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Dismissal costs and innovation

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Abstract

Empirical evidence suggests that dismissal costs are negatively associated with R&D intensity across countries but positively within countries over time. This evidence can be rationalized theoretically with a negative entry effect and a positive innovation effect for incumbent firms.

Keywords: Exit costs; Innovation; Employment protection

JEL classification: J65; O31

Labor dismissal costs are an important exit cost for firms. For example, regulation on dismissal costs imposes notification periods, seniority rules or severance payments and often implies costly judicial procedures (see OECD, 1999). Using an unbalanced panel of OECD countries in the period 1973–1998, the empirical evidence summarized in Table 1 suggests that across OECD countries higher labor dismissal costs (summarized by an indicator on the strictness of employment protection legislation) are associated with a lower R&D intensity (see column (1)). The negative correlation is significant at the 1% level for the baseline GLS estimation in Panel A[1]. Controlling for persistent differences across countries in column (2), this negative correlation becomes smaller and is no longer significant. The correlation even becomes

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[1] The negative correlation is in line with the evidence in OECD (2003), Table 3.3 which is obtained with a cross-section of 18 OECD countries. It is shown in OECD (2003) that the negative correlation depends on the industry and the regime of industrial relation. The theoretical perspective presented below can rationalize this if entry dynamics differ across industries and regimes of industrial relation.

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Table 1
Employment protection and R&D in OECD countries 1973–1998

	Independent variables	Dependent variable: R&D intensity			
		(1)	(2)	(3)	(4)
Panel A: GLS estimation	Employment protection legislation	−0.01	−0.008	0.009	0.018
		(3.87)	(1.4)	(1.81)	(3.66)
	Skill endowment ratio	–	–	–	0.02
		–	–	–	(2.65)
Panel B: GLS estimation allowing for heteroskedasticity and first-order autocorrelation	Employment protection legislation	−0.004	0.002	0.011	0.014
		(0.99)	(0.39)	(2.52)	(2.64)
	Skill endowment ratio	–	–	–	0.011
		–	–	–	(1.17)
	Other institutions	No	No	No	Yes
	Country fixed effects	No	Yes	Yes	Yes
	Year dummies	No	No	Yes	Yes
	Constant	Yes	Yes	Yes	Yes
	Observations	332	332	332	317
	R^2 (within)	0.04	0.01	0.43	0.58
	Number of countries	14	14	14	14

Absolute values of z-statistics in parentheses. As a measure of fit we compute the adjusted R^2 statistic of the corresponding fixed-effect model. Other institutions include the unemployment benefit replacement ratio and duration, tax wedge, union density and coordination and minimum wages. The unbalanced panel of countries includes Australia, Canada, Denmark, Finland, France, Germany, Italy, Japan, Netherlands, Norway, Spain, Sweden, UK, USA. See the Appendix for further details.

positive if one allows for time effects common to all countries in column (3). The positive correlation remains and is significant at the 1% level if we control for differences in skill endowment and other institutional differences in column (4). These results are by-and-large robust if we allow for heteroskedasticity and first-order autocorrelation that is heterogenous across countries (see Panel B of Table 1). Given the rather short time series for each country, it is not surprising that the coefficients are less significant in this case. However, the significant positive correlation in columns (3) and (4) remains. Moreover, robustness checks which are not reported, reveal that the positive correlation does not depend on a single country in our sample.

Of course, the data on R&D intensity and employment protection, further described in the Appendix, are measured with error; and given the construction of the EPL indicator as described by Blanchard and Wolfers (2000) one should be cautious to interpret too much into the changes of the EPL indicator over time. However, no better data are available that allow estimation of a country panel and the pattern described above survives (although at lower significance levels) if we use 5-year averages of the data.

The results presented in Table 1 are highly suggestive. The negative correlation between dismissal costs and R&D results from persistent differences across countries whereas dismissal costs are positively related to R&D within countries over time. In the simple framework presented below we rationalize the negative correlation with a long-term entry effect whereas the positive correlation might result from a short to medium term innovation effect of dismissal costs for incumbent firms.

The distinction between the opposite effect of dismissal costs on innovation in the long and short run is important. If the two effects are not disentangled, empirical studies will find different results depending on whether the sample contains more long- or short-term variation and as a consequence the policy conclusions of these studies will be flawed.

Two recent papers are closest to this note. Aghion et al. (2002) show in a model with step-by-step innovations that bankruptcy costs can induce more innovation. Although the modeling of bankruptcy costs differs from the dismissal costs in this note, the intuition is as for the innovation effect derived below: Firms try to avoid bankruptcy costs by innovating. Kessing (2002) shows in the context of contests that firms defend their market position more fiercely under employment protection; and they will be relatively more reluctant to expand their market position ex ante. This is similar to the opposite effect of dismissal cost on innovation for incumbent firms and market entrants which we derive below.

1. A theoretical perspective

A firm with present discounted value V needs to employ one unit of labor to produce. At every point in time the firm is exposed to two sources of uncertainty: (i) The firm can innovate to increase its productivity from z to z', $z'>z$, where innovations occur with endogenous Poisson probability q, and (ii) the firm has uncertain profit flows π where we assume for simplicity that the shock $a\in[-\infty;\infty]$ has an additive lump-sum nature and occurs with exogenous Poisson probability ξ. Assuming that also the innovation effort is denoted by q where the cost is quadratic in q, in a stationary environment and for small time intervals the asset value of the firm is given by

$$rV(z,a)=\pi(z)+a+q(z)(V(z',a)-V(z,a))-q(z)^2/2+\xi\left[\int_{\tilde{a}(z)}^{\infty}V(z,y)G(y)-V(z,a)\right], \tag{1}$$

where r is the risk-free market interest rate, $G(a)$ is the cumulative distribution function of the lump sum shock a, and the exit threshold $\tilde{a}$ is implicitly defined by

$$V(z,\tilde{a})=0. \tag{2}$$

Eq. (1) is a standard Bellman equation which implies that the return to the firm's business operations is equal to the one obtainable in the market. Clearly, $\partial V(z,a)/\partial a>0$. We assume that the profit flow increases with productivity, $\partial\pi(z)/\partial z>0$, so that also $\partial V(z,a)/\partial z>0$. Implicit differentiation of the exit condition Eq. (2) then implies that the exit threshold falls in the firm's productivity, $\partial\tilde{a}(z)/\partial z<0$. Quite intuitively, a more productive firm is less likely to exit.

The firm chooses research effort q so that its asset value is maximized. Maximizing the right-hand side of Eq. (1) with respect to q results in

$$q(z)=\Delta V(z), \tag{3}$$

where $\Delta V(z)\equiv V(z',a)-V(z,a)$ does not depend on a because of the additive lump-sum nature of the shock. The research effort depends on the increase of the asset value, which occurs if the firm's research effort is successful.

We now show that wasteful labor dismissal costs F increase $\Delta V(z,a)$ and thus innovation effort. With dismissal costs F, the exit decision is determined by

$$V(z,\tilde{a})=-F \tag{4}$$

and the asset value reads

$$rV(z,a) = \pi(z) + a + q(z)(V(z',a) - V(z,a)) - q(z)^2/2 \\ + \xi\left(\int_{\tilde{a}(z)}^{\infty} V(z,y)G(y) - G(\tilde{a}(z))F - V(z,a)\right). \quad (5)$$

An analogous equation holds for $V(z',a)$. Subtracting Eq. (5) from that equation, using Eq. (3) and rearranging, results in

$$\frac{1}{2}q(z)^2 + [r + \xi G(\tilde{a}(z))]q(z) = \Delta\pi(z) + \frac{1}{2}q(z')2 + \xi\int_{\tilde{a}(z')}^{\tilde{a}(z)} V(z',a)G(a) \\ + \xi[G(\tilde{a}(z)) - G(\tilde{a}(z'))]F, \quad (6)$$

where $q(z') = V(z'', a) - V(z', a)$, $z'' > z'$, is taken as given by the firm with technology z.

If $G(a)$ is uniformly distributed, it follows from Eq. (6) that

$$\frac{\partial q(z)}{\partial F} = \frac{\xi[G(\tilde{a}(z)) - G(\tilde{a}(z')) + cq(z)]}{q(z) + r + \xi G(\tilde{a}(z))} > 0,$$

where $c \equiv g(\tilde{a}(z))|\partial\tilde{a}(z)/\partial F|$ and $g(\cdot)$ is the density function. The denominator is positive; and the numerator is positive as well since a more productive firm is less likely to exit and thus has to pay dismissal costs with a smaller probability. Moreover, the fall in the exit threshold $\tilde{a}(z)$ implies that the firm stays in business longer which is captured by the term $cq(z)$ in the numerator.

Thus, labor dismissal costs increase the gain from innovation for an incumbent firm. Note that the linearity of V in a combined with the assumption of a uniform distribution implies that the terms $\int_{\tilde{a}(z')}^{\tilde{a}(z)} V(z',a)G(a)$ and $[G(\tilde{a}(z)) - G(\tilde{a}(z'))]$ on the right-hand-side of Eq. (6) remain unchanged although the exit thresholds $\tilde{a}(z)$ and $\tilde{a}(z')$ shift downward as F increases[2]. For more general specifications of $V(z',a)$ and $G(a)$ this is no longer true and the sign and size effect of firing cost on innovation depends on the chosen functional forms. However, as long as $V(z',a)$ is concave in a and the density $g(a)$ is continuous and decreasing at the initial exit thresholds, higher dismissal costs will exert a positive effect on innovation for incumbent firms.

Although dismissal costs induce the incumbent firm to innovate more, the effect on innovation for an entrant is unclear because dismissal costs deter entry. Assume that a firm with productivity z receives a draw of a and then decides whether to enter or not. The firm will enter and start production if

$$V(z,a) \geq 0. \quad (7)$$

Since higher dismissal costs decrease the asset value of the firm, the firm will only start to produce if a is large enough so that Eq. (7) holds. Defining $\underline{a}$ as the smallest value of a at which the firm

[2] Using the method of undetermined coefficients to solve for $V(z, a)$ and subtracting the exit and entry condition (mentioned below) for this solution, one can show that the exit threshold depends linearly on F. Thus, $\tilde{a}(z')$ and $\tilde{a}(z)$ shift downward but the size of the interval $[\tilde{a}(z'); a(z)]$ does not change.

enters, $V(z, \underline{a})=0$, it follows that $\partial \underline{a} / \partial F > 0$. The expected value of innovation of a firm with productivity z is

$$\tilde{q}(z) = (1 - G(\underline{a}))q(z)$$

and

$$\frac{\partial \tilde{q}(z)}{\partial F} = \underbrace{-\, g(\underline{a})q(z)\frac{\partial \underline{a}}{\partial F}}_{\text{Entry Effect}<0} + \underbrace{(1 - G(\underline{a}))\frac{\partial q(z)}{\partial F}}_{\text{Innovation Effect}>0}.$$

Coming back to the empirical motivation presented at the beginning, the persistent cross-country differences that are negatively correlated with R&D intensity could very well reflect the entry effect whereas changes in dismissal costs over time for a specific country that are positively correlated with R&D intensity are more likely to reflect the innovation effect. The empirical correlations presented in Table 1 suggest that the entry effect outweighs the innovation effect. Of course, our simplified theoretical explanation has focussed on a representative firm and has not taken into account other effects which would arise in a model with a population of heterogenous firms. It would be interesting in future research to extend the analysis in this direction and test the predictions with disaggregate data.

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Appendix A

The R&D intensity is defined as R&D expenditure over value added in the manufacturing sector. The data are contained in the OECD STAN-ANBERD database.

The skill endowment ratio is defined as the fraction of the population with some university education over the fraction of the rest of the population. The ratio is constructed with data on educational attainment provided by Angel de la Fuente and Rafael Domenech available at http://iei.uv.es/~domenech.

The indicator on employment protection is taken from Blanchard and Wolfers (2000) who construct a time varying indicator from 1960 to 1995 with one observation every 5 years. In this note we use an interpolated version of the Blanchard and Wolfers series, readjusted in the mean. The variable takes values in the interval {0,2} where a higher value denotes stricter employment protection. More information on this and the other variables on institutions used in this note can be found in Nickell et al. (2003).

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