



Effective labor regulation and microeconomic flexibility[☆]

Ricardo J. Caballero^{a,b,*}, Kevin N. Cowan^c, Eduardo M.R.A. Engel^{b,d}, Alejandro Micco^e

^a MIT, United States

^b NBER, United States

^c Central Bank of Chile, Chile

^d Yale University, United States, and University of Chile, Chile

^e University of Chile and Centro de Microdatos, Chile

ARTICLE INFO

Article history:

Received 13 July 2010

Received in revised form 19 March 2012

Accepted 31 August 2012

JEL classification:

E24

J23

J63

J64

K00

Keywords:

Microeconomic rigidities

Creative-destruction

Job security regulation

Adjustment costs

Rule of law

ABSTRACT

Microeconomic flexibility is at the core of economic growth in modern market economies because it facilitates the process of creative-destruction. The main reason why this process is not infinitely fast, is the presence of adjustment costs, some of them technological, others institutional. Chief among the latter is labor market regulation. While few economists object to the hypothesis that labor market regulation hinders the process of creative-destruction, its empirical support is limited. In this paper we revisit this hypothesis, using a new sectoral panel for 60 countries and a methodology suitable for such a panel. We find that job security regulation clearly hampers the creative-destruction process, especially in countries where regulations are likely to be enforced. Moving from the 20th to the 80th percentile in job security, in countries with strong rule of law, cuts the annual speed of adjustment to shocks by a third while shaving off about 1% from annual productivity growth. The same movement has negligible effects in countries with weak rule of law.

© 2012 Elsevier B.V. All rights reserved.

1. Introduction

Microeconomic flexibility, by facilitating the ongoing process of creative-destruction, is at the core of economic growth in modern market economies. This basic idea has been with economists for centuries, was brought to the fore by Schumpeter more than fifty years ago, and has recently been quantified in a wide variety of contexts.¹ In US manufacturing, for example, more than half of aggregate productivity growth can be directly linked to this process.²

The main obstacle faced by microeconomic flexibility is adjustment costs. Some of these costs are purely technological, others are institutional. Chief among the latter is labor market regulation, in particular job security provisions. The literature on the impact of labor market regulation on the many different economic, political and sociological variables associated to labor markets and their participants

is extensive and contentious. However, the proposition that job security provisions reduce restructuring is a point of agreement.

Despite this consensus, the empirical evidence supporting the negative impact of labor market regulation on microeconomic flexibility has been scant at best. This is not too surprising, as the obstacles to empirical success are legions, including poor measurement of restructuring activity and labor market institution variables, both within a country and more so across countries.³ In this paper we make a new attempt. We develop a methodology that allows us to bring together the extensive new data set on labor market regulation constructed by [Botero et al. \(2004\)](#) with comparable cross-country cross-sectoral data on employment and output from the [UNIDO](#)

[☆] We thank Joseph Altonji, John Haltiwanger, Michael Keane, Norman Loayza, the editor and two anonymous referees for helpful comments. Caballero and Engel thank the NSF for financial support.

* Corresponding author at: MIT. Tel.: +1 617 253 0489; fax: +1 617 253 6915.

E-mail address: caball@mit.edu (R.J. Caballero).

¹ See, e.g., the review in Caballero and Hammour (2000).

² See, e.g., Foster et al. (1998).

³ On a closely related literature, there is an extensive body of empirical work, pioneered by Lazear (1990), that has put together data on job security provisions across countries and over time, and measured the effect of these provisions on aggregate employment. A recent survey of this literature can be found in Heckman and Pagés (2003). Results are mixed. On the one hand, Lazear (1990), Grubb and Wells (1993), Nickell (1997) and Heckman and Pages (2000) find a negative relationship between job security and employment levels. On the other hand Garibaldi and Mauro (1999), OECD (1999), queryAddison et al. (2000), and Freeman (2001) fail to find evidence of such a relationship.

(2002) data-set. We also emphasize the key distinction between *effective* and official labor market regulation.

The methodology builds on the simple partial-adjustment idea that larger adjustment costs are reflected in slower employment adjustment to shocks.⁴ The accumulation of limited adjustment to these shocks builds a wedge between frictionless and actual employment, which is the main right hand side variable in this approach. We propose a new way of estimating this wedge, which allows us to pool data on labor market legislation with comparable employment and output data for a broad range of countries. As a result, we are able to enlarge the effective sample to 60 economies, more than double the country coverage of previous studies in this literature.⁵ Our attempt to measure *effective* labor regulation interacts existing measures of job security provision with measures of rule of law and government efficiency.⁶

Our results are clear and robust: countries with less effective job security legislation adjust more quickly to imbalances between frictionless and actual employment. In countries with strong rule of law, moving from the 20th to the 80th percentile of job security lowers the speed of adjustment to shocks by 35% which amounts to a cut in annual productivity of 0.85% in an AK-type world. The same movement for countries with low rule of law only reduces the speed of adjustment by approximately 1% and productivity growth by 0.02%.

The paper proceeds as follows. Section 2 presents the methodology and describes the new data set. Section 3 discusses the main results and explores their robustness. Section 4 gauges the impact of effective labor protection on productivity growth. Section 5 concludes and is followed by various appendices.

2. Methodology and data

Our methodology is based on an adjustment cost model where the dynamic employment gap is given by a simple expression involving employment and nominal output, both of which are available in the sectoral panel for the 60 countries we use in the empirical part.

2.1. Methodology

The starting point is a partial adjustment framework where the change in the number of (filled) jobs in sector j in country c between time $t-1$ and t is a fraction of the gap between desired and actual employment. That is:

$$\Delta e_{jct} = \psi_{jct} (e_{jct}^* - e_{jct-1}), \quad (1)$$

where e and e^* denote the logarithm of employment and desired employment, respectively.

Eq. (1) can be rationalized via quadratic adjustment costs (Sargent, 1978), or an exogenous process where the ψ_{jct} is either zero or one (Calvo, 1983), or a stochastic adjustment cost model that nests the preceding models as particular cases (Caballero, Engel and Micco, 2004). For simplicity we consider the Calvo interpretation. We therefore assume that the ψ_{jct} is i.i.d., both across sectors and over time, taking values 0 or 1, with a country-specific mean λ_c . Since these stochastic

adjustment speeds can be viewed as resulting from adjustment costs that are either zero (with probability λ_c) or infinite (with probability $1 - \lambda_c$) we refer to these frictions as “adjustment costs”. The parameter λ_c captures microeconomic flexibility. As λ_c goes to one, all gaps are closed quickly and microeconomic flexibility is maximum. As λ_c decreases, microeconomic flexibility declines.

Eq. (1) hints at two important components of our methodology: We need a measure of the employment gap and a strategy to estimate the country-specific speeds of adjustment (the λ_c). We describe both ingredients in detail in what follows. In a nutshell, we construct estimates of e_{jct}^* , the only unobserved element of the gap, by solving the optimization problem of a sector's representative firm, as a function of observables such as labor productivity and a suitable proxy for the average market wage. We estimate λ_c based upon the large cross-sectional size of our sample and the well documented heterogeneity in the realizations of the gaps (see, e.g., Caballero, Engel and Haltiwanger (1997) for US evidence).

2.1.1. Employment gap measure

A sector's representative firm faces an isoelastic demand and has access to a production technology that is Cobb–Douglas in labor and hours per worker:

$$y = a + \alpha e + \beta h, \\ p = d - \frac{1}{\eta} y,$$

where y , p , e , h , a and d denote output, price, employment, hours per worker, productivity and demand shocks, respectively, and η is the price-elasticity of demand. We let $\gamma \equiv (\eta - 1)/\eta$, and assume $\eta > 1$, $\alpha > \beta > 0$ and $\alpha\gamma < 1$. Firms are competitive in the labor market but pay wages that increase with hours worked according to a wage schedule $w(h)$, with w' and w'' strictly positive. All lower case variables are in logs.

If the firm can adjust hours and employment in every period at no cost, then its profit maximizing inputs, denoted by \hat{h} and \hat{e} , are characterized by:

$$w'(\hat{h}) = \frac{\beta}{\alpha}, \quad (2)$$

$$\hat{e} = \frac{1}{1 - \alpha\gamma} \left[\log \beta\gamma + d + \gamma\alpha - (1 - \beta\gamma)\hat{h} - \log \{W'(\hat{H})\} \right], \quad (3)$$

where $\log W(H) \equiv w(\log H)$ and $\log \hat{H} \equiv \hat{h}$ (see Appendix A for the derivation). It follows from Eq. (2) that our functional forms imply that the optimal choice of hours, \hat{h} , does not depend on productivity and demand shocks.

Having solved the problem of a firm that faces no frictions, we turn next to the case with adjustment costs. A key assumption is that the representative firm within each sector only faces adjustment costs when it changes employment levels, not when it changes the number of hours worked.⁷ It follows that the sector's choice of hours in every period can be expressed in terms of its current level of employment, by solving the corresponding first order condition for hours, which leads to an expression analogous to Eq. (3) with h and e in the place of \hat{h} and \hat{e} . Subtracting this expression from Eq. (3) and writing the Taylor expansion for $\log\{W'(e^h)\}$ around $h = \hat{h}$ as

$$\log\{W'(H)\} \cong \log\{W'(\hat{H})\} + (\mu - 1)(h - \hat{h}),$$

⁴ For surveys of the empirical literature on partial-adjustment see Nickell (1986) and Hamermesh (1993).

⁵ To our knowledge, the broadest cross-country study to date – Nickell and Nunziata (2000) – included 20 high income OECD countries. Other recent studies, such as Burgess and Knetter (1998) and Burgess et al. (2000), pool industry-level data from 7 OECD economies.

⁶ See Loboguerrero and Panizza (2003) for a similar interaction term in a study of the relation between labor market institutions and inflation.

⁷ For evidence on this see Sargent (1978) and Shapiro (1986). Also note that over-time payments, captured by the wage schedule $w(h)$, should not be viewed as adjustment costs since they depend on the level of hours worked, not on the change in hours.

with $\mu - 1 \equiv W'(\hat{H})\hat{H}/W'(\hat{H})$ assumed positive, we obtain:⁸

$$\hat{e} - e = \frac{\mu - \beta\gamma}{1 - \alpha\gamma} (h - \hat{h}). \tag{4}$$

This is the expression used by Caballero and Engel (1993). It cannot be applied in our case, since we do not have information on hours worked. For this reason we derive next an analogous expression relating the employment gap to the labor productivity gap; as we discuss later in this section, we have the data to apply this expression.

The value of the marginal product of labor (referred to, with some abuse, as “marginal labor productivity” in what follows) satisfies:

$$v = \log \alpha\gamma + d + \gamma a - (1 - \alpha\gamma)e + \beta\gamma h.$$

Subtracting this expression from its frictionless counterpart (obtained by substituting \hat{h} and \hat{e} for e and h) and then using Eq. (4) to get rid of the hours gap yield:

$$\hat{e} - e = \frac{\phi}{1 - \alpha\gamma} (v - \hat{w}), \tag{5}$$

where $\hat{w} \equiv W(\hat{h})$ and $\phi \equiv (\mu - \beta\gamma)/\mu$. The parameter ϕ is increasing in the elasticity of the marginal wage schedule with respect to average hours worked, $\mu - 1$, which is intuitive since the employment response to a given deviation of wages from marginal product will be larger if the marginal cost of the alternative adjustment strategy – changing hours – is higher.

The employment gap in Eq. (5), $\hat{e} - e$, is the difference between the static target \hat{e} and realized employment, not the dynamic employment gap $e_{jct}^* - e_{jct}$ related to the term on the right hand side of Eq. (1). However, if we assume that the linear combination of demand and productivity shocks, $d + \gamma a$, follows a random walk – an assumption consistent with the data⁹ – we have that e_{jct}^* is equal to \hat{e}_{jct} plus a constant proportional to the drift in the random walk. Allowing for a country-specific stochastic drift (see Appendix B for details), and for sector-specific differences in α and γ , leads to:

$$e_{jct}^* - e_{jct-1} = \frac{\phi}{1 - \alpha_j\gamma_j} (v_{jct} - w_{jct}^o) + \Delta e_{jct} + \delta_{ct}. \tag{6}$$

Note that both marginal product and wages are in nominal terms. However, since these expressions are in logs, their difference eliminates the aggregate price level component.

We proxy $\alpha_j\gamma_j$ in Eq. (6) by the sample median of the labor share for sector j across year and income groups. We estimate the marginal productivity of labor, v_{jct} , using output per worker multiplied by an industry-level labor share, assumed constant within country income groups and over time.

Two natural candidates to proxy for w_{jct}^o are the average (across sectors within a country, at a given point in time) of either observed wages or observed marginal productivities. The former is consistent with a competitive labor market, the latter may be expected to be more robust in settings with long-term contracts and multiple forms of compensation, where the salary may not represent the actual marginal cost of labor.¹⁰ We performed estimations using both

⁸ No approximation is involved when the elasticity $W'(\hat{H})\hat{H}/W'(\hat{H})$ does not vary with H , that is, when $W(H) = c_1 + c_2H^\mu$ with $c_1, c_2 > 0$ and $\mu > 1$. This is the case considered in Caballero and Engel (1993) and Caballero et al. (2004). Also note that $\mu > 1$ is needed to ensure that the second order conditions hold for the frictionless optimum (see Appendix A).

⁹ Pooling all countries and sectors together, the first order autocorrelation of the measure of Δe_{jct}^* constructed below is -0.018 . Computing this correlation by country the mean value is 0.011 with a standard deviation of 0.179.

¹⁰ While we have assumed a simple competitive market for the base salary (salary for normal hours) within each sector, our procedure could easily accommodate other, more rent-sharing like, wage setting mechanisms (with a suitable reinterpretation of some parameters, but not λ_{ct}).

alternatives and found no discernible differences (see below). This suggests that statistical power comes mainly from the cross-section dimension, that is, from the well documented and large magnitude of sector-specific shocks. In what follows we report the more robust alternative and approximate w^o by the average marginal productivity, which leads to:

$$e_{jct}^* - e_{jct-1} = \frac{\phi}{1 - \alpha_j\gamma_j} (v_{jct} - v_{ct}) + \Delta e_{jct} + \delta_{ct} \equiv \text{Gap}_{jct} + \delta_{ct}, \tag{7}$$

where v_{ct} denotes the average, over j , of v_{jct} (we use this convention throughout the paper). Differencing Eq. (7), we estimate ϕ from

$$\Delta e_{jct} = -\frac{\phi}{1 - \alpha_j\gamma_j} (\Delta v_{jct} - \Delta v_{ct}) - \Delta \delta_{ct} + \Delta e_{jct}^* \equiv -\phi z_{jct} + \kappa_{ct} + \varepsilon_{jct}, \tag{8}$$

where $\kappa_{ct} \equiv -\Delta \delta_{ct}$ is a country-year dummy, $\varepsilon_{jct} \equiv \Delta e_{jct}^*$ is the change in the desired level of employment and $z_{jct} \equiv (\Delta v_{jct} - \Delta v_{ct}) / (1 - \alpha_j\gamma_j)$. We assume that changes in sectoral labor composition are negligible between two consecutive years. In order to avoid the simultaneity bias present in this equation (Δv and Δe^* are correlated) we estimate Eq. (8) using $(\Delta w_{jct-1} - \Delta w_{ct-1})$ as an instrument for $(\Delta v_{jct} - \Delta v_{ct})$.¹¹

It is important to point out that our methodology yields an employment gap measure, defined implicitly in Eq. (7), that has some important advantages over standard partial adjustment estimations. First, it summarizes in a single variable all shocks faced by a sector. This feature allows us to increase precision and to study the determinants of the speed of adjustment using interaction terms. Second, and related, it only requires data on nominal output and employment, two standard and well-measured variables in most industrial surveys. Most previous studies on adjustment costs required measures of real output or an exogenous measure of sector demand.¹²

2.1.2. Speed of adjustment

The central empirical question of the present study is how cross-country differences in job security regulation affect the speed of adjustment. Accordingly, from Eq. (1) and Eq. (7) it follows that the basic equation we estimate is:

$$\Delta e_{jct} = \lambda_{ct} (\text{Gap}_{jct} + \delta_{ct}), \tag{9}$$

where Δe_{jct} is the log change in employment and λ_{ct} denotes the speed of adjustment.

We assume that the latter takes the form:

$$\lambda_{ct} = \tilde{\lambda}_1 + \tilde{\lambda}_2 \text{JS}_{ct}^{\text{eff}}, \tag{10}$$

where $\text{JS}_{ct}^{\text{eff}}$ is a measure of effective job security regulation. In practice we observe job security regulation (imperfectly), but not the rigor with which it is enforced. We proxy the latter with a “rule of law” variable, so that

$$\text{JS}_{ct}^{\text{eff}} = a \text{JS}_{ct} + b (\text{JS}_{ct} \times \text{RL}_{ct}), \tag{11}$$

where a and b are constants and RL_{ct} is a standard measure of rule of law (see below). When $b = 0$ there is no difference between de jure

¹¹ We lag the instrument to deal with the simultaneity problem and use the wage rather than productivity to reduce the (potential) impact of measurement error bias.

¹² Abraham and Houseman (1994), Hamermesh (1993), and Nickell and Nunziata (2000) evaluate the differential response of employment to observed real output. A second option is to construct exogenous demand shocks. Although this approach overcomes the real output concerns, it requires constructing an adequate sectoral query demand shock for every country. A case in point are the papers by Burgess and Knetter (1998) and Burgess et al. (2000), which use the real exchange rate as their demand shock. The estimated effects of the real exchange rate on employment are usually marginally significant, and often of the opposite sign than expected.

and de facto regulation. Substituting this expression in Eq. (10) and the resulting expression for λ_{ct} in Eq. (9), yields our main estimating equation:

$$\Delta e_{jct} = \lambda_1 \text{Gap}_{jct} + \lambda_2 (\text{Gap}_{jct} \times \text{JS}_{ct}) + \lambda_3 (\text{Gap}_{jct} \times \text{JS}_{ct} \times \text{RL}_{ct}) + \tilde{\delta}_{ct} + \varepsilon_{jct}, \quad (12)$$

with $\lambda_1 = \tilde{\lambda}_1$, $\lambda_2 = a\tilde{\lambda}_2$, $\lambda_3 = b\tilde{\lambda}_3$, and $\tilde{\delta}_{ct}$ denotes country \times time fixed effects (proportional to the δ_{ct} defined above).

The main coefficients of interest are λ_2 and λ_3 , which measure how the speed of adjustment varies across countries depending on their labor market regulation (both de jure and de facto).

The expression for the employment gap defined implicitly in Eq. (7) ignores systematic variations in labor productivity across sectors within a country. For example, unobserved labor quality may be much higher in some sectors. The presence of such heterogeneity could bias estimates of the speed of adjustment downwards, since measured productivity gaps would be positive most of the time for sectors with high labor quality while being mostly negative for sectors with lower quality workers.¹³ To avoid this potential bias, we subtract from $(v_{jct} - v_{ct})$ in Eq. (7) a moving average of relative sectoral productivity, $\hat{\theta}_{jct}$, where

$$\hat{\theta}_{jct} \equiv \frac{1}{2} \left[(v_{jct-1} - v_{ct-1}) + (v_{jct-2} - v_{ct-2}) \right].$$

As a robustness check, for our main specifications we also computed $\hat{\theta}_{jct}$ using a three and four period moving average, without significant changes in our results (more on this when we check robustness in Section 3.3). The resulting expression for the estimated employment-gap is:

$$\text{Gap}_{jct} = \frac{\phi}{1 - \alpha_j \gamma_j} (v_{jct} - v_{ct} - \hat{\theta}_{jct}) + \Delta e_{jct}. \quad (13)$$

2.2. The data

This section describes our sample and main variables. Additional variables are defined as we introduce them later in the text.

2.2.1. Job security and rule of law

We use two measures of job security, or legal protection against dismissal: the job security index constructed by Botero et al. (2004) for 60 countries world-wide (henceforth JS_c) and the job security index constructed by Heckman and Pages (2000) for 24 countries in OECD and Latin America (henceforth HP_{ct}). The JS_c measure is available for a larger sample of countries and includes a broader range of job security variables. The HP_{ct} measure has the advantage of having time variation.

Our main job security index, JS_c , is the sum of four variables, measured in 1997, each of which takes on values between 0 and 1: (i) grounds for dismissal protection PG_c , (ii) protection regarding dismissal procedures PP_c , (iii) notice and severance payments PS_c , and (iv) protection of employment in the constitution PC_c . The rules on grounds of dismissal range from allowing the employment relation to be terminated by either party at any time (employment at will) to allowing the termination of contracts only under a very narrow list of “fair” causes. Protective dismissal procedures require employers to obtain the authorization of third parties (such as unions and judges) before terminating the employment contract. The third variable, notice and severance payment, is the one closest to the HP_{ct} measure, and is the normalized sum of

two components: mandatory severance payments after 20 years of employment (in months) and months of advance notice for dismissals after 20 years of employment ($NS_{tc} = b_{ct+20} + SP_{ct+20}$, $t = 1997$). The four components of JS_c described above increase with the level of job security.

The Heckman and Pages measure is narrower, including only those provisions that have a direct impact on the costs of dismissal. To quantify the effects of this legislation, they construct an index that computes the expected (at hiring) cost of a future dismissal. The index includes both the costs of advanced notice legislation and firing costs, and is measured in units of monthly wages.

Our estimations also adjust for the level of enforcement of labor legislation. We do this by including measures of rule of law RL_c and government efficiency GE_c from Kaufmann et al. (1999), and interact them with JS_c and HP_{ct} .¹⁴ We expect labor market legislation to have a larger impact on adjustment costs in countries with a stronger rule of law (higher RL_c) and more efficient governments (higher GE_c).

The institutional variables as well as the countries in our sample and their corresponding income group are reported in Table 1. Table 2 reports the sample correlations between our main cross-country variables and summary statistics for each of these measures for three income groups (based on World Bank per capita income categories).¹⁵ As expected, the correlation between the two measures of job security is positive and significant. Differences can be explained mainly by the broader scope of the JS_{ct} index. Also as expected, rule of law and government efficiency increase with income levels. Note, however, that neither measure of job security is positively correlated with income per capita, since both JS_{ct} and HP_c are highest for middle income countries.

2.2.2. Industrial statistics

Our output, employment and wage data come from the 2002 3-digit UNIDO Industrial Statistics Database. The UNIDO database contains data for the period 1963–2000 for the 28 manufacturing sectors that correspond to the 3 digit ISIC code (revision 2). Because our measures of job security and rule of law are time invariant and measured in recent years, however, we restrict our sample to the period 1980–2000. Data on output and labor compensation are in current US dollars (inflation is removed through time effects in our regressions). Throughout the paper our main dependent variable is Δe_{jct} , the log change in total employment in sector j of country c in period t .

A large number of countries are included in the original dataset – however our sample is constrained by the cross-country availability of the independent variables measuring job security. In addition, we drop 2% of extreme employment changes in each of the three income groups. For our main specification the resulting sample includes 60 economies. Table 2 shows descriptive statistics for the dependent variable by income group.

3. Results

This section presents our main result, showing that effective job security has a significant negative effect on the speed of adjustment of employment to shocks in the employment-gap. It also presents several robustness exercises.

We recall, from Section 2, that our empirical strategy has two components. We first estimate the parameter ϕ needed to calculate our proxy for the employment gap measure from Eq. (8). Next we use our main estimating, Eq. (12), together with the gap measure

¹³ The impact of this bias on estimates of ϕ is likely to be less important, since Eq. (8) is in differences while the equations to estimate the speed of adjustment considered below are in levels.

¹⁴ For rule of law and government efficiency we use the earliest value available in the Kaufmann et al. (1999) database: 1996, since this is closest to the Botero et al. (2004) measure, which is for 1997.

¹⁵ Income groups are: 1 = high income OECD, 2 = high income non OECD and upper middle income, 3 = lower middle income and low income.

Table 1
Sample coverage and main variables.

WDI code	Inc group	Job security		Institutions			
		Botero et al.	HP	Strong RL	Rule of law	Gov. eff.	High gov. eff
AUS	1	-0.19	-0.71	1	1.03	0.95	1
AUT	1	-0.15	-0.65	1	1.13	0.92	1
BEL	1	-0.11	-0.70	1	0.81	0.81	1
CAN	1	-0.16	-1.64	1	1.02	0.92	1
DEU	1	0.17	-1.56	1	1.04	0.92	1
DNK	1	-0.21		1	1.17	1.02	1
ESP	1	0.17	1.29	1	0.41	0.64	1
FIN	1	0.24	-0.82	1	1.22	0.89	1
FRA	1	-0.02	-1.09	1	0.81	0.78	1
GBR	1	-0.13	-1.00	1	1.09	1.05	1
GRC	1	-0.04	-1.05	1	-0.01	-0.06	1
IRL	1	-0.21	-1.40	1	0.92	0.82	1
ITA	1	-0.09	0.79	1	0.09	0.05	1
JPN	1	-0.14	-1.84	1	0.76	0.46	1
NLD	1	0.04	-1.53	1	1.09	1.25	1
NOR	1	-0.03	-1.55	1	1.23	1.13	1
NZL	1	-0.29	-2.21	1	1.22	1.25	1
PRT	1	0.37	2.05	1	0.53	0.24	1
SWE	1	0.06	-0.50	1	1.17	0.97	1
USA	1	-0.25	-2.43	1	0.95	1.01	1
ARG	2	0.11	0.56	0	-0.48	-0.37	0
BRA	2	0.36	0.61	0	-1.00	-0.82	0
CHL	2	-0.02	0.21	1	0.44	0.32	1
HKG	2	-0.32		1	0.86	0.81	1
ISR	2	-0.17		1	0.36	0.42	1
KOR	2	-0.07	1.14	1	0.02	-0.15	0
MEX	2	0.38	0.73	0	-0.86	-0.85	0
MYS	2	-0.24		1	0.05	0.18	1
PAN	2	0.34	1.37	0	-0.50	-1.19	0
SGP	2	-0.22		1	1.26	1.41	1
TUR	2	-0.13	1.54	0	-0.73	-0.69	0
TWN	2	0.01		1	0.21	0.49	1
URY	2	-0.30	-0.20	0	-0.26	-0.17	0
VEN	2	0.31	4.29	0	-1.38	-1.32	0
ZAF	2	-0.17		0	-0.42	-0.40	0
BFA	3	-0.10		0	-1.46	-1.38	0
BOL	3	0.24	2.32	0	-1.37	-1.12	0
COL	3	0.29	1.17	0	-1.19	-0.61	0
ECU	3	0.34	0.97	0	-1.13	-1.29	0
EGY	3	0.13		0	-0.53	-0.99	0
GHA	3	-0.17		0	-0.86	-0.78	0
IDN	3	0.10		0	-1.09	-0.55	0
IND	3	-0.14		0	-0.77	-0.79	0
JAM	3	-0.20	-0.44	0	-0.95	-1.06	0
JOR	3	0.22		0	-0.56	-0.54	0
KEN	3	-0.16		0	-1.48	-1.13	0
LKA	3	0.09		0	-0.48	-0.93	0
MAR	3	-0.22		0	-0.57	-0.73	0
MDG	3	0.23		0	-1.55	-1.39	0
MOZ	3	0.38		0	-1.92	-1.23	0
MWI	3	0.11		0	-0.94	-1.32	0
NGA	3	-0.07		0	-1.89	-1.68	0
PAK	3	-0.15		0	-1.16	-1.02	0
PER	3	0.37	2.25	0	-1.08	-0.87	0
PHL	3	0.24		0	-0.86	-0.54	0
SEN	3	-0.04		0	-0.92	-1.04	0
THA	3	0.10		0	-0.29	-0.32	0
TUN	3	0.05		0	-0.69	-0.24	0
ZMB	3	-0.33		0	-1.08	-1.44	0
ZWE	3	-0.13		0	-0.97	-0.86	0

derived in Eq. (13), to estimate the adjustment speeds and their variation with job security measures.

3.1. Estimating the gap measure

Table 1 reports the estimation results of Eq. (8) for the full sample of countries and across income and job security groups. The first two columns use the full sample, with and without 2% of extreme values for the independent variable, respectively. The remaining columns report the estimation results for each of our three income groups and job security groups (see Section 2.2). Based on our results for the

baseline case, we set the value of ϕ at its full sample estimate of 0.378 for all countries in our sample.

3.2. Main results

Recall that our main estimating equation is:

$$\Delta e_{jct} = \lambda_1 \text{Gap}_{jct} + \lambda_2 (\text{Gap}_{jct} \times \text{JS}_c) + \lambda_3 (\text{Gap}_{jct} \times \text{JS}_c \times \text{RL}_c) + \tilde{\delta}_{ct} + \varepsilon_{jct}. \quad (14)$$

Table 2
Baseline sample statistics.

Employment growth (Yearly Avge.): 1980–2000					
Inc. group	Obs.	Mean	SD	Min	Max
1	8607	−0.01	0.06	−0.24	0.26
2	6063	0.00	0.11	−0.43	0.42
3	7063	0.02	0.16	−0.78	0.96
Total	21,733	0.00	0.11	−0.78	0.96
Job security from <i>Botero et al. (2004)</i> : JS					
Inc. group	Countries	Mean	SD	Min	Max
1	20	−0.05	0.18	−0.29	0.37
2	15	−0.01	0.25	−0.32	0.38
3	25	0.05	0.21	−0.33	0.38
Total	60	0.00	0.21	−0.33	0.38
Job security from <i>Heckman and Pages (2000)</i> : HP					
Inc. group	Countries	Mean	SD	Min	Max
1	19	−0.87	1.15	−2.43	2.05
2	9	1.14	1.30	−0.20	4.29
3	5	1.26	1.13	−0.44	2.32
Total	33	0.00	1.54	−2.43	4.29
Rule of law from <i>Kaufmann et al. (1999)</i> : RL					
Inc. group	Countries	Mean	SD	Min	Max
1	20	0.88	0.37	−0.01	1.23
2	15	−0.16	0.72	−1.38	1.26
3	25	−1.03	0.42	−1.92	−0.29
Total	60	−0.18	0.96	−1.92	1.26
Government effectiveness from <i>Kaufmann et al. (1999)</i> : GE					
Inc. group	Countries	Mean	SD	Min	Max
1	20	0.80	0.37	−0.06	1.25
2	15	−0.16	0.76	−1.32	1.41
3	25	−0.95	0.36	−1.68	−0.24
Total	60	−0.17	0.90	−1.68	1.41
Correlation country means					
	JS	HP	RL	GE	
JS	1.00				
HP	0.66	1.00			
RL	−0.36	−0.77	1.00		
GE	−0.35	−0.77	0.97	1.00	

Income groups are: 1 = high income OECD, 2 = high income non OECD and upper middle income, 3 = lower middle income and low income.

Note that we have dropped time subscripts from JS_{ct} and RL_{ct} as we only use time invariant measures of rule of law and job security in our baseline estimation. Note also that in all specifications that include the $(Gap_{ict} \times JS_{ct} \times RL_{ct})$ interaction we also include the respective $Gap_{ict} \times RL_{ct}$ as a control variable.

To estimate the adjustment speeds, we construct our gap measure using the value of ϕ which is estimated with error. To account for this error in our estimate of the adjustment speeds, we use the correction proposed by *Murphy and Topel (1985)*. This is referred to as “two-step standard errors” in the tables that follow.

We start by ignoring the effect of job security on the speed of adjustment, and set λ_2 and λ_3 equal to zero. This gives us an estimate of the average speed of adjustment and is reported in column 1 of *Table 4*. On average (across countries and periods) we find that 63% of the employment-gap is closed in each period. Furthermore, our measure of the employment-gap and country \times year fixed effects explains 62% of the variance in log-employment growth.

The next three columns present our main results, which are repeated in columns 5 to 7 allowing for different λ_1 by sectors and

country income level.¹⁶ Column 2 (and 5) presents our estimate of λ_2 . This coefficient has the right sign and is significant at conventional confidence levels. Employment adjusts more slowly to shocks in the employment-gap in countries with higher levels of official job security.

Next, we allow for a distinction between effective and official job security. Results are reported in columns 3 and 4 (and, correspondingly, 6 and 7) for different rules-enforcement criteria. In columns 3 and 6 the distinction between effective and official job security is captured by the product of JS_{ct} and $DSRL_{ct}$, where $DSRL_{ct}$ is a dummy variable for countries with strong rule of law ($RL_{ct} \geq RL_{Greece}$ – where Greece is the OECD country with the lowest RL score). The three panels in *Fig. 1* show the value of the job security index for countries in the high, medium and low income groups, respectively. Now λ_2 becomes insignificant, while λ_3 has the right sign and is highly significant. That is, the same change in JS_{ct} will have a significantly larger (downward) effect on the speed of adjustment in countries with stricter enforcement of laws, as measured by our rule-of-law dummy. The effect of the estimated coefficients reported in column 3 is large. In countries with strong rule of law, moving from the 20th percentile of job security (−0.19) to the 80th percentile (0.23) reduces $\hat{\lambda}$ by 0.21. The same change in job security legislation has a considerable smaller effect, less than 0.01, on the speed of adjustment in the group of economies with weak rule of law. That is, employment adjusts more slowly to shocks in the employment-gap in countries with higher levels of effective job security.

Columns 4 and 7 address whether the negative coefficient on λ_3 is robust to other measures of legal enforcement. To do so we use an alternative variable from the *Kaufmann et al. (1999)* dataset – government effectiveness (GE) – and construct a dummy variable for high effectiveness countries ($GE_{ct} \geq GE_{Greece}$). Clearly, the results are very close to those reported in columns 3 and 7. Job security legislation has a significant negative effect on the estimated speed of adjustment when governments are effective – a proxy for enforcement of existing labor regulation.

Finally, the last column in *Table 4* uses an alternative measure of job security. We repeat our specification from column 7 (including sector and income dummies) using the *Heckman and Pages (2000)* measure of job security. The HP_{ct} data are only available for countries in the OECD and Latin America so our sample size is reduced by half, and most low income countries are dropped. The flip side is that this measure is time varying which potentially allows us to capture the effects of changes in the job security regulation. As reported in column 8, we find a negative and significant effect of HP_{ct} on the speed of adjustment.

3.3. Further robustness

We continue our robustness exploration by assessing the impact of four broad econometric issues: misspecification due to endogeneity of the gap measure, alternative gap-measures, exclusion of potential (country) outliers, and asymmetric adjustment costs.

3.3.1. Potential endogeneity of the gap measure

One concern with our procedure is that the construction of the gap measure includes the change in employment, that is, the dependent variable shows up as part of the independent variable. While this does not represent a problem under the null hypothesis of the model, any measurement error in employment and ϕz_{jt} could introduce important biases. We address this issue with two procedures.

The first procedure maintains our baseline specification, but instruments for the contemporaneous gap measure. Given that $Gap_{jct} =$

¹⁶ We allow for an interaction between Gap_{jct} and 3 digit ISIC sector dummies (we also include sector fixed effects). We also control for the possibility that our results are driven by omitted variables, correlated with our measures of job security. For this, we include an additional interaction between Gap_{jct} and three income-group dummies.

Table 3
Estimating ϕ .

Specification:	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	Change in employment (ln)							
z_{jct}	-0.305 (0.051)***	-0.378 (0.068)***	-0.558 (0.135)***	-0.431 (0.127)***	-0.338 (0.115)***	-0.395 (0.091)***	-0.337 (0.240)	-0.374 (0.100)***
Observations	22,024	21,245	8311	5944	6990	7300	6964	6981
Income group	All	All	1	2	3	All	All	All
Job sec. group	All	All	All	All	All	1	2	3
Extr. obs. of instrument	Yes	No	No	No	No	No	No	No

Standard errors are reported in parentheses. All regressions use lagged $\Delta w_{jct} - \Delta w_{ct}$ as instrumental variable. As described in the main text, z_{jct} represents the log-change of the nominal marginal productivity of labor in each sector, minus the country average, divided by one minus the estimated labor share. All regressions disregard the 2% observations with most extreme change in employment values and include a country-year fixed effect (κ_{ct} in Eq. (8)). Income groups are 1: high income OECD, 2: high income non OECD and upper middle income, and 3: lower middle income and low income. Job security groups correspond to the highest, middle and lowest third of the measure in Botero et al. (2004). *** Significant at 1%.

$\phi z_{jt} + \Delta e_{jct}$ can be rewritten as $\phi z_{j,t-1} + \Delta e_{jct}^*$, a natural instrument is the lag of the ex-post gap, $\phi z_{j,t-1}$. Unfortunately, the latter is not a valid instrument if it is computed with measurement error and this error is serially correlated. In our specification this could be the case because we use a moving average to construct the estimate of relative sectoral productivity, θ_{jct} . To avoid this problem, we construct an alternative measure of the ex-post gap letting wage data play the role of productivity data when calculating the v and θ terms on the right hand side of (13).

The second procedure re-writes the model in a standard dynamic panel formulation that removes the contemporaneous employment change from the right hand side:¹⁷

$$\Delta \text{Gap}_{jct} = (1 - \lambda_c) \Delta \text{Gap}_{jct-1} + \varepsilon_{jct}. \quad (15)$$

Table 5 reports the values of the average λ estimated with these two alternative procedures (note the significant decline in the precision of the estimates). For comparison purposes, the first row reproduces the first column in Table 4. The second row shows the result for the IV procedure based on using lagged changes in wages as instruments. Finally, row 3 reports the estimate from the dynamic panel. It is apparent from the table that the estimates of average λ are in the right ballpark, and hence we conclude that the bias due to a potentially endogenous gap is not significant.

Finally, we note that the standard solution of passing the Δe -component of the gap defined in Eq. (13) to the left hand side of the estimating Eq. (9) does not work in our context. Passing Δe to the left suggests that the coefficient on the resulting gap will be equal to $\lambda/(1 - \lambda)$. This holds only in the case of a partial adjustment model. By contrast, when lumpy Calvo-type adjustments are also present, the corresponding coefficient will, on average, be negative.¹⁸ More important, even small departures from a partial adjustment model introduce significant biases when estimating λ using this approach.¹⁹

3.3.2. Alternative gap-measures

Table 4 suggests that conditional on our measure of the employment-gap, our main findings are robust: job security, when enforced, has a significant negative impact on the speed of adjustment to the employment-gap. Table 6 tests the robustness of this result to alternative measures of the employment-gap. Columns 1 and 2 relax the assumption of a ϕ common across all countries. They repeat our

baseline specifications – columns 2 and 3 in Table 4 – using the values of ϕ estimated per income-group reported in Table 1. In turn, columns 3 and 4 report the results of using values of ϕ estimated across countries grouped by level of job security. Countries are grouped into the upper, middle and lower thirds of job security. Next, columns 5 through 8 repeat our baseline specifications using a three and four period moving average to estimate $\hat{\theta}_{jct}$. The final two columns (9 and 10) use an alternative specification for w_{jct}^o based on average wages instead of average productivity (see Eq. (13)) to build Gap_{jct} . In all of the specifications reported in Table 6, our results remain qualitatively the same as in Table 4.

3.3.3. Exclusion of potential (country) outliers

Table 7 reports estimates of λ_2 and λ_3 using the specification from column 3 in Table 4 but dropping one country from our sample at a time. In all cases the estimated coefficient on λ_3 is negative and significant at conventional confidence intervals.

However, it is also apparent in this table that excluding either Hong Kong or Kenya makes a substantial difference in the point estimates. For this reason, we re-estimate our model from scratch (that is, from ϕ up) now excluding these two countries. In this case the value of ϕ rises from 0.378 to 0.42. Qualitatively, however, the main results remain unchanged. Table 8 reports these results.

3.3.4. Asymmetric adjustment costs

There is evidence from establishment level data that hiring is more costly than firing in some countries (see Pfann and Palm (1993) for the case of the Netherlands and the U.K.). Labor then adjusts more through the destruction margin than through the creation margin. This motivates redoing our main results allowing for asymmetric effects of effective job security on the speed of adjustment, depending on whether the hiring or firing margin is operative. We do this next and find some evidence for this effect. More importantly, our main result continues holding, namely that the extent to which labor regulations hampers adjustment is determined by effective job security.

Eq. (16) extends Eq. (14) to allow for asymmetric adjustment speeds, with Gap_{jct}^n equal to $\text{Gap}_{jct} + \delta_{ct}$ when $\text{Gap}_{jct} + \delta_{ct} < 0$ and zero otherwise and $I\text{Gap}_{jct}^n$ denoting an indicator function for $\text{Gap}_{jct} + \delta_{ct} < 0$. The parameter λ_{1n} captures the main effect of the differential speed for negative gaps, and λ_{2n} captures the differential effect of job security on negative dynamic gaps.

$$\Delta e_{jct} = \lambda_1 \text{Gap}_{jct} + \lambda_{1n} \text{Gap}_{jct}^n + \lambda_2 (\text{Gap}_{jct} \times \text{JS}_c) + \lambda_{2n} (\text{Gap}_{jct}^n \times \text{JS}_c) + \tilde{\delta}_{ct} + \gamma I\text{Gap}_{jct}^n + \varepsilon_{jct}. \quad (16)$$

We run a two-step regression. In the first step we estimate the $\text{Gap}_{jct} + \delta_{ct} < 0$ which we use in the second step to construct the regressors that involve only negative dynamic gaps.

¹⁷ To estimate this equation we follow Anderson and Hsiao (1982) and use twice and three-times lagged values of ΔGap_{jct} as instruments for the RHS variable. Similar results are obtained if we follow Arellano and Bond (1991).

¹⁸ In the Calvo-case, for every observation either the (modified) gap or the change in employment is zero. The former happens when adjustment takes place, the latter when it does not. It follows that the covariance of Δe and the (modified) gap will be equal to minus the product of the mean of both variables. Since these means have the same sign, the estimated coefficient will be negative.

¹⁹ See Caballero, Engel and Micco (2004) for a formal derivation.

Table 4
Estimation results.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Change in log-employment								
Gap (λ_1)	0.633 (0.005)***	0.636 (0.007)***	0.643 (0.008)***	0.646 (0.008)***				
Gap×JS (λ_2):		−0.074 (0.028)***	−0.020 (0.035)	−0.029 (0.035)	−0.129 (0.031)***	−0.033 (0.035)	−0.044 (0.035)	
Gap×JS×DSRL (λ_3)			−0.500 (0.078)***			−0.296 (0.084)***		
Gap×JS×DHGE (λ_3)				−0.502 (0.078)***			−0.306 (0.085)***	
Gap×HP (λ_2)								−0.022 (0.008)***
Controls								
Gap×DSRL			−0.085 (0.015)***			0.089 (0.028)***		
Gap×DHGE				−0.099 (0.016)***			0.050 (0.028)*	
Observations	21,725	21,725	21,725	21,725	21,725	21,725	21,725	12,011
R-squared	0.62	0.62	0.63	0.63	0.63	0.64	0.64	0.64
Gap–income interaction	No	No	No	No	Yes	Yes	Yes	Yes
Gap–sector interaction	No	No	No	No	Yes	Yes	Yes	Yes

Two-step standard errors in parentheses (Murphy and Topel, 1985). JS and HP stand for the Botero et al. (2004) and Heckman and Pages (2000) job security measures, respectively. DSRL and DHGE stand for strong rule of law and high government efficiency dummies (in both cases the threshold is given by Greece, see the main text), respectively, using the Kaufmann et al. (1999) indices. Each regression has country-year fixed effects. Gaps are estimated using a constant $\phi=0.378$. Sample excludes the upper and lower 1% of Δ and of the estimated values of Gap.

- * Significant at 10%.
- ** Significant at 5%.
- *** Significant at 1%.

Table 9 reports our results, which may be viewed as an extension of column (2) in Table 6 allowing different responses to positive and negative dynamic employment gaps. From column (1) we see that the effect of Job Security is present essentially for negative gaps, as (λ_2) in column (1) is small and not statistically different from zero while (λ_{2n}) is large and negative, as well as significant. This suggests that Job Security works more through the destruction margin rather than through the creation margin. Columns (2) and (3), that split the sample between high and low Rule of Law countries, confirm our previous results. Job Security reduces the speed of adjustment in countries with strong rule of law without any notable differences between the hiring and firing margins: λ_{2n} equals zero for all practical purposes now. As shown in column (3), for countries with weak rule of law we have a smaller overall employment response to our Job Security measure, also with no significant asymmetries.

4. Gauging the costs of effective labor protection

By impairing worker movements from less to more productive units, effective labor protection reduces aggregate output and slows down economic growth. In this section we develop a simple framework to quantify this effect. Any such exercise requires strong assumptions and our approach is no exception. Nonetheless, our findings suggest that the costs of the microeconomic inflexibility caused by effective protection is large. In countries with strong rule of law, moving from the 20th to the 80th percentile of job security lowers annual productivity growth by close to one percentage point. The same movement for countries with weak rule of law has a negligible impact on TFP.²⁰

Consider a continuum of establishments, indexed by i , that adjust labor in response to productivity shocks, while their share of the

economy's capital remains fixed over time. Their production functions exhibit constant returns to (aggregate) capital, K_t , and decreasing returns to labor:

$$Y_{it} = B_{it}K_t^\alpha L_{it}^{1-\alpha}, \tag{17}$$

where B_{it} denotes plant-level productivity and $0 < \alpha < 1$. The B_{it} 's follow geometric random walks, that can be decomposed into the product of a common and an idiosyncratic component:

$$\Delta \log B_{it} \equiv b_{it} = v_t + v_{it}^j,$$

where the v_t are i.i.d. $\mathcal{N}(\mu_A, \sigma_A^2)$ and the v_{it}^j 's are i.i.d. (across productive units, over time and with respect to the aggregate shocks) $\mathcal{N}(0, \sigma_I^2)$. We set $\mu_A = 0$, since we are interested in the interaction between rigidities and idiosyncratic shocks, not in Jensen-inequality-type effects associated with aggregate shocks.

The price-elasticity of demand is $\eta > 1$. Aggregate labor is assumed constant and set equal to one. We define aggregate productivity, A_t , as:

$$A_t = \int B_{it}^\alpha L_{it}^\alpha di, \tag{18}$$

so that aggregate output, $Y_t \equiv \int Y_{it} di$, satisfies

$$Y_t = A_t K_t.$$

Units adjust with probability λ_c in every period, independent of their history and of what other units do that period.²¹ The parameter that captures microeconomic flexibility is λ_c . Higher values of λ_c are

²⁰ Of course, a weak rule of law has an adverse impact on productivity through various channels not considered in this paper.

²¹ More precisely, whether unit i adjusts at time t is determined by a Bernoulli random variable ξ_{it} with probability of success λ_c , where the ξ_{it} 's are independent across units and over time. This corresponds to the case $\zeta = 1$ in Section 2.1.

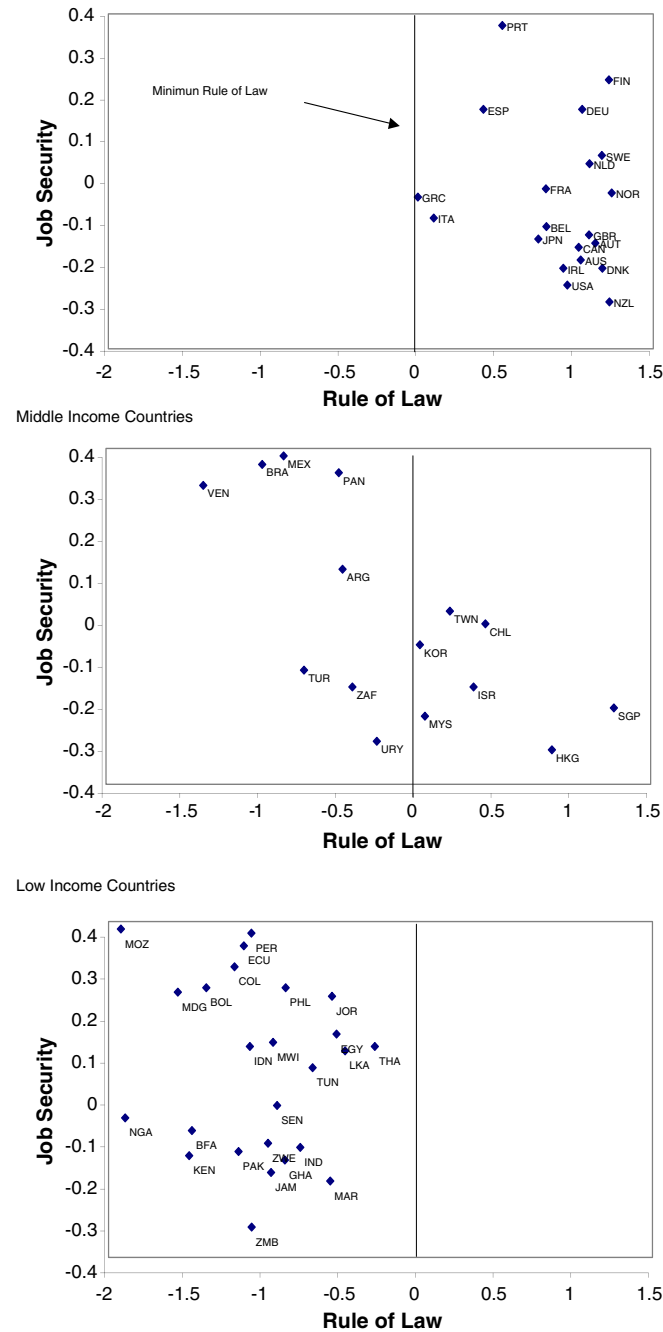


Fig. 1. Job security and rule of law in countries with high, medium and low income.

associated with a faster reallocation of workers in response to productivity shocks.

Standard calculations show that the growth rate of output, g_y , satisfies:

$$g_y = sA - \delta, \tag{19}$$

Table 5
IV estimation.

Estimation method	Average speed of adjustment	
	Point estimate	Standard error
Baseline model (Column 1 in Table 4)	0.633	0.005
Gap instrumented with wage data	0.647	0.088
Standard dynamic panel formulation	0.542	0.046

where s denotes the savings rate (assumed exogenous) and δ the depreciation rate for capital.

Now compare two economies that differ only in their degree of microeconomic flexibility, $\lambda_{c,1} < \lambda_{c,2}$. Tedious but straightforward calculations relegated to Appendix C show that:

$$g_{y,2} - g_{y,1} \cong (g_{y,1} + \delta) \left[\frac{1}{\lambda_{c,1}} - \frac{1}{\lambda_{c,2}} \right] \xi, \tag{20}$$

with

$$\xi = \frac{\alpha\gamma(2-\alpha\gamma)}{2(1-\alpha\gamma)^2} \sigma^2,$$

where we recall that $\gamma = (\eta - 1)/\eta$, and $\sigma^2 = \sigma_I^2 + \sigma_A^2$.²²

We choose parameters to apply Eq. (20) as follows: The mark-up is set at 20% (so that $\gamma = 5/6$), $g_{y,1}$ to the average rate of growth per worker in our sample for the 1980–1990 period, 0.7%, $\sigma = 27\%$,²³ $\alpha = 2/3$, and $\delta = 6\%$.

Table 10 reports the annual productivity costs of 20 percentile changes in job security regulation. These numbers are large. They imply that moving from the 20th to the 80th percentile in job security, in countries with strong rule of law, reduces annual productivity growth by 0.85%. The same change in job security legislation has a much smaller effect on TFP growth, 0.02%, in the group of economies with weak rule of law.

We are fully aware of the many caveats that such ceteris-paribus comparison can raise, as well as to the impact of the linear aggregate technology assumption on the growth versus levels claim, but the point of the table is simply to provide an alternative metric of the potential significance of observed levels of effective labor protection.

5. Concluding remarks

Many papers have shown that, in theory, job security regulation depresses firm level hiring and firing decisions. Job security provisions increase the cost of reducing employment and therefore lead to fewer dismissals when firms are faced with negative shocks. Conversely, when faced with a positive shock, the optimal employment response takes into account the fact that workers may have to be fired in the future, and the employment response is smaller. The overall effect is a reduction of the speed of adjustment to shocks.

However, conclusive empirical evidence on the effects of job security regulation has been elusive. One important reason for this deficit has been the lack of information on employment regulation for a sufficiently large number of economies that can be integrated to cross sectional data on employment outcomes. In this paper we have developed a simple empirical methodology that has allowed us to fill some of the empirical gap by exploiting: (a) the recent publication of two cross-country surveys on employment regulations (Heckman and Pages (2000) and Botero et al. (2004)) and, (b) the homogeneous data on employment and production available in the UNIDO dataset. Another important reason for the lack of empirical success is differences in the degree of regulation enforcement across countries. We address this problem by interacting the measures of employment regulation with different proxies for law-enforcement.

Using a dynamic labor demand specification we estimate the effects of job security across a sample of 60 countries for the period

²² There also is a (static) jump in the level of aggregate productivity when λ increases, given by: $\frac{\Delta_2 - \Delta_1}{\Delta_1} \cong \left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2} \right] \xi$. See Appendix C for the proof.

²³ This is the average across the five countries considered in Caballero et al. (2004).

Table 6
Robustness of main results to alternative specifications.

	ϕ varies across		ϕ varies across		$\phi = 0.378$					
	Income groups		Job security groups		$\theta = MA(3)$		$\theta = MA(4)$		dw	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Change in log-employment										
Gap	0.636 (0.007)***		0.643 (0.005)***		0.594 (0.007)***		0.560 (0.007)***		0.638 (0.007)***	
Gap×JS	-0.074 (0.028)***	-0.033 (0.035)	-0.041 (0.028)	-0.001 (0.035)	-0.047 (0.028)*	0.005 (0.035)	-0.016 (0.028)	0.052 (0.035)	-0.076 (0.030)**	-0.028 (0.037)
Gap×DSRL		0.089 (0.028)***		0.104 (0.027)***		0.079 (0.027)***		0.065 (0.026)**		0.076 (0.028)***
Gap×JS×DSRL		-0.296 (0.084)***		-0.236 (0.084)***		-0.306 (0.081)***		-0.364 (0.080)***		-0.327 (0.088)***
Observations	21,725		21,725		20,897		20,215		21,295	
R-squared	0.62	0.64	0.63	0.64	0.61	0.63	0.60	0.61	0.62	0.63
Gap-sector int.	No	Yes	No	Yes	No	Yes	No	Yes	No	Yes

Two-step standard errors in parentheses (Murphy and Topel, 1985). JS stands for the Botero et al. (2004) job security measure. DSRL stands for high (above Greece, see main text) rule of law using the Kaufmann et al. (1999) measure. Columns (1), (2), (3) and (4) use values of ϕ estimated in Table 3. Samples exclude the upper and lower 1% of Δe and of the estimated values of Gap.

* Significant at 10%.
** Significant at 5%.
*** Significant at 1%.

from 1980 to 1998. We consistently find a relatively lower speed of adjustment of employment in countries with high legal protection against dismissal, especially when such protection is likely to be enforced.

Appendix A. Representative firm's frictionless problem

Proposition 1. A firm with production function $Y = AE^\alpha H^\beta$ faces (inverse) demand $P = DY^{-1/\eta}$, where Y, E, H, P, A and D denote output, employment, hours per worker, price, productivity shock and demand shock, respectively. We denote $\gamma \equiv (\eta - 1)/\eta$ and assume $\eta > 1, \alpha > \beta > 0$ and $\alpha\gamma < 1$. The firm faces a wage schedule $W(H)$, and we define $w(h) \equiv \log W(e^h)$. We assume $w' > 0, w'' > 0, w'(0) < \beta/\alpha < w'(+\infty)$ and $W'(\hat{H}) > 0$, with \hat{H} defined via Eq. (21) below. In general, lower case letters denote the logs of upper case variables.

Then the values of h and e that solve the firm's static optimization problem are denoted by \hat{h} and \hat{e} and characterized by:

$$w'(\hat{h}) = \frac{\beta}{\alpha}, \tag{21}$$

$$\hat{e} = \frac{1}{1-\alpha\gamma} \left[\log \beta\gamma + d + \gamma a - (1-\beta\gamma)\hat{h} - \log \{W'(\hat{H})\} \right]. \tag{22}$$

Proof. The firm's (static) profit function is

$$\Pi(E, H) \equiv DA^\gamma E^{\alpha\gamma} H^{\beta\gamma} - W(H)E.$$

The corresponding partial derivatives and first order conditions then are:

$$\frac{\partial \Pi}{\partial E} = \alpha\gamma DA^\gamma E^{\alpha\gamma-1} H^{\beta\gamma} - W(H) = 0, \tag{23}$$

$$\frac{\partial \Pi}{\partial H} = \beta\gamma DA^\gamma E^{\alpha\gamma} H^{\beta\gamma-1} - W'(H)E = 0. \tag{24}$$

Multiplying Eq. (23) by $(\beta E)/(\alpha H)$, subtracting Eq. (24), and noting that $w'(h) = W'(H)H/W(H)$ leads to the first order condition $w'(h) =$

β/α . This equation has a unique solution due to the assumptions we made for w . Expression (22) follows from taking logs in Eq. (24).

Next we check that the second order conditions hold at \hat{h} and \hat{e} . From Eqs. (23) to (24) we have

$$\frac{\partial^2 \Pi}{\partial E^2} = -\alpha\gamma(1-\alpha\gamma)DA^\gamma E^{\alpha\gamma-2} H^{\beta\gamma}, \tag{25}$$

$$\frac{\partial^2 \Pi}{\partial H^2} = -\beta\gamma(1-\beta\gamma)DA^\gamma E^{\alpha\gamma} H^{\beta\gamma-2} - W''(H), \tag{26}$$

$$\begin{aligned} \frac{\partial^2 \Pi}{\partial E \partial H} &= \alpha\beta\gamma^2 DA^\gamma E^{\alpha\gamma-1} H^{\beta\gamma-1} - W'(H) \\ &= -\beta\gamma(1-\alpha\gamma)DA^\gamma E^{\alpha\gamma-1} H^{\beta\gamma-1}, \end{aligned} \tag{27}$$

where in the last step we used Eq. (24) evaluated at \hat{H} .

We therefore have $\partial^2 \Pi / \partial E^2 < 0$, while Eqs. (25), (26) and (27) can be used to show that

$$\begin{aligned} \frac{\partial^2 \Pi}{\partial E^2} \frac{\partial^2 \Pi}{\partial H^2} - \left[\frac{\partial^2 \Pi}{\partial E \partial H} \right]^2 &= \beta\gamma^2(1-\alpha\gamma)(\alpha-\beta)D^2 A^{2\gamma} E^{2\alpha\gamma-2} H^{2\beta\gamma-2} \\ &\quad + \alpha\gamma(1-\alpha\gamma)DA^\gamma E^{\alpha\gamma-1} H^{\beta\gamma} W''(H). \end{aligned}$$

The first term on the r.h.s. is positive because we assumed $\alpha > \beta$ and $\alpha\gamma < 1$. The second term is positive because we assumed $W'(\hat{H}) > 0$.

Appendix B. Relation between static and dynamic targets

Proposition 2. The firm's static employment target, \hat{e}_t , satisfies:

$$\hat{e}_t = \hat{e}_{t-1} + g_t + \varepsilon_t,$$

with ε_t i.i.d. innovations with zero mean and variance σ_ε^2 . The drift, g_t , is observed by the firm and satisfies:

$$g_t - g = \rho(g_{t-1} - g) + \nu_t,$$

with $0 \leq \rho \leq 1$ and ν_t i.i.d. innovations with zero mean and variance σ_ν^2 , independent from the ε_t .

Table 7
Excluding one country at a time.

Country	λ_2		λ_3		Country	λ_2		λ_3	
	Coeff.	St. dev.	Coeff.	St. dev.		Coeff.	St. dev.	Coeff.	St. dev.
ARG	-0.01	0.05	-0.51	0.07	KOR	-0.02	0.05	-0.52	0.07
AUS	-0.02	0.05	-0.52	0.07	LKA	-0.02	0.05	-0.51	0.07
AUT	-0.02	0.05	-0.52	0.07	MAR	-0.02	0.05	-0.51	0.07
BEL	-0.02	0.05	-0.52	0.07	MDG	-0.02	0.05	-0.51	0.07
BFA	-0.03	0.05	-0.50	0.07	MEX	0.00	0.05	-0.53	0.07
BOL	0.00	0.05	-0.52	0.07	MOZ	0.02	0.05	-0.55	0.07
BRA	-0.01	0.05	-0.52	0.07	MWI	-0.01	0.05	-0.52	0.07
CAN	-0.02	0.05	-0.52	0.07	NYS	-0.02	0.05	-0.46	0.07
CHL	-0.02	0.05	-0.53	0.07	NGA	0.00	0.05	-0.53	0.07
COL	-0.02	0.05	-0.51	0.07	NLD	-0.02	0.05	-0.51	0.07
DEU	-0.02	0.05	-0.52	0.07	NOR	-0.02	0.05	-0.51	0.07
DNK	-0.02	0.05	-0.52	0.07	NZL	-0.02	0.05	-0.53	0.07
ECU	-0.03	0.05	-0.50	0.07	PAK	0.02	0.05	-0.55	0.07
EGY	-0.02	0.05	-0.51	0.07	PAN	-0.01	0.05	-0.52	0.07
ESP	-0.02	0.05	-0.53	0.07	PER	0.06	0.05	-0.59	0.07
FIN	-0.02	0.05	-0.54	0.07	PHL	-0.03	0.05	-0.50	0.07
FRA	-0.02	0.05	-0.51	0.07	PRT	-0.02	0.05	-0.54	0.07
GBR	-0.02	0.05	-0.51	0.07	SEN	0.00	0.05	-0.53	0.07
GHA	-0.05	0.05	-0.48	0.07	SGP	-0.02	0.05	-0.52	0.07
GRC	-0.02	0.05	-0.51	0.07	SWE	-0.02	0.05	-0.53	0.07
HKG	-0.02	0.05	-0.37	0.07	THA	-0.01	0.05	-0.51	0.07
IDN	-0.02	0.05	-0.51	0.07	TUN	-0.02	0.05	-0.51	0.07
IND	0.01	0.05	-0.54	0.07	TUR	-0.03	0.05	-0.50	0.07
IRL	-0.02	0.05	-0.54	0.07	TWN	-0.02	0.05	-0.49	0.07
ISR	-0.02	0.05	-0.52	0.07	URY	-0.02	0.05	-0.50	0.07
ITA	-0.02	0.05	-0.51	0.07	USA	-0.02	0.05	-0.53	0.07
JAM	-0.02	0.05	-0.51	0.07	VEN	0.00	0.05	-0.53	0.07
JOR	-0.04	0.05	-0.49	0.07	ZAF	-0.02	0.05	-0.51	0.07
JPN	-0.02	0.05	-0.52	0.07	ZMB	-0.02	0.05	-0.51	0.07
KEN	-0.15	0.05	-0.38	0.07	ZWE	0.03	0.05	-0.55	0.07

This table reports the estimated coefficients for λ_2 and λ_3 , for the specification in column 3 of Table 4, leaving out one country (the one indicated for each set of coefficients) at a time.

The firm's discount factor is β and its adjustment technology is Calvo, that is, in every period it either adjusts at no cost (with probability λ) or it cannot adjust (with probability $1 - \lambda$). The firm's loss from deviating from its static target is quadratic in the employment log-difference,

Then the firm's dynamic employment target, that is, its optimal employment choice should it adjust, is given by:

$$e_t^* = \hat{e}_t + \delta_t \tag{28}$$

with

$$\delta_t \equiv \frac{\beta(1-\lambda)}{1-\beta(1-\lambda)}g + \frac{\beta(1-\lambda)\rho}{1-\beta(1-\lambda)\rho}(g_t - g). \tag{29}$$

Proof. If the firm adjusts in t , it will choose its employment level, e_t^* , so as to minimize the expected cost of deviating from its static target during the period where the new price is in place:

$$E_t \sum_{k \geq 0} [\beta(1-\lambda)]^k (e_t^* - \hat{e}_{t+k})^2.$$

It follows that:

$$e_t^* = [1-\beta(1-\lambda)] \sum_{k \geq 0} [\beta(1-\lambda)]^k E_t \hat{e}_{t+k}. \tag{30}$$

The assumptions for \hat{e}_t imply that

$$\hat{e}_{t+k} = \hat{e}_t + \sum_{i=1}^k g_{t+i} + \sum_{i=1}^k \varepsilon_{t+i},$$

and therefore

$$E_t \hat{e}_{t+k} = \hat{e}_t + kg + \frac{\rho}{1-\rho} (1-\rho^k)(g_t - g).$$

Substituting this expression in Eq. (30) yields Eqs. (28) and (29).

Appendix C. Gauging the costs

In this appendix we derive Eq. (20). From Eqs. (19) to (20) it follows that it suffices to show that under the assumptions in Section 4 we have:

$$\frac{A_2 - A_1}{A_1} \cong \left[\frac{1}{\lambda_1} - \frac{1}{\lambda_2} \right] \xi, \tag{31}$$

where we have dropped the subindex c from the λ and

$$\xi = \frac{\alpha\gamma(2-\alpha\gamma)}{2(1-\alpha\gamma)^2} (\sigma_I^2 + \sigma_A^2). \tag{32}$$

The intuition is easier if we consider the following, equivalent, problem. The economy consists of a very large and fixed number of firms (no entry or exit). Production by firm i during period t is $Y_{i,t} = A_{i,t} L_{i,t}^\alpha$,²⁴ while (inverse) demand for good i in period t is $P_{i,t} = Y_{i,t}^{-1/\eta}$, where $A_{i,t}$ denotes productivity shocks, assumed to follow a geometric random walk, so that

$$\Delta \log A_{i,t} \equiv \Delta a_{i,t} = v_t^A + v_{i,t}^I,$$

with v_t^A i.i.d. $N(0, \sigma_A^2)$ and $v_{i,t}^I$ i.i.d. $N(0, \sigma_I^2)$. Hence $\Delta a_{i,t}$ follows a $N(0, \sigma_f^2)$, with $\sigma_f^2 = \sigma_A^2 + \sigma_I^2$. We assume the wage remains constant throughout.

In what follows lower case letters denote the logarithm of upper case variables. Similarly, *-variables denote the frictionless counterpart of the non-starred variable.

Solving the firm's maximization problem in the absence of adjustment costs leads to:

$$\Delta l_{i,t}^* = \frac{\gamma}{1-\alpha\gamma} \Delta a_{i,t}, \tag{33}$$

and hence

$$\Delta y_{i,t}^* = \frac{1}{1-\alpha\gamma} \Delta a_{i,t}. \tag{34}$$

Denote by Y_t^* aggregate production in period t if there were no frictions. It then follows from Eq. (24) that:

$$Y_{i,t}^* = e^{\tau \Delta a_{i,t}} Y_{i,t-1}^*, \tag{35}$$

with $\tau \equiv 1/(1-\alpha\gamma)$. Taking expectations (over i for a particular realization of v_t^A) on both sides of Eq. (35) and noting that both terms being multiplied on the r.h.s. are, by assumption, independent (random walk), yields

$$Y_t^* = e^{\tau \lambda^2 + \frac{1}{2} \tau^2 \sigma_f^2} Y_{t-1}^*, \tag{36}$$

Averaging over all possible realizations of v_t^A (these fluctuations are not the ones we are interested in for the calculation at hand) leads to

$$Y_t^* = e^{\frac{1}{2} \tau^2 \sigma_f^2} Y_{t-1}^*,$$

²⁴ That is, we ignore hours in the production function.

Table 8
Estimation results excluding Hong Kong and Kenya.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Change in log-employment								
Gap (λ_1)	0.641 (0.007)***	0.645 (0.007)***	0.674 (0.008)***	0.676 (0.008)***				
Gap×JS (λ_2):		-0.094 (0.031)***	-0.145 (0.037)***	-0.151 (0.037)***	-0.197 (0.032)***	-0.163 (0.037)***	-0.175 (0.037)***	
Gap×JS×DSRL (λ_3)			-0.230 (0.085)***			-0.064 (0.089)		
Gap×JS×DHGE (λ_3)				-0.227 (0.085)***			-0.073 (0.089)	
Gap×HP (λ_2)								-0.021 (0.008)**
Controls								
Gap×DSRL			-0.122 (0.016)***			-0.070 (0.028)**		
Gap×DHGE				-0.136 (0.016)***			0.028 (0.028)	
Observations	20,903	20,903	20,903	20,903	20,903	20,903	20,903	12,004
R-squared	0.63	0.63	0.63	0.63	0.64	0.64	0.64	0.64
Gap-income interaction	No	No	No	No	Yes	Yes	Yes	Yes
Gap-sector interaction	No	No	No	No	Yes	Yes	Yes	Yes

Two-step standard errors in parentheses (Murphy and Topel, 1985). JS and HP stand for the Botero et al. (2004) and Heckman and Pages (2000) job security measures, respectively. DSRL and DHGE stand for high (above Greece, see main text) rule of law and government efficiency dummies, respectively, using the Kaufmann et al. (1999) indices. Each regression has country-year fixed effects. Gaps are estimated using a constant $\phi = 0.42$. Sample excludes the upper and lower 1% of Δe and of the estimated values of gap.

- * Significant at 10%.
- ** Significant at 5%.
- *** Significant at 1%.

and therefore for $k = 1, 2, 3, \dots$:

$$Y_t^* = e^{\frac{1}{2}k\tau^2\sigma_T^2} Y_{t-k}^* \tag{37}$$

Denote:

- $Y_{t,t-k}$: aggregate Y that would attain in period t if firms had the frictionless optimal levels of labor corresponding to period $t-k$. This is the average Y for units that last adjusted k periods ago.
- $Y_{i,t,t-k}$: the corresponding level of production of firm i in t .

Table 9
Asymmetric responses.

	(1)	(2)	(3)
Change in log-employment			
Gap (λ_1):	0.688 (0.011)***	0.583 (0.027)***	0.697 (0.016)***
Gap ⁿ (λ_{1n}):	-0.032 (0.018)*	0.001 (0.035)	-0.026 (0.025)
Gap×JS (λ_2):	0.006 (0.050)	-0.491 (0.129)***	0.070 (0.070)
Gap ⁿ ×JS (λ_{2n}):	-0.189 (0.008)**	-0.002 (0.189)	-0.191 (0.115)*
IGap ⁿ	0.015 (0.001)***	0.006 (0.002)***	0.021 (0.004)***
Observations	21,725	11,848	9877
R-squared	0.63	0.67	0.61
Rule of law	All	High	Low

JS stand for the Botero et al. (2004) job security measure. rule of law (the threshold is given by Greece, see the main text) from Kaufmann et al. (1999) indices. Each regression has country-year fixed effects. Gaps are estimated using a constant $\phi = 0.378$. Sample excludes the upper and lower 1% of Δe and of the estimated values of gap.

- * Significant at 10%.
- ** Significant at 5%.
- *** Significant at 1%.

From the expressions derived above it follows that:

$$\frac{Y_{i,t,t-1}}{Y_{i,t}^*} = \left(\frac{L_{i,t-1}^*}{L_{i,t}^*} \right)^\alpha = e^{-\alpha\gamma\tau\Delta a_{i,t}}$$

and therefore

$$Y_{i,t,t-1} = e^{\Delta a_{i,t}} Y_{i,t-1}^*$$

Taking expectations (with respect to idiosyncratic and aggregate shocks) on both sides of the latter expression (here we use that $\Delta a_{i,t}$ is independent of $Y_{i,t-1}^*$) yields

$$Y_{t,t-1} = e^{\frac{1}{2}\sigma_T^2} Y_{t-1}^*$$

which combined with Eq. (37) leads to:

$$Y_{t,t-1} = e^{\frac{1}{2}(1-\tau^2)\sigma_T^2} Y_t^*$$

A derivation similar to the one above, leads to:

$$Y_{i,t,t-k} = e^{\Delta a_{i,t} + \Delta a_{i,t-1} + \dots + \Delta a_{i,t-k+1}} Y_{t-k}^*$$

Table 10
Productivity growth and job security.

Change in job security index	Cost in annual growth rate	
	Weak rule of law	Strong rule of law
20th to 40th percentile	0.002%	0.083%
40th to 60th percentile	0.007%	0.292%
60th to 80th percentile	0.008%	0.478%

Reported: change in annual productivity growth rates associated with moving across percentiles in the distribution of country job security measures computed in Botero et al. (2004). Lower values of job security index correspond to less job security. Values of speed of adjustment calculated using Column 3 in Table (4). The threshold for weak and strong rule of law is given by the OECD country with the lowest rule of law score (Greece). Changes in annual productivity growth calculated based on Eq. (20). Parameter values used: $\gamma = 5/6$, $g_{y,1} = 0.007$, $\sigma = 0.27$, $\alpha = 2/3$, and $\delta = 0.06$.

which combined with Eq. (37) gives:

$$Y_{t,t-k} = e^{-k\xi} Y_t^* \quad (38)$$

with ξ defined in Eq. (32).

Assuming Calvo-type adjustment with probability λ , we decompose aggregate production into the sum of the contributions of cohorts:

$$Y_t = \lambda Y_t^* + \lambda(1-\lambda)Y_{t,t-1} + \lambda(1-\lambda)^2 Y_{t,t-2} + \dots$$

Substituting Eq. (38) in the expression above yields:

$$Y_t = \frac{\lambda}{1-(1-\lambda)e^{-\xi}} Y_t^* \quad (39)$$

It follows that the production gap, defined as:

$$\text{Prod. Gap} \equiv \frac{Y_t^* - Y_t}{Y_t^*},$$

is equal to:

$$\text{Prod. Gap} = \frac{(1-\lambda)(1-e^{-\xi})}{1-(1-\lambda)e^{-\xi}} \quad (40)$$

A first-order Taylor expansion then shows that, when $|\xi| \ll 1$:

$$\text{Prod. Gap} \approx \frac{(1-\lambda)}{\lambda} \xi \quad (41)$$

Subtracting this gap evaluated at λ_1 from its value evaluated at λ_2 , and noting that this gap difference corresponds to $(A_2 - A_1)/A_1$ in the main text, yields Eq. (31) and therefore concludes the proof.

References

- Abraham, K., Houseman, S., 1994. Does employment protection inhibit labor market flexibility: lessons from Germany, France and Belgium. In: Blank, R.M. (Ed.), *Protection Versus Economic Flexibility: Is There A Tradeoff?* University of Chicago Press, Chicago.
- Addison, J.T., Teixeira, P., Grosso, J.L., 2000. The effect of dismissals protection on employment: more on a vexed theme. *Southern Economic Journal* 67, 105–122.
- Anderson, T.W., Hsiao, C., 1982. Formulation and estimation of dynamic models using panel data. *Journal of Econometrics* 18, 67–82.
- Arellano, M., Bond, S.R., 1991. Some specification tests for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies* 58, 277–298.
- Botero, J., Djankov, S., La Porta, R., Lopez-de-Silanes, F., Shleifer, A., 2004. The regulation of labor. *Quarterly Journal of Economics* 119 (4), 1339–1382.
- Burgess, S., Knetter, M., 1998. An international comparison of employment adjustment to exchange rate fluctuations. *Review of International Economics* 6 (1), 151–163.
- Burgess, S., Knetter, M., Michelacci, C., 2000. Employment and output adjustment in the OECD: a disaggregated analysis of the role of job security provisions. *Economica* 67, 419–435.
- Caballero, R., Engel, E., 1993. Microeconomic adjustment hazards and aggregate dynamics. *Quarterly Journal of Economics* 108 (2), 359–383.
- Caballero, R., Hammour, M., 2000. Creative destruction and development: institutions, crises, and restructuring. *Annual World Bank Conference on Development Economics* 2000, pp. 213–241.
- Caballero, R., Engel, E., Haltiwanger, J., 1997. Aggregate employment dynamics: building from microeconomic evidence. *American Economic Review* 87 (1), 115–137.
- Caballero, R., Engel, E., Micco, A., 2004. Effective labor regulation and microeconomic flexibility. NBER Working Paper No. 10744.
- Calvo, G., 1983. Staggered prices in a utility maximizing framework. *Journal of Monetary Economics* 12, 383–398.
- Foster, L., Haltiwanger, J., Krizan, C.J., 1998. Aggregate productivity growth: lessons from microeconomic evidence. NBER Working Papers No. 6803.
- Freeman, 2001. Institutional Differences and economic performance among OECD countries. CEP Discussion Papers 0557.
- Garibaldi, P., Mauro, P., 1999. Deconstructing job creation. *International Monetary Fund Working Paper WP/99/109*.
- Grubb, D., Well, W., 1993. Employment regulation and patterns of work in the EC countries. *OECD Economic Studies* No. 21, Winter.
- Hamermesh, D., 1993. *Labor Demand*. Princeton University Press, Princeton.
- Heckman, J., Pages, C., 2000. The cost of job security regulation: evidence from Latin American labor markets. *Inter-American Development Bank Working Paper* 430.
- Heckman, J., Pagés, C., 2003. Law and employment: lessons from Latin America and the Caribbean. NBER Working Paper No. 10129.
- Kaufmann, D., Kraay, A., Zoido-Lobaton, P., 1999. Governance matters. *World Bank Policy Research Department Working Paper* No. 2196.
- Lazear, E., 1990. Job security provisions and employment. *Quarterly Journal of Economics* 105 (3), 699–726.
- Loboguerrero, A.M., Panizza, U., 2003. Inflation and labor market flexibility: the squeaky wheel gets the grease. Working Paper 495. Research Department, Inter-American Development Bank.
- Murphy, K.M., Topel, R.H., 1985. Estimation and inference in two-step econometric models. *Journal of Business and Economic Statistics* 3 (4), 370–379.
- Nickell, S., 1986. Dynamic models of labour demand. In: Ashenfelter, O., Layard, R. (Eds.), *Handbook of Labor Economics*. Elsevier.
- Nickell, S., 1997. Unemployment and labor market rigidities: Europe versus North America. *Journal of Economic Perspectives* 11 (3), 55–74.
- Nickell, S., Nunziata, L., 2000. Employment patterns in OECD countries. *Center for Economic Performance Discussion Paper* No. 448.
- OECD, 1999. *Employment protection and labor market performance*. OECD Economic Outlook. OECD, Paris. (Chapter 2).
- Pfann, G., Palm, F.C., 1993. Asymmetric adjustment costs in non-linear labour demand models for the Netherlands and U.K. manufacturing sectors. *Review of Economic Studies* 60 (2), 397–412.
- Sargent, T., 1978. Estimation of dynamic labor demand under rational expectations. *Journal of Political Economy* 86, 1009–1044.
- Shapiro, M.D., 1986. The Dynamic demand for capital and labor. *Quarterly Journal of Economics* 101, 513–542.
- UNIDO, 2002. *Industrial Statistics Database 2002 (3-digit level of ISIC code (Revision 2))*.