocks drive quantity and prices in opposite directions.

[17] Unanticipated changes in wage rates would also affect equation 4 and hence equation 6. Also, unantic-

This downward bias on the revenue term does not affect our coefficients of interest, δ_r and δ_b, in our specification equation 10 so long as the prediction bias is not systematically larger in countries with more rigid regulations, for reasons unrelated to changes in labor regulation.[18] A priori, we have no reason to believe that the prediction bias would be larger in countries with a larger labor regulation index, so we believe our baseline results relating to the effects of labor regulation are unlikely to be biased due to prediction error on quantity or prices.

However, we check the robustness of our results to this and other potential mis-specification issues in two main ways. First, we use the information available in our data on the choice of materials costs and run the same regression as in 10 for these costs (f_{it}):

$$f_{it} \quad = \quad \beta^f r_{it} + \gamma^f f_{i,t-1} + \delta_r^f \tau^j r_{it} + \delta_b^f \tau^j f_{i,t-1} + \eta_{is}^f + \varepsilon_{it}^f. \tag{13}$$

If the estimates of δ_r and δ_b in specification 10 are indeed driven by the effects of labor regulation on the adjustment cost for labor, our theory predicts that the corresponding coefficients in a regression for materials cost should be statistically insignificant. That is, we expect $\delta_r^f = 0$ and $\delta_b^f = 0$. If the prediction bias in quantity and/or price (and hence revenue) due to unanticipated demand or productivity shocks is systematically greater in countries with poor regulation, then the coefficient on revenue interacted with labor regulation would be downward biased in the materials costs regressions also, so that we would expect to find $\delta_r^f < 0$.

Second, we adopt lagged revenue and suitable further lags for labor costs as instruments (following Arellano and Bond, 1991).[19] Lagged revenue and labor cost should be correlated with the current values of revenue and lagged labor costs, but uncorrelated with prediction errors or other errors induced by unexpected demand or productivity shocks. We also use lags of materials costs as instruments for revenue; since lagged materials costs are predetermined, we expect them to be uncorrelated with prediction errors and hence be valid instruments.

The two robustness tests just described address another potential source of bias in our specification. As discussed in Heckman and Pagés (2003), autocorrelation in the error term could induce an upward bias in the coefficient on lagged labor. Since the main sources of persistence in the labor demand equation are captured by the store-period fixed effects that we include in our regressions, we do not expect the autocorrelation issue to be severe. Further, our theory suggests that conditional on revenue and lagged labor, the key source of error is prediction error (as discussed above). Therefore, if our model is not misspecified, the error term is unlikely to be autocorrelated – the prediction error is expected to be orthogonal to information available at the time the prediction is made. Also, even if there is autocorrelation in the error term, this affects our parameters of interest only if the degree

ipated voluntary quitting by workers would be another source of error. We assume that the unanticipated shocks to wages and unanticipated quitting are uncorrelated with output quantity and prices, once we control for outlet and outlet-period effects using store, store-year and store-season fixed effects.

[18] For example, if firms are unable to adjust labor quickly in countries with a larger labor index, firms may invest less resources in predicting future demand in these countries. Any bias induced by this still reflects the effect of the regulation and in that sense is not a real bias.

[19] Arellano and Bond, 1991 use lagged levels as instruments for first differences of endogenous variables. We control for fixed effects using store-year dummies, and use the lagged levels as instruments for the levels themselves.

of persistence is systematically related to the rigidity of labor regulation. More specifically, our estimates are upward biased only if the error terms are systematically more strongly autocorrelated in countries with a larger index of labor regulation.

We do not have any a priori reason to expect the persistence in the error term to be correlated with the regulation variable, i.e. we do not expect higher persistence in countries with more rigid labor regulations. However, if our model is misspecified, there could be autocorrelation in the labor demand error term for other reasons, and the degree of persistence may somehow be correlated with the labor regulation index. As in the case of the prediction error discussed above, we expect any error term autocorrelation to also affect the materials demand specification. Thus, if the larger hysteresis in labor demand is driven by a combination of specification error and greater persistence of demand and/or productivity shocks in countries with a larger labor regulation index, this should have a similar effect on the materials cost specification, leading to an expectation of a positive δ_b^f coefficient in specification 13. Moreover, results obtained under our instrumental variables approach – using lags of endogenous right hand side variables and materials cost as instruments – would be unbiased as the lagged variables should be uncorrelated with the previous period error term.[20]

5.1 Robustness Check Results: Materials Costs Specification

Since the labor regulations are expected to affect the adjustment costs mainly for labor, our model does not imply the same effect on material costs.[21] As discussed above, one way to check whether our results in Tables 3 and 4 are driven by a correlation between unexpected demand and productivity shocks and the regulatory regime, or due to a correlation between persistence in demand/productivity shocks and regulation, is to examine whether materials costs specifications yield similar results as the labor specifications.

The results from our analysis of material cost demand are presented in Table 5. We find that in almost all cases, the impact of labor regulation on materials demand is not statistically significant. In the specification with store-year-season fixed effects, there is a marginally statistically significant reduction in the elasticity of materials demand with respect to revenue, but the magnitude of this effect is very small, as shown in the bottom panel of table 5. Specifically, the impact of a one standard deviation increase in the labor regulation index on the response of material demand to a one standard deviation change in

[20] For example, suppose the optimal labor cost equation is:

$$b_{it}^* = log\alpha' + r_{it} + e_{it}$$

and

$$e_{it} = \rho e_{i,t-1} + u_{it}.$$

Then our specification in equation 10 is biased by the autocorrelation in the error term e_{it}. Since we expect lagged revenue ($r_{i,t-1}$) to be correlated with lagged labor and to be orthogonal to $e_{i,t-1}$, lagged revenue would be a valid instrument.

[21] In the case of strong complementarity between the inputs, adjustment costs to one input could affect the demand for the other input. For example, for a Leontief production function, if the first order condition for labor input was binding, the demand function for materials would simply be a scalar function of the demand for labor. We do not expect such a strong complementarity to exist in the production function of the Company, and hence we expect a lower or zero effect of labor regulation on the materials demand function.

revenue is -0.32, -0.11, and -0.87 percentage points respectively in our three specifications (with store, store-year and store-year-season fixed effects).

The magnitude of the effects are slightly larger, but still quite small – at 2.71, 2.16, and 1.11 percentage point respectively for our three specifications – and the coefficients are never statistically significant, when we consider the impact of regulation on the response to changes in lagged materials choice. Moreover, contrary to the case of labor demand where we found increased hysteresis, here we find decreased hysteresis when labor regulation becomes more rigid. The decreased hysteresis in materials could reflect a more careful optimization of materials costs when labor flexibility is low; however, as noted above, these effects are not statistically significant.[22]

In summary, the results from the materials costs specification suggest that the estimated effects of labor regulation on labor costs are not driven by spurious correlation between either unexpected demand/productivity shocks or persistence in demand/productivity shocks and the regulation index, but rather reflect real effects of increased rigidities due to regulation on labor costs.

5.2 Robustness check – IV specification

As discussed in section 5, our baseline estimates may be biased either due to systematic differences in the downward bias induced by prediction error on the revenue coefficient, or because of a mis-specification coupled with a systematic relationship between the regulation index and the magnitude of autocorrelation in the error term.

To address these potential biases, in this section we adopt an instrumental variables (IV) approach. We use lagged dependent variables as well as lags of materials costs as instruments. In the IV analyses reported here, we use up to 5 lags for the instruments. In all specifications, we control for outlet and time specific effects using store-year fixed effects.

The results from our analyses are presented in Table 6. In the first column, we consider only log revenue and its interaction with the index of regulation as endogenous. (See notes below the table for the full list of instruments). In column 2, we instead take lagged labor cost and its interaction with regulation as endogenous. Finally, in column 3, we take all the right hand side variables (i.e log revenue and log lagged labor cost, as well as their interactions with the index of labor regulation) to be endogenous.

In these IV regressions, coefficients on both interaction terms are stronger than in our baseline case above. This suggests that potential endogeneity, biases downward the estimates on the parameters of interest (coefficients on the interaction terms). In any case, we surmise that the results from our baseline analyses are quite robust.

We carried out a number of tests to look for potential weaknesses in our IV approach. First, we find that the p value for the Hansen J-statistic, reported in the second to last row is low enough that the null hypothesis – that the instruments are exogenous – cannot be rejected. Second, we check for weak instruments using the Cragg-Donald statistic, as suggested by Stock and Yogo (2002). We find that the statistic is far above the cutoffs for weak instruments suggested by Stock and Yago (2002), i.e. the instruments we use do

[22] In Appendix 4, Table 1, we present results from the same specification but using our alternative measure of labor market inflexibility (from the Global Competitiveness Survey, 2002). The results are very similar to those presented above, in both statistical and economic significance.

not appear to be weak by this measure. This is also reflected in the Shea partial r-square (unreported) of the first stage regressions, which are in the range of 0.2 to 0.5 (across the different endogenous variables). We also report the p value from the Anderson canonical correlations likelihood-ratio test of whether the equation is identified; we find that the null hypothesis (that the equation is under-identified) is strongly rejected.

We conclude from these IV results that the estimates in our baseline specifications were not biased upwards by endogeneity. Thus, the elasticity of labor demand with respect to revenue is significantly reduced in countries with more rigid labor regulations. Also, hysteresis in labor demand (i.e. the elasticity of current labor with respect to last period's labor) is significantly higher in countries with more rigid labor regulation.[23]

6 Impact of labor regulations on expansion

Given all the evidence above that labor regulation affects labor input choices, a reasonable implication would be that the Company would delay entry or expansion in markets where labor regulations are relatively rigid.

We test for these two effects in Table 7. Other key variables that we expect to influence foreign entry and expansion, and that we must control for in our regressions, are the size of the market (which we proxy for using the GDP and population of the country), and the distance of the country from the headquarters (USA). Note that these are the factors that have been used to explain international trade in the "gravity" model of trade.

We obtain data on GDP and population from the World Bank's World Development Report. Data on the distance from the US capital to the capital of other foreign countries are from Jon Haveman's website on international trade data. [24] We define the time to entry for country i as the difference in years between 1983 (when the Company first ventured into a foreign market) and the year the Company entered country i.

As expected, we find, in column 1 of Table 7, that the Company was quicker to enter countries with larger markets (proxied by GDP). Controlling for GDP, population was not a significant factor. Also, the Company was slower to enter countries farther away from the US, as the gravity model of trade would suggest. Controlling for market size and distance from the US, in column 2 we see that the firm was slower to enter markets with more rigid labor regulation. The magnitude of this effect is large; an increase in labor regulation by one standard deviation increases the time to entry by 1.17 years (from $e^{(2.19)} = 8.935$ years to $e^{(2.19+1.104*0.16)} = 10.66$ years), which is about 19.3% of the mean log years to entry (which is 2.19 log points or 8.9 years).

We find similar results when we examine the number of outlets established in foreign markets. In column 3, we find that there are more stores in larger markets (proxied by GDP), and fewer stores in countries further away from the US. In Column 4, labor reg-

[23]We find similar results using the IV approach with the index of hiring/firing inflexibility obtained from the Global Competition Survey (2002), as reported in Appendix 4, Table 2. We also checked results using different lag structures for the instruments, and found our results to be generally robust. We also verified results using the Blundell and Bond (1998) GMM approach. While this yields very similar coefficient estimates, the set of Blundell-Bond instruments do not pass the overidentification tests.

[24]http://www.macalester.edu/research/economics/PAGE/HAVEMAN/Trade.Resources/Data/Gravity/dist.txt.

ulation appears to reduce the number of outlets. While the coefficient is only marginally significant, the magnitude of the effect is large; a one standard deviation change in the index of labor regulation reduces the number of stores by about 0.32 log points (-2.016*0.16). This translates to a 27.6 % drop in the number of outlets around the mean log outlets, since the mean log outlets is 2.49 (or mean outlets are $e^{2.49} = 12.06$ outlets). This number is reduced to $e^{(2.49-0.32)} = 8.74$ outlets with a one standard deviation increase in the index of labor regulation.

A few caveats should be kept in mind as we consider these results. For one thing, a number of idiosyncratic and transient factors may have influenced entry by the Company into foreign markets. Some of these omitted factors could be correlated with the regulation index, though we have no a priori reasons to expect them to be. Two, the analysis could suffer from selection bias as we do not include countries that the Company had not entered as of 2003. The direction of the bias is unclear; the coefficient on the labor regulation index could be downward (upward) biased if a number of countries that the Company chose not to enter had rigid (liberal) labor regulations, yet the decision was not based on the presence or absence of these regulations. Still, the results we find with respect to the Company's expansion decisions are clearly consistent with our findings in the previous sections. We conclude that labor market rigidity appears to hamper international entry and expansion, in addition to restricting labor choices within outlets.

7 Conclusion

In this paper, we ask if rigidities associated with labor regulation, as measured by an index of statutory requirements (constructed by Botero, et al 2004) or through surveys of executives, have a measurable impact on the day-to-day operations of firms. We found strong evidence that labor regulations dampen firm responses to demand/supply shocks in our very micro-level data. To our knowledge, ours is the first establishment-level cross-country study to document such an effect.

Our data in fact provide several unique advantages. First, they are available at very high frequency (weekly) for a long period (four years), which has significant advantages relative to annual frequency firm level or aggregate data where considerable within year or establishment level variation may go unmeasured ((Hamermesh 1989, Hammermesh and Pfann 1996). Moreover, the very high frequency of our data allow us to adopt estimation strategies involving either store, store-year or even store-year-season fixed effects, and thereby control for many factors that might bias results estimates otherwise. Second, we look at outlets of the same firm producing the same product across different countries. Since outlets use very similar technologies to produce their very similar products, it is reasonable to assume that our results are not driven by differences in technology and production function parameters across countries. Finally, the fact that our results are derived from data from a single firm also implies that we are holding constant a number of headquarters policies that may confound comparisons of different firms across countries.

In addition to showing a measurable impact of regulations on day-to-day operations and labor decisions, we find evidence that the Company delays entry and also operates fewer outlets – conditional on the size of the economy, population and distance to the US – in countries with more rigid labor regulations.

Our study focused on assessing the effect of labor regulation on the Company's operations. The goal of labor policies, of course, is to protect labor. Our findings are consistent with the idea that incumbent workers benefit from the regulation, as the stores does not reduce labor as much as it would otherwise when facing negative shocks. Thus such workers may benefit from employment tenure or reduced uncertainty. Of course, our results also imply that the stores do not increase labor as much as it would under a less regulated regime when it faces positive shocks. Moreover, we found evidence that the firm uses less labor overall in countries with more rigid regulations, both because individual outlets choose to use less labor, and because the Company has not expanded as much in these markets. All things considered, and especially given the magnitude of the economic effects we uncover, we believe the weight one gives to incumbent workers and their utility must be quite high to make such policies socially beneficial.

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Figure 1: Index of labor regulation

This graph plots the index of labor regulation obtained from Botero, et al (2004). Larger values indicate less flexibility in hiring and firing regular and temporary workers.

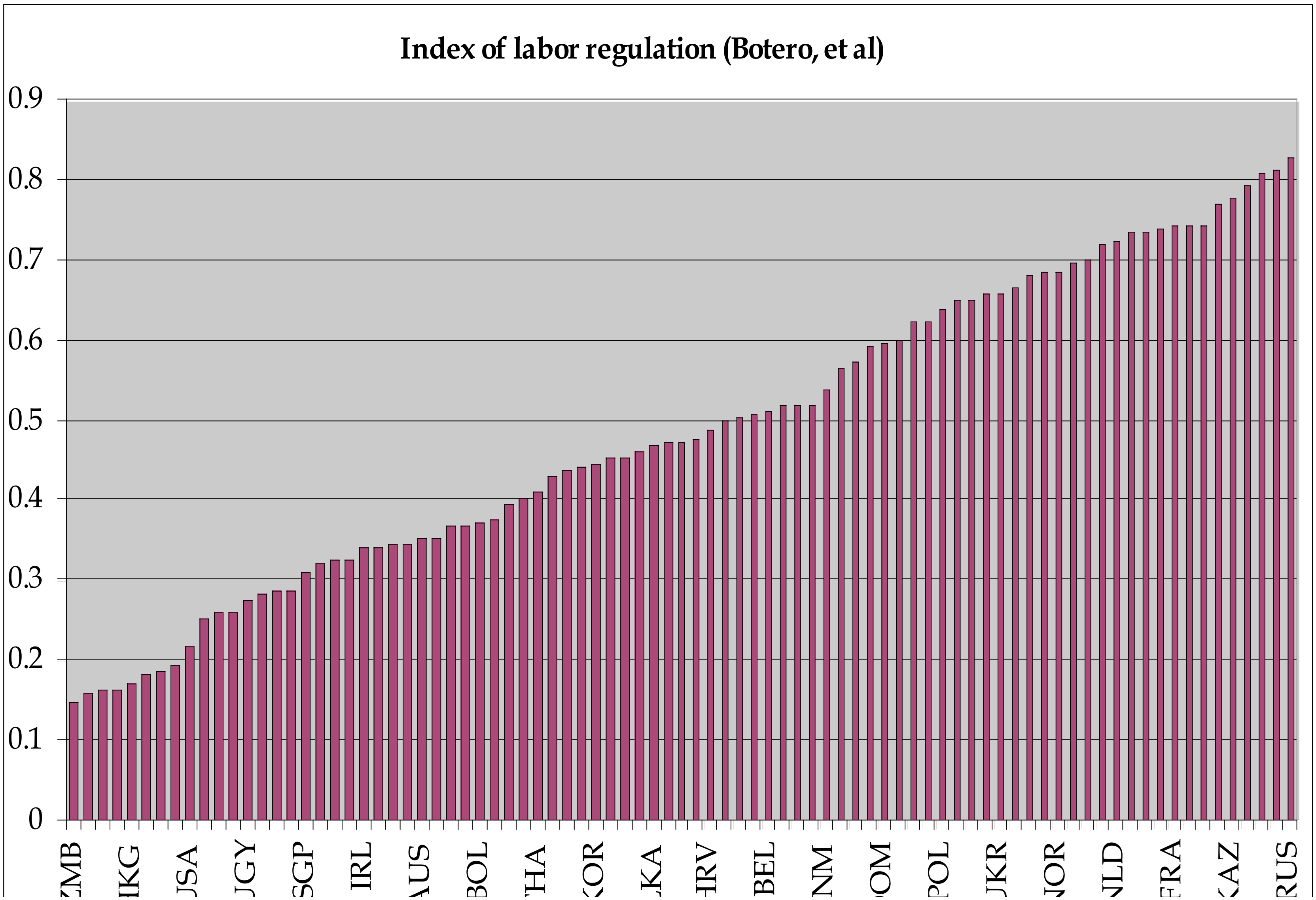


Table 1: Regression results from simulated data

The dependent variable is log labor cost from simulated datasets. Adjustment cost parameter varies from nil to one week's wage in 44 equal increments across 45 regimes (countries). Standard errors are clustered at the regime (country) level. + significant at 10%; * significant at 5%; ** significant at 1%.

	Symmetric quadratic adjustment costs, IID shocks		**Symmetric quadratic adjustment costs, auto-correlated shocks**		**Asymmetric linear adjustment costs, IID shocks**		**Asymmetric linear adjustment costs, auto-correlated shocks**	
Log (Revenue)	0.418	0.416	0.424	0.428	1.371	1.371	1.29	1.289
	[0.121]**	[0.122]**	[0.103]**	[0.105]**	[0.019]**	[0.019]**	[0.014]**	[0.013]**
Log (Lagged labor cost)	0.221	0.143	0.491	0.419	-0.034	-0.027	-0.027	-0.017
	[0.132]	[0.109]	[0.116]**	[0.117]**	[0.009]**	[0.008]**	[0.007]**	[0.005]**
Adjustment cost X Log (Revenue)	**-0.013**	**-0.013**	**-0.013**	**-0.013**	**-0.035**	**-0.035**	**-0.026**	**-0.026**
	[0.004]**	**[0.004]****	**[0.004]****	**[0.004]****	**[0.001]****	**[0.001]****	**[0.001]****	**[0.001]****
Adjustment cost X Log (Lagged labor cost)	**0.048**	**0.069**	**0.018**	**0.024**	**0.019**	**0.017**	**0.017**	**0.014**
	[0.010]**	**[0.015]****	**[0.005]****	**[0.007]****	**[0.001]****	**[0.001]****	**[0.000]****	**[0.000]****
Constant	-0.453	-0.915	0.012	-0.058	0.477	0.527	0.426	0.516
	[0.157]**	[0.317]**	[0.025]	[0.070]	[0.014]**	[0.014]**	[0.005]**	[0.004]**
Store fixed effects	Yes	No	Yes	No	Yes	No	Yes	No
Store-season fixed effects	No	Yes	No	Yes	No	Yes	No	Yes
Observations	234,000	234,000	234,000	234,000	234,000	234,000	234,000	234,000
R-squared	0.88	0.89	0.91	0.92	0.96	0.97	0.91	0.92
Adjusted R-squared	0.876	0.887	0.909	0.916	0.964	0.966	0.91	0.922
Number of clusters	45	45	45	45	45	45	45	45

Table 2: Summary statistics

For comparability, labor cost, food cost and revenue are expressed in US dollars, using the average of the weekly exchange rates (reported in the Company dataset) for the year. Index of labor regulation is obtained from Botero, et al (2004). Index of hiring/firing inflexibility is obtained from the survey data used in the Global Competitiveness Report (2002).

Variable	N	Mean	SD	P25	P50	P75	Min	Max
Log (Labor cost)	406,923	7.21	0.86	6.72	7.30	7.83	-5.96	10.25
Log (Lagged labor cost)	406,610	7.21	0.86	6.72	7.30	7.83	-5.96	10.25
Log (Revenue)	417,110	8.84	0.70	8.47	8.92	9.33	2.85	11.50
Log (Materials cost)	445,812	7.76	0.68	7.41	7.83	8.20	-5.96	10.94
Log (Lagged materials cost)	445,006	7.75	0.68	7.41	7.83	8.20	-5.96	10.94
Index of labor regulation	416,519	0.42	0.16	0.28	0.44	0.59	0.16	0.83
Index of hiring/firing inflexibility	433,214	0.55	0.13	0.42	0.53	0.64	0.33	1.00

Table 3: Labor regulation and labor demand hysteresis

The dependent variable is the log of labor cost per week for each store (outlet). "Regulation" is the index of labor regulation, a measure of the rigidity of the labor market, obtained from the study by Botero, et al (2004). Standard errors are clustered at country level. + significant at 10%; * significant at 5%; ** significant at 1%.

	(1)	(2)	(3)
Log (Revenue)	0.581	0.563	0.563
	[0.071]**	[0.049]**	[0.047]**
Log (Lagged labor cost)	0.072	-0.035	-0.087
	[0.143]	[0.107]	[0.090]
Regulation X Log (Revenue)	**-0.579**	**-0.493**	**-0.417**
	[0.145]**	**[0.101]****	**[0.106]****
Regulation X Log (Lagged labor)	**1.034**	**0.924**	**0.700**
	[0.296]**	**[0.224]****	**[0.203]****
Constant	0.634	1.559	2.311
	[0.231]**	[0.312]**	[0.359]**
Observations	322,043	322,043	322,043
Fixed Effects	Store	Store-year	Store-year-season
R-squared	0.940	0.950	0.960
Adjusted R-squared	0.945	0.951	0.958
Number of clusters	43	43	43

Effect of a one standard deviation (0.70) increase in Log (Revenue)			
At Regulation = mean (0.42)	23.65%	24.92%	27.15%
At Regulation = mean + sd (0.42+0.16=0.58)	17.16%	19.39%	22.48%
Impact of increase in Regulation	-6.48%	-5.52%	-4.67%
Effect of a one standard deviation (0.86) increase in Log (Lagged labor)			
At Regulation = mean (0.42)	43.54%	30.36%	17.80%
At Regulation = mean + sd (0.58)	57.77%	43.08%	27.43%
Impact of increase in Regulation	14.23%	12.71%	9.63%

Table 4: Labor regulation and labor demand hysteresis – Robustness to alternate measure of labor flexibility

The dependent variable is the log of labor cost per week for each store (outlet). "Inflexibility" is the index of hiring/firing inflexibility, a measure of the rigidity of the labor market, obtained from the survey data used in the Global Competitiveness Report (2002). Standard errors are clustered at country level. + significant at 10%; * significant at 5%; ** significant at 1%.

	(1)	(2)	(3)
Log (Revenue)	0.771	0.783	0.770
	[0.156]**	[0.141]**	[0.162]**
Log (Lagged labor cost)	-0.038	-0.152	-0.188
	[0.228]	[0.184]	[0.146]
Inflexibility X Log (Revenue)	**-0.746**	**-0.720**	**-0.633**
	[0.221]**	**[0.216]****	**[0.261]***
Inflexibility X Log (Lagged labor)	**1.017**	**0.939**	**0.732**
	[0.338]**	**[0.293]****	**[0.233]****
Constant	0.249	1.142	1.913
	[0.242]	[0.317]**	[0.363]**
Observations	338,655	338,655	338,655
Fixed Effects	Store	Store-year	Store-year-season
R-squared	0.950	0.950	0.960
Adjusted R-squared	0.947	0.954	0.960
Number of clusters	48	48	48

Effect of a one standard deviation (0.70) increase in Log(Revenue)			
At Regulation = mean (0.42)	32.04%	33.64%	35.29%
At Regulation = mean + sd (0.42+0.16=0.58)	23.68%	25.58%	28.20%
Impact of increase in Regulation	-8.36%	-8.06%	-7.09%
Effect of a one standard deviation (0.86) increase in Log(Lagged labor)			
At Regulation = mean (0.42)	33.47%	20.84%	10.27%
At Regulation = mean + sd (0.58)	47.46%	33.77%	20.34%
Impact of increase in Regulation	13.99%	12.92%	10.07%

Table 5: Robustness check: labor regulation and hysteresis in material inputs

The dependent variable is the log of food cost per week for each store (outlet). "Regulation" is the index of labor regulation, a measure of the rigidity of the labor market, obtained from the study by Botero, et al (2004). Standard errors are clustered at country level. + significant at 10%; * significant at 5%; ** significant at 1%.

	(1)	(2)	(3)
Log (Revenue)	0.865	0.906	0.976
	[0.072]**	[0.053]**	[0.020]**
Log (Lagged materials cost)	0.242	0.177	0.066
	[0.113]*	[0.113]	[0.067]
Regulation X Log (Revenue)	**-0.029**	**-0.010**	**-0.078**
	[0.138]	**[0.092]**	**[0.043]+**
Regulation X Log (Lagged Materials)	**-0.197**	**-0.157**	**-0.081**
	[0.202]	**[0.198]**	**[0.128]**
Constant	-1.028	-1.098	-0.850
	[0.085]**	[0.128]**	[0.134]**
Observations	362,710	362,710	362,710
Fixed Effects	Store	Store-year	Store-year-season
R-squared	0.950	0.950	0.960
Adjusted R-squared	0.946	0.952	0.959
Number of clusters	43	43	43

Effect of a one standard deviation (0.70) increase in Log(Revenue)			
At Regulation = mean (0.42)	59.70%	63.13%	66.03%
At Regulation = mean + sd (0.42+0.16=0.58)	59.37%	63.01%	65.15%
Impact of increase in Regulation	-0.32%	-0.11%	-0.87%
Effect of a one standard deviation (0.86) increase in Log(Lagged materials)			
At Regulation = mean (0.42)	13.70%	9.55%	2.75%
At Regulation = mean + sd (0.58)	10.99%	7.39%	1.64%
Impact of increase in Regulation	-2.71%	-2.16%	-1.11%

Table 6: Labor regulation and labor demand hysteresis -- IV specifications
The dependent variable is the log of labor cost per week for each store (outlet). "Regulation" is the index of labor regulation, a measure of the rigidity of the labor market, obtained from the study by Botero, et al (2004). All regressions include store-year fixed effects. Standard errors are clustered at country level. + significant at 10%; * significant at 5%; ** significant at 1%.

	(1)	(2)	(3)
Log (Revenue)	0.661	0.598	0.79
	[0.171]**	[0.046]**	[0.178]**
Log (Lagged labor cost)	-0.063	-0.208	-0.27
	[0.139]	[0.097]*	[0.152]+
Regulation X Log (Revenue)	**-0.84**	**-0.677**	**-1.487**
	[0.329]*	**[0.107]****	**[0.357]****
Regulation X Log (Lagged labor)	**0.993**	**1.657**	**1.995**
	[0.284]**	**[0.206]****	**[0.303]****
Observations	260010	260010	260010
Number of clusters	43	43	43
Anderson under-identification test	0.000	0.000	0.000
Hansen J p-value	0.2794	0.3202	0.2307
Stock-Yogo Cragg-Donald Weak IV statistic	3393.20	4614.32	2041.54

Column 1: Instrumented -- Log (Revenue), Regulation X Log (Revenue)
Excluded instruments -- L(1/5).Log (Revenue), L(1/5).Log (Lagged labor cost), L(1/5).Regulation X Log (Revenue), L(1/5).Regulation X Log (Lagged labor), L(1/5).Log (Material cost)

Column 2: Instrumented -- Log (Lagged labor cost), Regulation X Log (Lagged labor)
Excluded instruments -- L(1/5).Log (Revenue), L(1/5).Log (Lagged labor cost), L(1/5).Regulation X Log (Revenue), L(1/5).Regulation X Log (Lagged labor), L(1/5).Log (Material cost)

Column 3: Instrumented -- Log (Lagged labor cost), Regulation X Log (Lagged labor), Log (Revenue), Regulation X Log (Revenue)
Excluded instruments -- L(1/5).Log (Revenue), L(1/5).Log (Lagged labor cost), L(1/5).Regulation X Log (Revenue), L(1/5).Regulation X Log (Lagged labor), L(1/5).Log (Material cost)

* Note: In all regressions, all right hand side variables that are not considered endogenous (for example Log (Lagged labor cost) and Inflexibility X Log (Lagged labor) in column 1) are included in the full set of instruments.

Table 7: Labor regulation and international expansion

The dependent variable in columns 1, 2, 5 and 6 is the log of the numbers of years to entry (from the date of the first entry by the Company into any foreign country (1983)). The dependent variable in columns 3, 4, 7 and 8 is the log of the number of stores in the market. The sample for the regressions in columns 1, 2, 3 and 4 is one weekly observation for each country for each of the four years (2000-2003). The sample for regressions in columns 5, 6, 7 and 8 is the last observed week for each country for the year 2001 (midpoint of the sample). "Regulation" is the index of labor regulation, a measure of the rigidity of the labor market, obtained from the study by Botero, et al (2004). Standard errors are clustered at country level. * significant at 5%; ** significant at 1%.

	All years				**End 2001**			
Dependent variable	**Log(Years to entry)**		**Log(Number of stores)**		**Log(Years to entry)**		**Log(Number of stores)**	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Log(GDP in USD)	-0.224	-0.312	0.565	0.593	-0.228	-0.317	0.477	0.508
	[0.074]**	[0.071]**	[0.121]**	[0.128]**	[0.076]**	[0.074]**	[0.168]**	[0.175]**
Log(Population)	0.093	0.125	-0.037	0.038	0.098	0.138	-0.027	0.075
	[0.051]+	[0.077]	[0.141]	[0.212]	[0.053]+	[0.085]	[0.149]	[0.234]
Log(Distance to USA in kms)	0.311	0.280	-0.423	-0.448	0.301	0.236	-0.298	-0.377
	[0.124]*	[0.195]	[0.217]+	[0.264]+	[0.124]*	[0.208]	[0.278]	[0.320]
Regulation		1.104		-2.016		1.140		-2.601
		[0.438]*		[0.832]*		[0.452]*		[1.071]*
Constant	3.563	5.090	-7.324	-8.254	3.670	5.358	-6.412	-7.097
	[1.485]*	[2.011]*	[2.455]**	[3.562]*	[1.556]*	[2.141]*	[3.111]*	[4.637]
Observations	9420	6906	9937	7423	47	34	51	38
R-squared	0.240	0.420	0.400	0.410	0.250	0.450	0.290	0.340
Number of clusters	50	37	54	41	47	34	51	38

Appendix 1: Definition of Employment Laws Index (from Botero, et al, 2004)

Alternative employment contracts	Measures the existence and cost of alternatives to the standard employment contract, computed as the average of: (1) a dummy variable equal to one if part-time workers enjoy the mandatory benefits of full-time workers;(2) a dummy variable equal to one if terminating part-time workers is at least as costly as terminating full time workers; (3) a dummy variable equal to one if fixed-term contracts are only allowed for fixed-term tasks; and(4) the normalized maximum duration of fixed-term contracts.
Cost of increasing hours worked	Measures the cost of increasing the number of hours worked. We start by calculating the maximum number of normal hours of work per year in each country (excluding overtime, vacations, holidays, etc.). Normal hours range from 1,758 in Denmark to 2,418 in Kenya. Then we assume that firms need to increase the hours worked by their employees from 1,758 to 2,418 hours during one year. A firm first increases the number of hours worked until it reaches the countrys maximum normal hours of work, and then uses overtime. If existing employees are not allowed to increase the hours worked to 2,418 hours in a year, perhaps because overtime is capped, we assume the firm doubles its workforce and each worker is paid 1,758 hours, doubling the wage bill of the firm. The cost of increasing hours worked is computed as the ratio of the final wage bill to the initial one.
Cost of firing workers	Measures the cost of firing 20 percent of the firms workers (10% are fired for redundancy and 10% without cause). The cost of firing a worker is calculated as the sum of the notice period, severance pay, and any mandatory penalties established by law or mandatory collective agreements for a worker with three years of tenure with the firm. If dismissal is illegal, we set the cost of firing equal to the annual wage. The new wage bill incorporates the normal wage of the remaining workers and the cost of firing workers. The cost of firing workers is computed as the ratio of the new wage bill to the old one.
Dismissal procedures	Measures worker protection granted by law or mandatory collective agreements against dismissal. It is the average of the following seven dummy variables which equal one: (1) if the employer must notify a third party before dismissing more than one worker; (2) if the employer needs the approval of a third party prior to dismissing more than one worker; (3) if the employer must notify a third party before dismissing one redundant worker; (4) if the employer needs the approval of a third party to dismiss one redundant worker; (5) if the employer must provide relocation or retraining alternatives for redundant employees prior to dismissal; (6) if there are priority rules applying to dismissal or lay-offs; and (7) if there are priority rules applying to reemployment.
Employment laws index	**Measures the protection of labor and employment laws as the average of: (1) Alternative employment contracts; (2) Cost of increasing hours worked; (3) Cost of firing workers; and (4) Dismissal procedures.**

Appendix 2: A stochastic dynamic programming model of adjustment costs

In this appendix, we present a stochastic dynamic programming model of labor adjustment in the presence of adjustment costs. We numerically solve the model for a set of parameter values, and then simulate data to assess the effect of increased adjustment cost on two properties of the optimal labor choice: (i) the observed elasticity of labor demand with respect to output, and (ii) the elasticity of labor choice with respect to the previous period's labor choice.

A Model setup

The production function of the optimizing producer (here each outlet of the multinational firm) uses a single input, with the following form:

$$Y = f(l) = \theta \ell^{\alpha} \tag{14}$$

where Y is the output of the outlet, ℓ is the labor input, θ is a productivity shock faced by the outlet, and α is a production function parameter. We assume that each outlet faces a downward sloping iso-elastic demand curve. The outlet faces a iso-elastic downward sloping demand curve:

$$P = \lambda \cdot Q^{\frac{1}{\mu}}$$

where λ represents demand shocks.

The firm faces perfectly elastic labor supply at wage level w. The impact of labor regulations is modelled as affecting the adjustment costs. The labor regulations impose one of two types of adjustment costs:

(i) symmetric quadratic adjustment costs: $g(\Delta l_t) = c \cdot (\Delta l_t)^2$, where $\Delta l_t = l_t - l_{t-1}$.

(ii) asymmetric, linear adjustment cost: $g(\Delta l_t) = c \cdot (\Delta l_t) \cdot D_t$, where D_t is an indicator function for firing defined as follows:

$$D_t = \begin{cases} 1 & \text{if} \quad \Delta \mathrm{l_t} < 0 \\ 0 & \text{if} \quad \Delta \mathrm{l_t} \geq 0 \end{cases}$$

The assumption of quadratic symmetric adjustment costs is invoked in a number of early theoretical work on labor adjustment costs. However, Jaramillo et al (1993) and Pfann and Palm (1993) suggest that labor adjustment costs are asymmetric. Our specification of asymmetric firing costs is consistent with regimes with mandated severance payments.

Productivity (θ) and demand (λ) shocks are revealed to the outlet at the beginning of the period, and then the outlet chooses the labor level for that period. Thus the objective function of the outlet in period 1 is:

$$\max_{\{\ell_t\}_{t=1}^{t=\infty}} \left\{ \phi_1 \ell_1^{\alpha^*} - w\ell_1 - c(\Delta \ell_1) + E_1 \left[\sum_{t=2}^{\infty} \beta^t \left(\phi_t \ell_t^{\alpha^*} - w\ell_t - g(\Delta \ell_t) \right) \; |\phi_1 \right] \right\} \tag{15}$$

where $\phi = \lambda\theta^{\left(1+\frac{1}{\mu}\right)}$ and $\alpha^* = \alpha^{\left(1+\frac{1}{\mu}\right)}$.

The productivity and demand shocks (and therefore the combined productivity and demand shock parameter ϕ) follow a first order Markov process. Then the problem facing the firm is identical from period to period except for two (state) variables – the amount of labor from the last period and the current combined productivity and demand shock term (ϕ). Accordingly, equation 15 in the Bellman equation form is:

$$V(\phi, \ell) = \max_{\{\ell'\}} \left\{ \phi \ell'^{\alpha^*} - w\ell' - g(\Delta\ell') + \beta E[V(\phi', \ell') \mid \phi] \right\}. \quad (16)$$

The sufficient condition for the above equation to be a contraction mapping is that the objective function be concave, which is fulfilled if $\alpha^* < 1$ (see Stokey, Lucas and Prescott, 1989). However, the equation does not yield closed form solutions for the value function $V(\theta, \ell)$ or the policy function $\ell'(\theta, \ell)$. To estimate numeric solutions, we need to make assumptions regarding parameter values, which we discuss in the next section.

B Selecting parameter values

We make the following parametric assumptions to derive a numeric solution to the dynamic programming problem in equation 16:

- $\alpha^* = 0.6$, based on a labor share of value added (α) of 0.36 and a demand elasticity (μ) of -2.[25]
- We set the wage $w = 0.3$. (Note that the output price is set in equilibrium based on demand shock λ and demand elasticity μ.)
- We set the range for the combined productivity and demand shock ϕ to be [0.5, 2]. (The evolution of the shock process is discussed below.)
- We assume a discount factor $\beta = \frac{1}{1.08}$, based on an 8 per cent required rate of return for outlet owners.

Based on the above assumptions, the per period labor choices are bounded between 1 and 32, since:

$$\ell_{min} = \left[\frac{\alpha^* \phi_{min}}{w}\right]^{\frac{1}{(1-\alpha^*)}} = 1$$

$$\ell_{max} = \left[\frac{\alpha^* \phi_{max}}{w}\right]^{\frac{1}{(1-\alpha^*)}} = 32$$

Correspondingly, the output level is bounded between 0.5 and 16, and hence the maximum of the value function is bounded by 86.4 (assuming $\theta = 2$, which yields per period profit of 6.4). The following additional assumptions are about the evolution of the combined demand and productivity shock parameter (ϕ):

[25] The labor share is derived from the data, and demand elasticity is backed out from the observed material share of revenue and an estimate of the revenue production function. See the companion paper Lafontaine and Sivadasan (2006) for details on the demand elasticity estimate.

- We assume that ϕ follows a discrete Markov chain, with 16 states ($s_1 = 0.5, s_2 = 0.6, ..., s_{16} = 2.0$).
- T_{ij} defines the probability of transition from state s_i to s_j. We assume two types of shock processes:
  - (i) IID shocks: This is captured by setting $T_{ii} = T_{ij} = \frac{1}{16} = 0.0625$.
  - (ii) Persistent or autocorrelated shocks: This is captured by setting $T_{ii} = 0.5 > T_{ij} = \frac{0.5}{15} = 0.033$.

C Solving the model and simulating data

Our simulations are intended to capture the effect of varying the cost of firing c on the relationship between labor demand and measured output. We undertake the following 2 stage procedure:

C.1 Stage 1: Obtaining optimal policy functions

In this stage, we solve and store the optimal policy function for the 45 separate regimes, where the adjustment cost parameter c varies from 0 to 1 period's (week) wage (in increments of $\frac{1}{45}$ of the weekly wage).

Since standard regularity conditions hold, the Bellman equation (16) can be solved numerically. Given the above choices for the parameters, we search over a grid $\phi X \ell = [0.5, 2.0] X [1, 32]$, with ϕ increments of 0.1 and ℓ increments of 1. We start with the initial guess of:

$$V_1(\phi, \ell) = \frac{\phi \ell^{\alpha^*} - w\ell}{1 - \alpha^*}$$

We find that our contraction search routine converges in about 6 iterations to reasonably small differences between consecutive iterations of the value functions (a total squared difference of about 49, corresponding to a per point mean difference of about 0.09, at the sixth iteration of the first simulation run). As discussed above, we obtain the optimal policy functions for four scenarios:

(i) Symmetric, quadratic adjustment costs with IID shocks;

(ii) Symmetric, quadratic adjustment costs with autocorrelated shocks ($P_{ii} = 0.5$);

(iii) Asymmetric, linear adjustment costs with IID shocks; and

(iv) Asymmetric, linear adjustment costs with autocorrelated shocks ($P_{ii} = 0.5$).

C.2 Stage 2: Simulating data

In the second stage, we simulate data for 100 firms in each of the 45 adjustment cost level regimes, for each of the four scenarios. For each outlet i, we draw period 0 labor levels (l_{i0}) from a uniform distribution over [1, 32], and period 0 productivity shocks (θ_{i0}) from a uniform distribution over [0.5, 2.0].

Draws of theta for period t (θ_{it}) are drawn based on previous the prior period shock and the transition probability matrix. Labor choice in period t is based on the optimal policy function (solved in step 2 using the contraction search routine).

We simulate the model for 50 periods to allow the distribution of shocks and labor levels to reach steady state. We then simulate 52 weeks of data for each outlet, for each of the four scenarios considered.

At the end of stage 2, we have four datasets, each containing data on $45 \cdot 100 = 4500$ firms for 52 weeks each ($4500 \cdot 52 = 234,000$ observations). In the next section, we discuss the regression specifications we run on the simulated data to analyze the effect of changes in adjustment costs on the elasticity of labor demand with respect to revenue and with respect to the previous period's labor demand.

D Regression analysis on simulated data

We run the following regression specification on the simulated data:

$$b_{it}^{j} = \beta r_{it}^{j} + \gamma b_{it-1}^{j} + \delta_r c^j r_{it}^{j} + \delta_b c^j b_{it-1}^{j} + \eta_{is}^{j} + \varepsilon_{it}^{j} \qquad (17)$$

where

Here i indexes firms and j indexes the 45 different adjustment cost regimes and t indexes weeks. The log labor cost b_{it}^{j} = Log(labor $\cdot$ wage). Here labor is the choice made by the firm' based the optimal policy function (depending on prior period labor and current ϕ shock).

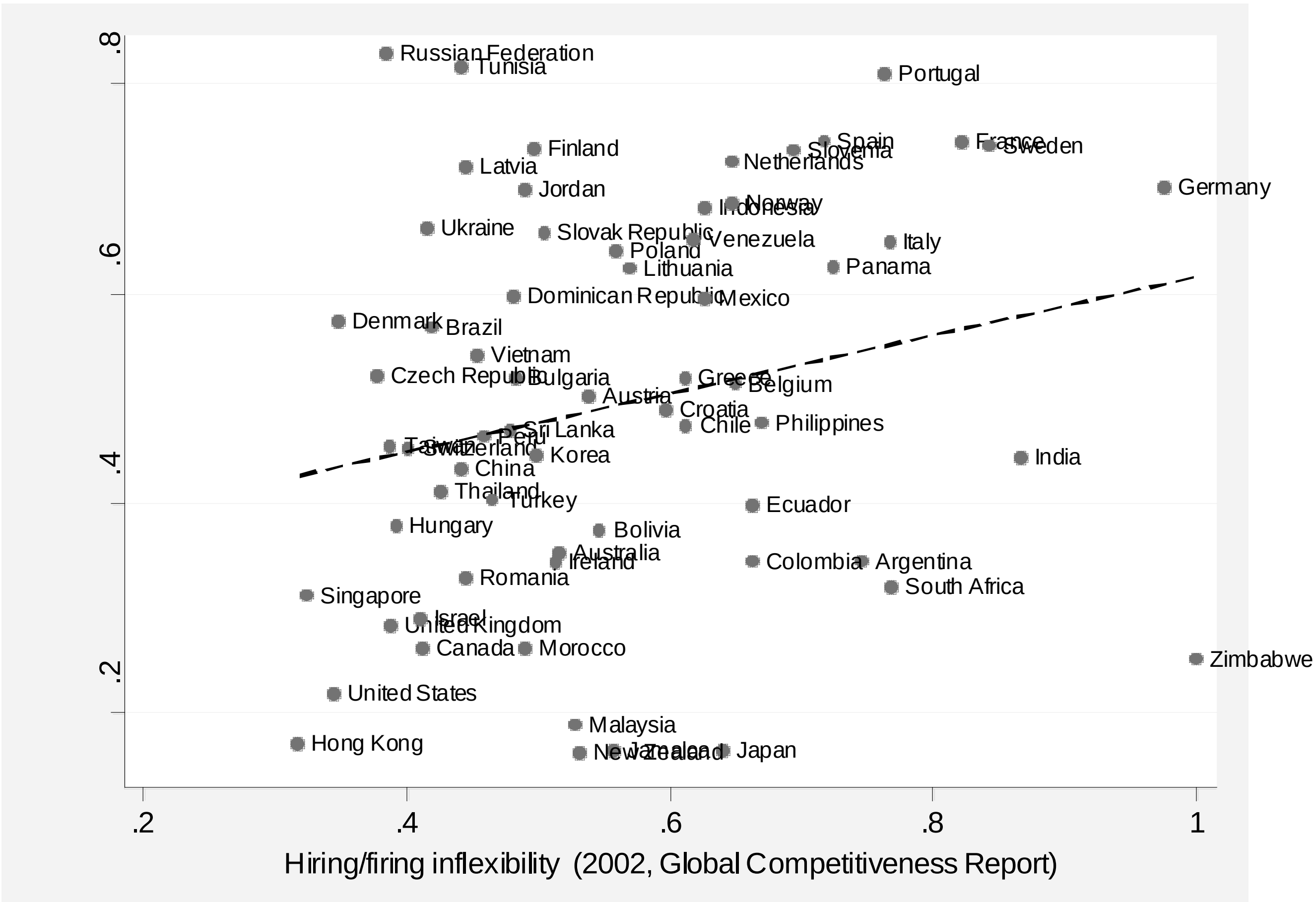
Log revenue r_{it}^{j} is the sum the log quantity and the log price. To define log quantity and price, we make the following assumption about the demand and productivity shocks underlying the combined shock process ϕ. We assume that the productivity level θ stays equal to 1, so that the demand shock λ is identically equal to the combined shock ϕ. This assumption makes it simple to derive output and price, and is not unreasonable in the context of retail food outlets, where the productivity term θ can be expected to stay more or less constant over time, given the standardization of technology and processes. Quantity is the obtained from labor as $Q = l^{0.36}$, since the underlying assumption was $\alpha = 0.36$ (see section B). Price is then defined as $P = \lambda \cdot Q^{\frac{1}{\mu}} = \phi \cdot Q^{\frac{1}{-2}}$, since μ was taken as -2 (see section B).

c^j represents adjustment cost (and is therefore analogous to the labor regulation index in the data). η_{is}^{j} captures firm or firm-season fixed effects.

The results from simulations are presented in Table 1 and discussed in section 2.2.

Appendix 3

Index of labor regulation (Botero, et al) versus index of hiring/firing inflexibility (2002, Global Competitiveness Report)



Appendix 4

Table 1: Robustness check: labor regulation and hysteresis in material inputs, alternative measure of labor regulation

The dependent variable is the log of food cost per week for each store (outlet). "Inflexibility" is the index of hiring/firing inflexibility, a measure of the rigidity of the labor market, obtained from the survey data used in the Global Competitiveness Report (2002). Standard errors are clustered at country level. * significant at 5%; ** significant at 1%.

	(1)	(2)	(3)
Log (Revenue)	0.863	0.880	0.938
	[0.115]**	[0.083]**	[0.050]**
Log (Lagged labor cost)	0.205	0.147	0.009
	[0.168]	[0.169]	[0.079]
Inflexibility X Log (Revenue)	-0.010	0.047	0.014
	[0.169]	[0.119]	[0.075]
Inflexibility X Log (Lagged labor)	-0.079	-0.064	0.045
	[0.257]	[0.253]	[0.127]
Constant	-1.087	-1.131	-0.895
	[0.125]**	[0.165]**	[0.178]**
Observations	379,406	379,406	379,406
Fixed Effects	Store	Store-year	Store-year-season
R-squared	0.950	0.960	0.960
Adjusted R-squared	0.951	0.956	0.963
Number of clusters	48	48	48

Effect of a one standard deviation (0.70) increase in Log(Revenue)			
At Regulation = mean (0.42)	60.12%	62.98%	66.07%
At Regulation = mean + sd (0.42+0.16=0.58)	60.00%	63.51%	66.23%
Impact of increase in Regulation	-0.11%	0.53%	0.16%
Effect of a one standard deviation (0.86) increase in Log(Lagged labor)			
At Regulation = mean (0.42)	14.78%	10.33%	2.40%
At Regulation = mean + sd (0.58)	13.69%	9.45%	3.02%
Impact of increase in Regulation	-1.09%	-0.88%	0.62%

Appendix 4

Table 2: Robustness check: Labor regulation and labor demand hysteresis -- IV specifications, alternative measure of labor regulation

The dependent variable is the log of labor cost per week for each store (outlet). "Inflexibility" is the index of hiring/firing inflexibility, a measure of the rigidity of the labor market, obtained from the survey data used in the Global Competitiveness Report (2002). All regressions include store-year fixed effects. Standard errors are clustered at country level. + significant at 10%; * significant at 5%; ** significant at 1%.

	(1)	(2)	(3)
Log (Revenue)	0.771	0.952	0.921
	[0.132]**	[0.250]**	[0.340]**
Log (Lagged labor cost)	-0.471	-0.245	-0.577
	[0.190]*	[0.207]	[0.300]+
Inflexibility X Log (Revenue)	-0.77	-1.124	-1.357
	[0.210]**	[0.368]**	[0.584]*
Inflexibility X Log (Lagged labor)	1.775	1.119	2.154
	[0.353]**	[0.325]**	[0.523]**
Observations	274668	274668	274668
Number of clusters	48	48	48
Anderson under-identification test	0.000	0.000	0.000
Hansen J p-value	0.1573	0.1924	0.2714
Stock-Yogo Cragg-Donald Weak IV statistic	4894.08	3920.58	2034.79

Column 1: Instrumented -- Log (Revenue), Inflexibility X Log (Revenue)
Excluded instruments -- L(1/5).Log (Revenue), L(1/5).Log (Lagged labor cost), L(1/5). Inflexibility X Log (Revenue), L(1/5). Inflexibility X Log (Lagged labor), L(1/5).Log (Material cost)

Column 2: Instrumented -- Log (Lagged labor cost), Inflexibility X Log (Lagged labor)
Excluded instruments -- L(1/5).Log (Revenue), L(1/5).Log (Lagged labor cost), L(1/5). Inflexibility X Log (Revenue), L(1/5). Inflexibility X Log (Lagged labor), L(1/5).Log (Material cost)

Column 3: Instrumented -- Log (Lagged labor cost), Inflexibility X Log (Lagged labor), Log (Revenue), Inflexibility X Log (Revenue)
Excluded instruments -- L(1/5).Log (Revenue), L(1/5).Log (Lagged labor cost), L(1/5). Inflexibility X Log (Revenue), L(1/5). Inflexibility X Log (Lagged labor), L(1/5).Log (Material cost)

* Note: In all regression, all right hand side variables that are not considered endogenous (for example Log (Lagged labor cost) and Inflexibility X Log (Lagged labor) in column 1) are included in the full set of instruments.