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Restructuring of firms in transition: ownership, institutions and openness to trade

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Abstract
We develop a theoretical framework for defensive and strategic restructuring, and provide estimates of restructuring in privatized firms in an advanced transition economy: Slovenia. Our rich data point to both types of restructuring, as well credit rationing and bargaining with respect to investment. Privatized firms display profit-maximizing behavior, and a firm's export orientation and institutional features, such as insider *vs* outsider privatization, employee ownership, and employee control, do not affect the firm's employment and investment behavior. The results suggest that a major exposure to world competition induces similar economic behavior in firms with different structural and institutional characteristics.
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INTRODUCTION

What are the extent, speed and nature of corporate restructuring during major changes in the business environment, such as the transition to a market economy? Does the restructuring vary systematically with institutional and other factors, such as insider (manager and worker) *vs* outsider ownership, employee participation in management, and the extent of export orientation of the firm, when the economy is open to external competition? While restructuring of firms is one of the most important aspects of the transition process, it is only now that a second generation of studies is beginning to address these issues in a systematic conceptual framework, using post-privatization data and a number of restructuring indicators.[1] Studies based on early transition data provide only tentative and often misleading answers, and there is a major debate about the nature of restructuring and the performance of firms in the transition economies.[2]

In this study, we provide an answer to the above questions by analyzing a unique panel of annual 1996–2000 firm-level data from Slovenia – one of the more successful and economically advanced transition economies. Our study is of interest for five principal reasons. First, we combine recent theoretical work on corporate adjustment with the concepts of restructuring that have been developed in the transition context, and show how they can be used for analyzing the behavior of firms that experience external shocks.

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Second, our study is the first to cover several performance indicators related to restructuring – labor adjustment and investment in fixed assets, research and development (R&D), domestic and foreign marketing, and employee training/education – thus giving our results broader validity than is usual in studies of emerging market economies.[3]

Third, we examine systematically the effect on restructuring-related performance of different types of privatization and subsequent ownership, an issue that has received attention but generated ambiguous findings.

Fourth, we analyze the effect of employee representation on the supervisory boards of firms – an important institutional feature of a number of key countries in the European Union (EU) that has been adopted by several of the 10 new EU members. The impact of this feature of corporate governance is not yet fully understood, and we provide a test of its effects on a number of key restructuring-related performance indicators.[4]

Finally, we are able to assess whether a firm's exposure to foreign *vs* only domestic markets affects corporate performance. If the barriers between domestic and export markets are low, the relationship between export orientation and performance should be weak or non-existent because both types of firm are exposed to world competition. More generally, with the fall of the communist regime, the Central European transition countries moved virtually overnight into the ranks of the most open economies in the world, thus defying the widely accepted infant industry thesis that firms in emerging market economies require a long period of protection before being able to face worldwide competition.[5]

The transition economy context hence provides a fruitful setting in which to examine the hypothesis that countries that expose their firms to world competition induce similar economic behavior in all firms, irrespective of their structural and institutional differences. In this sense our study contributes in an important way to the ongoing debate about the importance of various types of institution for economic performance.

Our results with respect to employment indicate that firms actively adjust employment, and the adjustment is of both defensive (short-term) and strategic (long-term) nature, and is consistent with profit-maximizing behavior. We also find evidence against the hypothesis that institutional characteristics such as insider privatization, employee ownership, and employee control through supervisory board membership affect employment intensity of production. Moreover, firms selling a larger proportion of their output on the domestic market increase employment less, *ceteris paribus*, than more export-oriented firms. Our conclusions with respect to investment suggest that firms' restructuring is consistent with profit-maximizing behavior; investment in employee training is small, and unrelated to any of the explanatory variables; Slovenian capital markets have suffered from some imperfections; the ability of workers to appropriate firms' internal funds as above-market wages does not appear to affect restructuring negatively through investment in fixed capital or training, but a trade-off between wages and investment is detected with respect to investment in R&D and marketing; evidence about the effect of privatization on external *vs* internal owners is mixed; firms owned more by outsiders than employee-insiders invest the same; the proportion of external members *vs* employee representatives on the supervisory boards is found to be unrelated to the firm's restructuring through investment; and, unlike the case of labor adjustment, the firm's export *vs* domestic market orientation is found to be unrelated to investment activities.

The paper is organized as follows. We start in this section with a brief overview of the Slovenian institutional and policy setting. We then present the theoretical framework of restructuring and the corresponding estimating equations, followed by a description of the data and variables that we use. In the fourth section we present the results of our empirical tests, and in the last section we draw our conclusions.

The Institutional and Policy Setting

During the 1990s, Slovenia pursued a gradual transition approach, with the most important reforms being macro stabilization, liberalization of trade, and increase of product market competition. Price stabilization was achieved through restrictive monetary and fiscal policies that brought down inflation from 21.5% per month in October 1991, when Slovenia launched its own currency, to an annual rate of 6–7% in the late 1990s. Slovenia also pursued a policy of managed flexible exchange rate and low import duties. This, together with an aggressive development of small and medium-sized firms and government hardening of the budget constraints on the large socially owned firms, has led to greater competition in the domestic market and improved competitive position in the Western

markets (Prašnikar, Jazbec, Mrak, Domadenik, & Gregorič, 2002). Foreign capital has not played a significant part.

Compared with the aggressive pursuit of consistent macro policies, the government has placed relatively less emphasis on the development of efficient labor and capital markets. The financial system as a whole has remained underdeveloped, and it represents a minute part of corporate financing, despite the extensive restructuring of banks and the founding of a stock exchange (Gregorič, Prašnikar, & Ribnikar, 2000). Privatization of firms to insiders or outsiders took place in the early to mid-1990s, relying on a combination of voucher and manager-worker buy-out methods, and resulting in primarily insider (internal) or outsider (external) ownership.[6] The varying degrees of ownership of firms by investment privatization funds, state funds, other non-financial enterprises, employees, former employees, retirees, and other small shareholders make Slovenia an interesting laboratory for examining the effects of different forms of privatization and resulting patterns of ownership on restructuring and performance of firms.

A potentially important aspect of corporate governance is the German-style 1993 Law on Workers' Co-Determination, which gives employees in companies with 500 to 1000 (more than 1000) employees at least one-third (one-half) of seats on the supervisory boards of their firms. Since the supervisory board elects company management, and also has other channels of influence, the employee-insiders potentially play an important role in the firms' decision-making process (Prašnikar & Gregorič, 2002). Employee influence is also reflected in collective bargaining, which has permitted wages to vary across firms and defied government attempts to reign in real wage growth.

THEORETICAL FRAMEWORK AND ESTIMATING EQUATIONS

Building on Grosfeld and Roland (1997), Aghion, Blanchard, and Carlin (1997) and Frydman, Gray, Hessel, and Rapaczynski (1999), we conceptually divide the restructuring of firms into defensive and strategic restructuring.[7] While the former is usually perceived as occurring in the short run and as reactive in nature, strategic restructuring aims at capturing more deliberate, strategic investments in the development of firms' advantages, including changes in the composition of the labor force and investment in fixed capital as well as "soft" capital, such as R&D, marketing and training. In our empirical work, we treat short-term adjustment of labor as defensive restructuring, and long-term labor adjustment, as well as all types of investment, as strategic restructuring.

Our approach is to use a flexible dynamic optimization (error correction) model of the firm that is becoming a leading approach in the literature (see Bond, Harhoff, & Van Reenen, 2003). The approach allows us to specify several estimating equations for restructuring-related performance variables, and it has the advantage that the equations may be viewed as being derived from a particular dynamic framework or being a flexible approximation to a number of dynamic specifications. We start with employment adjustment and then present the investment equations.

Labor Force Restructuring

In order to capture the employment adjustments of firms when they are confronted with the shocks of the transition process, it is useful to start with a model of a firm that maximizes the value of equity owned by its shareholders, subject to capital and labor accumulation constraints. Derived static factor demand functions can be taken as desired long-run equilibrium levels of labor and capital and rewritten as a log-linear function of output and real wage. In the absence of any adjustment costs, the equilibrium employment equation of a profit-maximizing firm with constant returns to scale CES production function may be written as

$$l_t = \alpha + y_t - \sigma(w - p)_t \qquad (1)$$

where l_t denotes the natural logarithm of desired labor in period t, y_t denotes the logarithm of output, and $(w-p)_t$ denotes the logarithm of the user cost of labor.[8]

Realistically, the behavior of the firm is dynamic rather than static. Since the dynamic adjustment process may be complex, the literature usually nests Eq. (1) within a general autoregressive-distributed lag (ADL) dynamic regression model, and uses a "general-to-specific" specification search to let the data determine the relevant dynamics.[9] Formally, using lower-case letters to denote logarithms of variables, a first-degree general distributed lag model of Eq. (1) may be specified as

$$l_t = \alpha_0 + \alpha_1 l_{t-1} + \alpha_2 y_t + \alpha_3 y_{t-1} + \alpha_4 (w - p)_t + \alpha_5 (w - p)_{t-1} \qquad (1')$$

The model has an important advantage compared with estimating an Euler equation or a neoclassical

model because it allows a flexible specification of the adjustment dynamics to be estimated from the data.[10]

In this paper, we go a step further in allowing for flexibility in adjustment, and allow the adjustment process to follow a second-degree ADL process, thus yielding the following equation:

$$l_t = \alpha_0 + \alpha_1 l_{t-1} + \alpha_2 l_{t-2} + \alpha_3 y_t + \alpha_4 y_{t-1} + \alpha_5 y_{t-2} + \alpha_6 (w-p)_t + \alpha_7 (w-p)_{t-1} + \alpha_8 (w-p)_{t-2} \quad (1'')$$

For estimating purposes, it is convenient to reparameterize Eq. (1) in an error correction form and thus separate the short- and long-run effects.[11] Letting

$$l_{t-n} = \Delta l_{t-n} + l_{t-n-1}$$

$$y_{t-n} = \Delta y_{t-n} + y_{t-n-1}$$

$$(w-p)_{t-n} = \Delta (w-p)_{t-n} + (w-p)_{t-n-1}$$

where n=0, 1, introducing firm-specific effects, and assuming that the institutional features discussed in the previous section may be important, the estimating equation takes on the form

$$\begin{aligned}\Delta l_{it} = {} & \rho_0^L + \rho_1^L \Delta l_{i,t-1} + \rho_2^L \Delta y_{it} + \rho_3^L \Delta y_{i,t-1} + \rho_4^L \Delta (w-p)_{it} \\ & + \rho_5^L \Delta (w-p)_{i,t-1} + \rho_6^L (l-y)_{i,t-2} \\ & + \rho_7^L y_{i,t-2} + \rho_8^L (w-p)_{i,t-2} + \rho_9^L \mathrm{EXTPRIV}_{it} \\ & + \rho_{10}^L \mathrm{OWNERFUNDS}_{it} + \rho_{11}^L \mathrm{OWNERPIFS}_{it} \\ & + \rho_{12}^L \mathrm{OWNERFIRMS}_{it} + \rho_{13}^L \mathrm{OWNEROTHER}_{it} \\ & + \rho_{14}^L \mathrm{EXTBOARD}_{it} + \rho_{15}^L \mathrm{HOMEMKT}_{it} \\ & + (\rho_{16}^L)' \mathrm{INDUSTRY}_i + (\rho_{17}^L)' \mathrm{REGION}_i \\ & + s_t + \alpha_i + v_{it}\end{aligned} \quad (2)$$

where subscripts i and t denote firm and period, respectively, and

$$\rho_0^L = \alpha_0^L$$

$$\rho_1^L = \alpha_1^L - 1$$

$$\rho_2^L = \alpha_3^L$$

$$\rho_3^L = \alpha_3^L + \alpha_4^L$$

$$\rho_4^L = \alpha_6^L$$

$$\rho_5^L = \alpha_6^L + \alpha_7^L$$

$$\rho_6^L = -(1 - \alpha_1^L - \alpha_2^L)$$

$$\rho_7^L = \alpha_3^L + \alpha_4^L + \alpha_5^L - (1 - \alpha_1^L - \alpha_2^L)$$

and

$$\rho_8^L = \alpha_6^L + \alpha_7^L + \alpha_8^L$$

In Eq. (2), EXTPRIV is a dummy variable, coded 1 if the firm was privatized primarily to external owners, and 0 if it was privatized primarily to insiders (managers and workers). Variables OWNERFUNDS, OWNERPIFS, OWNERFIRMS, and OWNEROTHER measure the percentage of a given firm's shares that are owned by state funds, privatization investment funds, other firms, and other (miscellaneous) owners, respectively. The miscellaneous owner category does not include the percentage of shares owned by insiders (workers, managers, and retired workers) because this share of ownership is treated as the base, captured in the regression constant, against which the effects of other forms of ownership are being estimated. EXTBOARD measures the percentage of non-employee representatives on the supervisory board, and HOMEMKT is the share of total sales going to the home (domestic) market. Finally, INDUSTRY and REGION are industry and region dummy variables that control for industry-specific and region-specific conditions, respectively, while s_t is an annual dummy variable that controls for macroeconomic shocks. The model requires that $\rho_6^L < 0$ be consistent with "error correcting" behavior, implying that the number of employees above the desired level is associated with lower future hires.

The coefficients ρ_2^L and ρ_4^L correspond to short-run elasticities of labor demand with respect to output and real wage, respectively, reflecting the extent of the firm's defensive restructuring. Long-run elasticities with respect to output and wage, reflecting strategic restructuring, are given by $(1+\rho_7^L)/(-\rho_6^L)$ and $\rho_8^L/(-\rho_1^L)$, respectively. Similarly, the coefficients ρ_9^L to ρ_{14}^L correspond to short-run employment effects of external privatization, different types of ownership and supervisory board compositions, respectively, while the corresponding long-run effects are given by the short-run effects divided by $(-\rho_1^L)$.

In terms of our conceptual framework, Eq. (2) permits us to test several hypotheses about the process of labor adjustment during the transition:

Hypothesis 1: Firms engage in short-term, defensive labor restructuring ($\rho_2^L > 0$ and/or $\rho_4^L < 0$).

Hypothesis 2: Firms engage in long-term, strategic labor restructuring ($(1+\rho_7^L)/(1+\rho_6^L)>0$ and/or $\rho_8^L/(-\rho_1^L)<0$).

Hypothesis 1 states that firms engage in defensive restructuring of their labor force, and defines defensive restructuring as corresponding to non-zero short-run elasticities of labor demand with respect to output and/or wage. Hypothesis 2 states that firms engage in strategic labor restructuring, and defines strategic restructuring as reflecting non-zero long-run elasticities of labor demand with respect to output and/or wage. A test of these two hypotheses also enables us to assess whether the adjustment in employment is significant, or whether firms resist adjusting employment and thus resemble the "socialist" (stodgy) enterprises as presented by Basu, Estrin, and Svejnar (2005). In this socialist model, firms do not adjust employment in response to changes in output and wages ($\rho_2^L=\rho_4^L=(1+\rho_7^L)/(-\rho_6^L)=\rho_8^L/(-\rho_1^L)=0$).

In the context of the error correction model we also test whether firms respond to shocks by moving towards a new equilibrium:

Hypothesis 3: Number of employees above its desired level is associated with lower subsequent rate of employment growth ($\rho_6^L<0$).

Finally, Eq. (2) permits us to test specific hypotheses about the employment effects of the institutional characteristics of firms' privatization and corporate governance. In particular, there has been a major debate about whether employee ownership and control are associated with excessive use of labor or labor hoarding (e.g., Brada, 1996; Hinds, 1990), no employment effect (e.g., Prašnikar, Svejnar, Mihaljek, & Prašnikar, 1994), or whether employee-insiders actually restrict employment so as to increase their own wages (e.g., Bonin, Jones, & Putterman, 1993). We have rich data and can test these propositions with three sets of variables: whether the firm was privatized primarily to external *vs* internal owners (EXTPRIV), the extent of external *vs* internal ownership in any given year (OWNERFUNDS, OWNERPIFS, OWNERFIRMS, and OWNEROTHER), and the percentage of non-employee representatives on the firm's supervisory board (EXTBOARD). The corresponding *ceteris paribus* hypotheses are:

Hypothesis 4: Firms privatized primarily to external owners and owned more by outsiders (state or investment funds, other firms, and miscellaneous other owners) than by employee-insiders exhibit:

(a) a lower rate of employment growth ($\rho_9^L<0$ and/or $\rho_{10}^L<0$ and/or $\rho_{11}^L<0$ and/or $\rho_{12}^L<0$ and/or $\rho_{13}^L<0$);
(b) the same rate of employment growth ($\rho_9^L=\rho_{10}^L=\rho_{11}^L=\rho_{12}^L=\rho_{13}^L=0$); or
(c) a higher rate of employment growth ($\rho_9^L>0$ and/or $\rho_{10}^L>0$ and/or $\rho_{11}^L>0$ and/or $\rho_{12}^L>0$ and/or $\rho_{13}^L>0$).

Hypothesis 5: Firms controlled more by outsiders (non-employee representatives on supervisory boards) than by employee-insiders exhibit:

(a) a lower rate of employment growth ($\rho_{14}^L<0$);
(b) the same rate of employment growth ($\rho_{14}^L=0$); or
(c) a higher rate of employment growth ($\rho_{14}^L>0$).

Finally, the extent to which firms economize on inputs, including labor, may or may not be systematically related to whether they produce more for the domestic or the export markets. If the barriers between domestic and export markets are low, the relationship between export orientation and labor intensity should be weak or non-existent. Since the Central European transition countries quickly moved into the ranks of the most open economies in the world, this is an interesting hypothesis to test. Alternatively, if the barriers between domestic and export markets are not sufficiently low, then exporting firms face more competitive conditions, and may be expected to use less labor, given output, wages, and other conditions. Finally, if export markets are more demanding in terms of providing services such as delivery, warranty and product repair, it is possible that export-oriented firms will use more labor, *ceteris paribus*. The relevant *ceteris paribus* hypotheses hence are:

Hypothesis 6: Firms that sell a larger proportion of their output in the domestic (home) market exhibit:

(a) the same rate of employment growth as firms that sell more output on foreign markets ($\rho_{15}^L=0$); or
(b) a higher rate of employment growth than firms that sell more output on foreign markets ($\rho_{15}^L>0$); or
(c) a lower rate of employment growth than firms that sell more output on foreign markets ($\rho_{15}^L<0$).

Restructuring through Investment

Restructuring through investment in fixed and soft capital permits firms to achieve greater competitiveness on the domestic and foreign markets. The importance of investment in fixed capital has been amply documented in the business and economics literatures. The literature on investment in soft capital, such as R&D, marketing, and training/education, is more recent but equally important. R&D expenses may for instance be included in the framework of the production function if output is a homothetic function of physical capital and technology acquired through R&D (Mairesse & Sassenou, 1991), and one may replace output by sales revenue in the production function, since part of R&D expenses represents the development of new products (Griliches, 1986).[12] Chandler (1993) puts emphasis on investment in new markets, with firms shifting sales from declining to expanding markets and carrying out greater investments in market research, development of new market routes, promotion (designing trademarks), and sales. Batra (1997) in turn stresses the investment aspect of marketing expenditures in firms that operate in transition countries, pointing to the importance of competitiveness in both the domestic and foreign markets.[13] Finally, Milkovich and Bloom (1998) consider investments made by firms in employee training an important source of competitive advantage for firms in the world of global competition. This is especially important for firms operating in transition countries, because they often need to carry out radical upgrading of their human resources (Carlin, Van Reenen, & Wolfe, 1994).

In order to capture these aspects of restructuring empirically, we estimate an investment equation that incorporates firms' output demand (demand side), internal funds (supply side), and the bargaining about – or trade-off between – investment and wages (Fazzari, Hubbard, & Petersen, 1988; Prašnikar & Svejnar, 2007). As in the preceding subsection, we first outline the theoretical framework that underlies our estimating equations.

Using the same dynamic model as for labor demand, the long-run desired level of the capital stock can also be specified as a log-linear function of output and the user cost of capital. Letting k_t denote the natural log of the desired capital stock in period t, y_t denote the log of output, and j_t denote the log of the user cost of capital yields

$$k_t = \alpha + y_t - \sigma j_t \tag{3}$$

As in the case of labor restructuring, we assume second-degree ADL specification as

$$\begin{aligned} k_t =& \alpha_0^I + \alpha_1^I k_{t-1} + \alpha_2^I k_{t-2} + \alpha_3^I y_t + \alpha_4^I y_{t-1} + \alpha_5^I y_{t-2} \\ &+ \alpha_6^I j_t + \alpha_7^I j_{t-1} + \alpha_8^I j_{t-2} \end{aligned} \tag{3'}$$

and re-parameterize the model in an error correction form as

$$\begin{aligned} \Delta k_t =& \alpha_0^I + (\alpha_1^I - 1)\Delta k_{t-1} + \alpha_3^I \Delta y_t + (\alpha_3^I + \alpha_4^I)\Delta y_{t-1} + \alpha_6^I \Delta j_t \\ &+ (\alpha_6^I + \alpha_7^I)\Delta j_{t-1} - (1 - \alpha_1^I - \alpha_2^I)(k - y)_{t-2} \\ &+ [\alpha_3^I + \alpha_4^I + \alpha_5^I - (1 - \alpha_1^I - \alpha_2^I)]y_{t-2} \\ &+ (\alpha_6^I + \alpha_7^I + \alpha_8^I)j_{t-2} + \varepsilon_t \end{aligned} \tag{3''}$$

where the long-run elasticity of capital with respect to output is given by $(\alpha_3^I + \alpha_4^I + \alpha_5^I)/(1-\alpha_1^L-\alpha_2^L)$, while the corresponding elasticity with respect to user cost of capital is $(\alpha_6^I + \alpha_7^I + \alpha_8^I)/(1-\alpha_1^L-\alpha_2^L)$.[14]

To implement this model using firm panel data, we assume that the variation in the user cost of capital can be captured by additive year-specific (μ_t) and firm-specific (η_i) effects (see also Bond et al., 2003). Moreover, the capital accumulation constraint $I_t = K_t - (1-\delta)K_{t-1}$ implies that

$$\left(\frac{I_t}{K_{t-1}}\right) - \delta = \frac{K_t - K_{t-1}}{K_{t-1}} \approx \Delta k_t \tag{4}$$

where δ is the firm-specific depreciation rate, subsumed into the firm-specific effects (η_i). Eqs. (3″) and (4) in turn yield a model for the investment rate:

$$\begin{aligned} \left(\frac{I_{it}}{K_{i,t-1}}\right) =& \rho_0^I + \rho_1^I \left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \rho_2^I \Delta y_{it} + \rho_3^I \Delta y_{i,t-1} \\ &+ \rho_4^I (k - y)_{i,t-2} + \rho_5^I y_{i,t-2} + \eta_i + \varepsilon_{it} \end{aligned} \tag{5}$$

where

$$\rho_1^I = \alpha_1^I - 1$$

$$\rho_2^I = \alpha_3^I$$

$$\rho_3^I = \alpha_3^I + \alpha_4^I$$

$$\rho_4^I = -(1 - \alpha_1^I - \alpha_2^I)$$

and

$$\rho_5^I = \alpha_3^I + \alpha_4^I + \alpha_5^I - (1 - \alpha_1^I - \alpha_2^I)$$

Eq. (5) also requires that $\rho_4^I < 0$ to be consistent with error-correcting behavior implying that capital stock above its desired level is associated with lower future investment.

The error correction model has recently also been used in empirical work on soft capital investments

(e.g., Bond & Van Reenen, 2007). Conceptually, the firm's stock of knowledge is given by

$$\mathrm{INT}_{it}^{k} = (1-\delta_i^k)\mathrm{INT}_{i,t-1}^{k} + R_{it}^{k} \tag{6}$$

where R_{it} is the level of soft capital spending, δ_i^k is the firm-specific rate at which knowledge stock depreciates, and k denotes the different types of soft capital investment. Analogously to Eq. (3), the natural logarithm of the desired knowledge stock in period t, g_t, can be specified as

$$g_t^k = \alpha^R + y_t - \sigma j_t^{R,k} \tag{7}$$

and the corresponding error correction model has the form

$$\begin{aligned}\Delta g_t^k =& \alpha_0^{R,k} + (\alpha_1^{R,k}-1)\Delta g_{t-1}^k + \beta_0^{R,k}\Delta y_t + (\beta_0^{R,k}+\beta_1^{R,k})\Delta y_{t-1} \\ &+ \gamma_0^{R,k}\Delta j_t^{R,k} + (\gamma_0^{R,k}+\gamma_1^{R,k})\Delta j_{t-1}^{R,k} \\ &- (1-\alpha_1^{R,k}-\alpha_2^{R,k})(g^k - y)_{t-2} \\ &+ [\beta_0^{R,k}+\beta_1^{R,k}+\beta_2^{R,k}-(1-\alpha_1^{R,k}-\alpha_2^{R,k})]y_{t-2} \\ &+ (\gamma_0^{R,k}+\gamma_1^{R,k}+\gamma_2^{R,k})j_{t-2}^{R,k} + \varepsilon_t^{R,k}\end{aligned} \tag{8}$$

where the long-run elasticity of "knowledge" capital with respect to output is given by

$$(\beta_0^{R,k}+\beta_1^{R,k}+\beta_2^{R,k})/(1-\alpha_1^{R,k}-\alpha_2^{R,k})$$

and the corresponding elasticity with respect to the user cost of knowledge capital is

$$(\gamma_0^{R,k}+\gamma_1^{R,k}+\gamma_2^{R,k})/(1-\alpha_1^{R,k}-\alpha_2^{R,k})$$

The usual challenge in estimating soft capital investment models is how to measure the value of intangibles that the firm uses in the production process. The error correction model avoids this problem because it does not require knowledge of the stock of soft capital. Following Hall (1992), Bond et al. (2003), and Bond and Van Reenen (2007), for the case of R&D expenses, let a firm in a steady state have the current level of soft capital stock given by

$$\mathrm{INT}_t^k = (1+\upsilon^k)\mathrm{INT}_{t-1}^k \tag{9}$$

where υ^k represents the growth rate of soft capital stock. Correspondingly, expenditures on intangibles are given by

$$R_t^k = (\delta^k+\upsilon^k)\mathrm{INT}_{t-1}^k = \left(\frac{\delta^k+\upsilon^k}{1+\upsilon^k}\right)\mathrm{INT}_t^k \tag{10}$$

or

$$r_t^k = \ln\left(\frac{\delta^{R,k}+\upsilon^k}{1+\upsilon^k}\right) + g_t^k \tag{11}$$

where r_t^k is the logarithm of expenditures on soft capital. The unobservable g_t^k can then be replaced in Eq. (8) by the observed r_t^k, and the first term in Eq. (11) is captured by the firm-specific effects to yield

$$\begin{aligned}\Delta r_t^k =& \mu_t^{R,k} + \rho_1^{R,k}\Delta r_{t-1}^k + \omega_0^{R,k}\Delta y_t + \omega_1^{R,k}\Delta y_{t-1} \\ &+ \theta^{R,k}(r^k - y)_{t-2} + \varphi^{R,k}y_{t-2} + \eta^{R,k} + \varepsilon_t^{R,k}\end{aligned} \tag{12}$$

As in the case of fixed capital investment, Eq. (12) requires that $\theta^R<0$ to be consistent with error correcting behavior.

Eqs. (5) and (12) implicitly assume that the firm operates in a perfect capital market, in that it may obtain as much external capital as it wants at the same rate as that at which it can lend its internal funds. However, the underdeveloped nature of the capital markets in the transition economies and the existence of informational asymmetries between banks and firms suggest that firms may face constraints on external financing (Bole, 1999; Meyendorff & Thakor, 2002). In this case, the amount of any given firm's investment will vary positively with the amount of funds that it can generate internally.[15] It is customary to test for this phenomenon by augmenting Eqs. (5) and (12) with a proxy for these internal funds, such as profits (e.g., Lizal & Svejnar, 2002).

As mentioned earlier, in a transition economy setting it is also important to assess the extent to which employee ownership and/or control affect the firm's investment. The literature on participatory and labor-managed firms has for a long time debated the existence and seriousness of the so-called "under-investment problem", allegedly brought about by the short (less than infinite) time horizon of individual workers in these firms. The basic argument is that worker-insiders, unlike diversified capital owners (outsiders), prefer to distribute enterprise surplus as current labor income and fringe benefits rather than reinvest it in the firm for future growth (e.g., Furubotn & Pejovich, 1970; Vanek, 1970). More recently, Blanchard and Aghion (1996) have followed this thesis by arguing in the transition context that insider-dominated firms may not generate the resources needed for restructuring activities such as investment.[16] While this may be the case, it is also possible that, as transition proceeds and workers become more secure, they are willing to defer wages and allocate more internal

funds for investment. In order to examine these hypotheses, we use explanatory variables that permit us to assess the extent to which (a) there is bargaining over the internally generated funds that the firm could use for investment *vs* expenditures on wages, salaries, and bonus payments and (b) employee ownership and/or control affect the firm's investment negatively or positively.

To tackle the issue of bargaining, let profit Π be defined as revenues Q minus labor costs WL and all non-labor costs H: $\Pi = Q - WL - H$. Moreover, let W^a be the reservation (best alternative) wage and $WL - W^aL$ be the difference between the actual and reservation level of wage bill (labor cost).[17] The extent to which employee-insiders earn more than their reservation income ($WL - W^aL > 0$) reflects their ability to appropriate what would otherwise be the firm's surplus. $WL - W^aL$ is hence an outcome of bargaining over the firm's internally generated funds. Since we analyze strategic decisions over labor cost as well as investment in several areas, we include expenditures on R&D I_{RD}, expenditures on marketing I_M, and expenditures on training I_T as part of the internal funds that are subject to bargaining.[18] The measure of internal funds that are subject to bargaining is therefore given by

$$\begin{aligned}\Pi^a &= \Pi + (WL - W^aL) + (I_{RD} + I_M + I_T)\\ &= Q - W^aL - H + I_{RD} + I_M + I_T\end{aligned}$$

We include Π^a in augmented forms of Eqs. (5) and (12) and interpret the estimated coefficient on Π^a as a measure of the extent to which firms with more internal funds invest more than others, *ceteris paribus*. We also include $WL - W^aL$ as an explanatory variable in these augmented equations in order to assess whether worker earnings over and above the reservation level result in a lower level of investment, controlling for Π^a and the other regressors. The estimated coefficient on $WL - W^aL$ hence gives us the magnitude of the bargaining trade-off between extra labor cost and investment.

To answer the second question, namely whether employee ownership and control have a negative or positive effect on firm's investment, we include as explanatory variables EXTPRIV, OWNERFUNDS, OWNERPIFS, OWNERFIRMS, OWNEROTHER, and EXTBOARD, defined above.

Analogously to Bond et al. (2003), in our context the empirical specification of an augmented error correction model for capital demand is

$$\begin{aligned}\left(\frac{I_{it}}{K_{i,t-1}}\right) =& \rho_0^I + \rho_1^I\left(\frac{I_{i,t-1}}{K_{i,t-2}}\right) + \rho_2^I \Delta y_{it} + \rho_3^I \Delta y_{i,t-1}\\ &+ \rho_4^I (k-y)_{i,t-2} + \rho_5^I y_{i,t-2} + \rho_6^I\left(\frac{\Pi_{it}^a}{K_{i,t-1}}\right)\\ &+ \rho_7^I\left(\frac{\Pi_{i,t-1}^a}{K_{i,t-2}}\right) + \rho_8^I\left(\frac{\Pi_{i,t-2}^a}{K_{i,t-3}}\right) + \rho_9^I\left[\frac{(WL - W^aL)_{it}}{K_{i,t-1}}\right]\\ &+ \rho_{10}^I\left[\frac{(WL - W^aL)_{i,t-1}}{K_{i,t-2}}\right] + \rho_{11}^I\left[\frac{(WL - W^aL)_{i,t-2}}{K_{i,t-3}}\right]\\ &+ \rho_{12}^I \mathrm{EXT}_{it} + \rho_{13}^I \mathrm{OWNERFUNDS}_{it}\\ &+ \rho_{14}^I \mathrm{OWNERPIFS}_{it} + \rho_{15}^I \mathrm{OWNERFIRMS}_{it}\\ &+ \rho_{16}^I \mathrm{OWNEROTHER}_{it} + \rho_{17}^I \mathrm{EXTBOARD}_{it}\\ &+ \rho_{18}^I \mathrm{HOMEMKT}_{it} + (\rho_{19}^I)'\mathrm{INDUSTRY}_i\\ &+ (\rho_{20}^I)\mathrm{REGION}_i + s_t + \alpha_i + \upsilon_{it}\end{aligned} \tag{13}$$

As discussed earlier, since investment involves deliberate expenditures rather than defensive cost-cutting, and since the benefits of investment accrue over time, we treat investment as strategic restructuring. The coefficients ρ_2^I, ρ_6^I, and ρ_9^I correspond to short-run elasticities of capital with respect to sales, internal funds, and excess wages, respectively, reflecting the extent of the firm's short strategic restructuring. The long-run effects of the relevant variables on capital adjustment are given by the long-run elasticity of capital with respect to sales, $(1 - \rho_5^I/\rho_4^I)$, the long-run elasticity of capital with respect to internal funds, $(\rho_6^I + \rho_7^I + \rho_8^I)/(-\rho_4^I)$, and the long-run elasticity of capital with respect to excess wages, $(\rho_9^I + \rho_{10}^I + \rho_{11}^I)/(-\rho_4^I)$. Similarly, the coefficients ρ_{12}^I to ρ_{17}^I correspond to short-term effects of external privatization, ownership, and supervisory board structures on investment, while the corresponding long-run effects are calculated by dividing the short-term effects by $(-\rho_1^L)$.

Eq. (13) contains firm-specific variables related to the firm's orientation towards the domestic *vs* foreign market, and controls for industry and regional characteristics as well as annual macroeconomic shocks. The inclusion of the variable capturing the share of firm's sales on the domestic market reflects the hypothesis that exporting firms face greater competition and hence need to invest more than their domestically oriented counterparts in order to succeed.

Eq. (13) contains the following key hypotheses about restructuring of firms in the transition

economies, as reflected in their investment behavior:

Hypothesis 7: A firm's investment is positively related to its revenue: (a) in the short run ($\rho_2^I > 0$) and (b) in the long run ($1-\rho_5^I/\rho_4^I > 0$).

Hypothesis 8: Firms face financial constraints and their investment depends positively on the level of internal funds: (a) in the short run ($\rho_6^I > 0$) and (b) in the long run ($(\rho_6^I + \rho_7^I + \rho_8^I)/-\rho_4^I > 0$).

Hypothesis 9: Employees are able to appropriate internal funds that would otherwise be used for investment: (a) in the short run ($\rho_9^I < 0$) and (b) in the long run ($(\rho_6^I + \rho_7^I + \rho_8^I)/(-\rho_4^I) < 0$).

Hypothesis 10: Firms privatized primarily to external as opposed to internal owners and owned more by outsiders (state or investment funds, other firms, and miscellaneous other owners) than employee-insiders invest (a) more ($\rho_{12}^I > 0$ and/or $\rho_{13}^I > 0$ and/or $\rho_{14}^I > 0$ and/or $\rho_{15}^I > 0$ and/or $\rho_{16}^I > 0$) or (b) the same ($\rho_{12}^I = \rho_{13}^I = \rho_{14}^I = \rho_{15}^I = \rho_{16}^I = 0$) or (c) less ($\rho_{12}^I < 0$ and/or $\rho_{13}^I < 0$ and/or $\rho_{14}^I < 0$ and/or $\rho_{15}^I < 0$ and/or $\rho_{16}^I < 0$).

Hypothesis 11: Firms with a greater percentage of external (non-employee) members of the supervisory board invest (a) more ($\rho_{17}^I > 0$) or (b) the same ($\rho_{17}^I = 0$).

Hypothesis 12: Firms oriented more towards the domestic market invest (a) less than export-oriented firms ($\rho_{18}^I < 0 < 0$) or (b) the same as export-oriented firms ($\rho_{18}^I = 0$).

Econometric Issues

In interpreting the coefficients of Eqs. (2) and (13), it is important to note that the constant term serves as the base that contains certain characteristics against which we measure the other effects. In particular, the constant reflects the effect of firms that have been privatized primarily to insiders (EXTPRIV=0), are completely insider-owned (OWNERFUNDS= OWNERFIRMS=OWNEROTHER=0), do not have non-employee representatives on the supervisory board (EXTBOARD=0), and export all of their output (HOMEMKT=0).

It should also be noted that by using micro-level panel data we are able to eliminate bias introduced by using aggregate investment data (Abel & Blanchard, 1986), reduce measurement error, and take into account heterogeneity across firms and over time (e.g., Bond & Meghir, 1994). The most important problem in estimating Eqs. (2) and (13) is the endogeneity of the contemporaneous right-hand side variables with respect to current and past disturbances. Moreover, owing to the inclusion of a lagged dependent variable as a regressor and its clear correlation with the error term, the estimation of the parameters of the model using ordinary least squares (OLS) in levels will be inconsistent even if the errors are not serially correlated.[19]

One way to account for those problems is to estimate the model using the "within group" estimator that captures all time-constant characteristics. The problem of correlation between the RHS variables and the error term is usually solved by using a method based on the instrumental variables (IV) technique, ranging from simple instrumenting to using the generalized method of moments (GMM) method. The biases from random measurement errors in the first differenced and within estimates may be severe; they tend to affect the first-differenced estimates and to a lesser extent the within estimates, even when they are small for the untransformed total estimates.[20] The biases from the endogeneity of variables with respect to past disturbances will also affect estimates very differently. In the case of the within estimator the bias arises from the correlation with an average of past disturbances – precisely the part that enters $\varepsilon_{it} = s_t + \alpha_i + \upsilon_{it}$ (i.e., $(\varepsilon_{i1} + \varepsilon_{i2} + \cdots + \varepsilon_{it-1})/T$). The bias will thus fall with the length T of the study period. In the case of the first differences, the bias results from the correlation of the current values of explanatory variables and the one-year lagged disturbance (ε_{it-1}), and hence will remain the same even in a longer panel. Anderson and Hsiao (1982) suggested first-differencing the model to get rid of the individual specific constant term (α_i) and then using differences lagged for two periods or simply second lag of dependent variable as an instrument for $\Delta y_{t-1} = (y_{t-1} - y_{t-2})$ that appears as a regressor after first differentiation is performed. These instruments will not be correlated with the first difference of the error term as long as s_t are not serially correlated between themselves. However, as Ahn and Schmidt (1995) report, this IV method leads to consistent but not necessarily efficient estimates of the parameters in the model, because it does not use all available moment conditions, and it does not take into account the differenced structure on the residual disturbances.[21] Arellano and Bond (1991) build on the Anderson–Hsiao idea, noting

that, in general, there are many more instruments available in order to obtain more efficient estimates of the parameters. Using the GMM framework developed by Hansen (1982) they propose a GMM procedure, arguing that additional instruments can be obtained if one uses the orthogonality conditions that exist between lagged values of dependent variable and the error term v_{it}.

Since the work of Arellano and Bond (1991), the GMM technique has been widely used in the estimation of dynamic panel data models. However, subsequent estimation of the finite sample performance of the GMM estimator has shown that it is substantially biased. One source of bias arises from the "weak instruments problem" (Staiger & Stock, 1997), and another stems from the relative number of instruments to sample size – the so-called "many instruments problem". Hahn and Hausman (2002), among others, have shown that the finite sample bias of a 2SLS estimator is monotonically increasing in the number of instruments, and leads to trade-off between the efficiency and the bias of the estimator. To overcome the "weak instruments problem" Blundell and Bond (1998) propose the system GMM estimator, which has been widely used in empirical studies since then. Hayakawa (2005) shows that although using more instruments than the first-differencing and the level estimators, even in the case of fixed N and T, system GMM is less biased than both (the first differencing and the level) preceding GMM estimators.

The system GMM estimator controls for the presence of unobserved firm-specific effects and for the endogeneity of the current-dated explanatory variables. It uses equations in first differences, from which the firm-specific effects are eliminated by the transformation, and for which endogenous variables lagged two or more periods will be valid instruments provided there is no serial correlation in the time-varying component of the error terms. These differenced equations are combined with equations in levels, for which the instruments must be orthogonal to the firm-specific effects. Blundell and Bond (1998) show that in ADL models, first differences of the series can be uncorrelated with the firm-specific effects provided that the series have stationary means. The validity of instruments is tested by using a Sargan–Hansen test of over-identifying restrictions.

Given the considerations above, we use the system GMM estimates. In the case of labor adjustment we instrument $\Delta l_{i,t-1}$, Δy_{it} and $\Delta(w-p)_{it}$ by using $l_{i,t-3}$, $l_{i,t-4}$, $y_{i,t-3}$, $y_{i,t-4}$, $(w-p)_{it-3}$, $(w-p)_{it-4}$, $(l-y)_{i,t-3}$, and $(l-y)_{i,t-4}$ as instruments in the differenced equation, and $\Delta l_{i,t-2}$, $\Delta l_{i,t-3}$, Δy_{t-2}, Δy_{t-3}, $\Delta(w-p)_{t-2}$, and $\Delta(w-p)_{t-3}$ as instruments in the levels equation. In the case of the investment equations we instrument Δy_{it}, Π^a_t/K_{t-1}, and $(WL-W^aL)_t/K_{t-11}$ by using $y_{i,t-3}$, $y_{i,t-4}$, Π^a_{t-3}/K_{t-4}, and $(WL-W^aL)_{t-3}/K_{t-4}$ in the differenced equation, and Δy_{t-2}, Δy_{t-3}, $\Delta(\Pi^a_t/K_{t-1})$, $\Delta(\Pi^a_{t-1}/K_{t-2})$, $\Delta(\Pi^a_{t-2}/K_{t-3})$, $\Delta(WL-W^aL)_t/K_{t-1}$, $\Delta(WL-W^aL)_{t-1}/K_{t-2}$, and $\Delta(WL-W^aL)_{t-2}/K_{t-3}$ as instruments in the levels equations.

DESCRIPTION OF DATA AND VARIABLES

The sample contains 1996–2000 annual data on the 157 largest Slovenian firms that were privatized in the 1993–1995 period.[22] We hence observe the firms in the immediate post-privatization period when they could carry out defensive and strategic restructuring. Most of these firms are registered as joint stock companies, and in 2000 they generated 18% of total income and employed 9.8% of all employees among the firms registered in Slovenia. The data set is unique in that it provides information on a number of key variables, namely investment in R&D, marketing, and training, which are usually not available in balance sheets and income statements.

As may be seen from the summary statistics in Table 1, the variables display reasonable mean values and considerable variances. The average firm in the sample employs 558 workers, achieves a ratio of sales to tangible capital of 9.6, and sells 58% of the value of its products on the domestic market. Gross investment in fixed capital and marketing expenditures are equal to about 14 and 22% of tangible capital, respectively, while investment in R&D and externally provided training equal to 6 and 1% of tangible capital, respectively.[23] Over 60% of the marketing expenditures are geared towards the domestic market. Slightly more than one-half of the firms were privatized primarily to insiders, and the average share ownership is 31% by insiders, 34% by state and investment funds, 21% by other firms, and 13% by other owners. Finally, the average share of non-employee representatives on the supervisory boards of firms is 51%, confirming that employees have a significant over-representation on these boards compared with their ownership share.

The average intertemporal adjustments, not reported in a tabular form, include a decline in net employment of 4 and 2% in 1997 and 1998,

Table 1 Summary statistics for variables used in estimating labor adjustment and investment equations

Variable	*N*	*Mean*	*Standard deviation*	*Description*
L_t	761	558.1	779.786	Number of employees
W_t	761	2,138.843	709.355	Labor costs per employee
Y_t/L_t	761	10,136.77	10,218.48	Sales per employee
K_t	762	3,140,805	5,691,588	Value of tangible assets in 1996 prices
$K_{RD,t}$	691	637,623	2,046,896	Value of intangible R&D capital in 1996 prices
$K_{M,t}$	649	1,431,713	4,447,087	Value of intangible marketing capital in 1996 prices
$K_{T,t}$	686	72,492	196,125	Value of intangible training capital in 1996 prices
I_t/K_{t-1}	566	0.169	0.353	Investment in fixed capital/capital$_{-1}$
$I_{RD,t}/K_{RD,t-1}$	404	0.497	1.930	R&D investment/capital in R&D$_{-1}$
$I_{M,t}/K_{M,t-1}$	486	0.593	4.743	Total marketing expenses/capital in marketing$_{-1}$
$I_{T,t}/K_{T,t-1}$	485	0.103	0.928	Investment in training/training capital$_{-1}$
Π_t^a/K_{t-1}	488	0.758	1.539	Value-added less reservation labor costs plus R&D expenses, marketing expenses and training expenses/capital$_{-1}$
$\Pi_t^a/K_{RD,t-1}$	366	12.117	34.451	Value-added less reservation labor costs plus R&D expenses, marketing expenses and training expenses/R&D capital$_{-1}$
$\Pi_t^a/K_{M,t-1}$	474	10.441	92.221	Value-added less reservation labor costs plus R&D expenses, marketing expenses and training expenses/marketing capital$_{-1}$
$\Pi_t^a/K_{T,t-1}$	487	89.811	252.925	Value-added less reservation labor costs plus R&D expenses, marketing expenses and training expenses/training capital$_{-1}$
$(WL-W^aL)_t/K_{t-1}$	602	0.325	0.896	Labor costs less reservation labor costs/capital$_{-1}$
$(WL-W^aL)_t/K_{RD,t-1}$	426	5.731	22.893	Labor costs less reservation labor costs/R&D capital$_{-1}$
$(WL-W^aL)_t/K_{M,t-1}$	524	6.700	63.882	Labor costs less reservation labor costs/marketing capital$_{-1}$
$(WL-W^aL)_t/K_{T,t-1}$	550	236.339	2,434.924	Labor costs less reservation labor costs/training capital$_{-1}$
y_t	762	14.793	1.228	Logarithm of sales revenue
$(k-y)_t$	761	−0.657	0.772	Difference in logarithms of capital and sales revenue
$k_{RD,t}-y_t$	529	−2.753	1.222	Difference in logarithms of R&D capital and sales revenue
$k_{M,t} \times y_t$	636	−2.277	1.245	Difference in logarithms of marketing capital and sales revenue
$k_{T,t}-y_t$	668	−5.188	1.355	Difference in logarithms of training capital and sales revenue
OWNERINSIDERS$_t$	738	0.318	0.229	Ownership share of managers, workers and former employees
OWNERFUNDS$_t$	733	0.181	0.162	Ownership share of state funds
OWNERPIFS$_t$	733	0.161	0.158	Ownership share of investment companies
OWNERFIRMS$_t$	738	0.210	0.325	Ownership share of other firms
OWNEROTHER$_t$	738	0.128	0.184	Ownership share of banks, small shareholders, state, unrealized internal buy-outs and other
EXTBOARD$_t$	686	0.515	0.200	Share of non-employees' representatives on the supervisory board
HOMEMKT$_t$	730	0.586	0.346	Sales on domestic market relative to total sales
EXTPRIV	780	0.488	0.500	Privatization dummy (1 = external; 0 = internal)

Variables measuring monetary values are expressed in 1000 Slovene tolars in 1996 prices.

respectively, followed by a 1 and 3% increase in 1999 and 2000, respectively, a reduction in the relative differential between actual and reservation wages from 37% in 1996 to 32% in 2000,[24] a 2% annual increase in the stock of fixed capital, 14.8, 18, and 12.4% annual increase in the stock of intangible (R&D, marketing, and training) capital,[25] respectively, a 5.2% annual increase in real sales per worker, and a 2% annual increase in labor costs. The average ownership share of insiders (employees, managers, and retired employees) dropped significantly from 35 to 25.3%,[26] the share of state and investment funds from 37 to 31.2%,[27] and the share of others (small shareholders, state, and banks) from 13.9 to 13.3%,[28] while the share of non-financial firms increased considerably from 13.7 to 30.3% in the 1996–2000 period. Investment in fixed capital relative to sales increased from 5.8% in 1996 to 7.9% in 2000, and marketing expenditures to sales rose from 4.4% in 1996 to 6% in 2000. In contrast, investment in R&D relative to sales increased by only 0.88 percentage points, from 1.94 to 2.82%, in the 1996–2000 period, and training expenses actually declined from 0.34% in 1996 to 0.26% in 2000.[29]

EMPIRICAL RESULTS

Employment Adjustment

In Table 2, we present the estimated GMM system coefficients of the employment adjustment model given by Eq. (2). The estimated coefficients on current and lagged real revenue and wages are statistically significant, and the results are hence consistent with the hypothesis that the firms' employment adjustment has been significantly

Table 2 Labor adjustment

Variables	*Coefficients*	*System GMM*
Δl_{t-1}	ρ_1^L	−0.338** (0.151)
Δy_t	ρ_2^L	0.730*** (0.150)
Δy_{t-1}	ρ_3^L	−0.229** (0.106)
$\Delta(w-p)_t$	ρ_4^L	−1.348** (0.623)
$\Delta(w-p)_{t-1}$	ρ_5^L	0.488 (0.299)
$(l-y)_{t-2}$	ρ_6^L	−0.386** (0.154)
y_{t-2}	ρ_7^L	−0.124** (0.057)
$(w-p)_{t-2}$	ρ_8^L	−0.494* (0.295)
EXTPRIV_t	ρ_9^L	0.014 (0.032)
OWNERFUNDS_{t-1}	ρ_{10}^L	0.209 (0.174)
OWNERPIFS_{t-1}	ρ_{11}^L	0.093 (0.148)
OWNERFIRMS_{t-1}	ρ_{12}^L	0.026 (0.104)
OWNEROTHER_{t-1}	ρ_{13}^L	0.173 (0.126)
EXTBOARD_{t-1}	ρ_{14}^L	−0.032 (0.058)
HOMEMKT_t	ρ_{15}^L	−0.159* (0.084)
Year dummies		Yes
Constant	ρ_0^L	2.062 (1.652)
Industry dummies		Yes
Regional dummies		Yes
Short-run elasticity of L to W	ρ_4^L	−1.348** (0.623)
Long-run elasticity of L to W	$\rho_8^L/(-\rho_1^L)$	−1.458** (0.623)
Short-run elasticity of L to Y	ρ_2^L	0.730*** (0.150)
Long-run elasticity of L to Y	$\rho_7^L/(-\rho_6^L)+1$	0.677*** (0.102)
Short-run elasticity of L to EXTPRIV_t	ρ_9^L	0.014 (0.032)
Long-run elasticity of L to EXTPRIV_t	$\rho_9^L/(-\rho_1^L)$	−0.029 (0.064)
Short-run elasticity of L to OWNERFUNDS_{t-1}	ρ_{10}^L	0.209 (0.174)
Long-run elasticity of L to OWNERFUNDS_{t-1}	$\rho_{10}^L/(-\rho_1^L)$	−0.428 (0.293)
Short-run elasticity of L to OWNERPIFS_{t-1}	ρ_{11}^L	0.093 (0.148)
Long-run elasticity of L to OWNERPIFS_{t-1}	$\rho_{11}^L/(-\rho_1^L)$	−0.191 (0.250)
Short-run elasticity of L to OWNERFIRMS_{t-1}	ρ_{12}^L	0.026 (0.104)
Long-run elasticity of L to OWNERFIRMS_{t-1}	$\rho_{12}^L/(-\rho_1^L)$	−0.055 (0.212)
Short-run elasticity of L to OWNEROTHER_{t-1}	ρ_{13}^L	0.173 (0.126)
Long-run elasticity of L to OWNEROTHER_{t-1}	$\rho_{13}^L/(-\rho_1^L)$	−0.354* (0.207)
Short-run elasticity of L to EXTBOARD_{t-1}	ρ_{14}^L	−0.032 (0.058)
Long-run elasticity of L to EXTBOARD_{t-1}	$\rho_{14}^L/(-\rho_1^L)$	0.067 (0.120)
R^2		
Sargan–Hansen (p-value)		0.818
N		374

(The dependent variable is Δl_t; standard errors are reported in parentheses.)
Notes: ***, ** and * denote statistically significant values at 1, 5 and 10% on a two-tailed test, respectively.
NA=not applicable.
System GMM refers to Blundell–Bond two-step estimator for dynamic panel data with finite sample correction (Windmeijer, 2006).
Sargan–Hansen is a test of the over-identifying restrictions (p-value reported).
In System GMM estimation we instrument $\Delta l_{i,t-1}$, Δy_{it} and $\Delta(w-p)_{it}$ by using $l_{i,t-3}$, $l_{i,t-4}$ $y_{i,t-3}$, $y_{i,t-4}$, $(w-p)_{it-3}$, $(w-p)_{it-4}$, $(l-y)_{i,t-3}$ and $(l-y)_{i,t-4}$ as instruments in the differenced equation, while $\Delta l_{i,t-2}$, $\Delta l_{i,t-3}$, Δy_{t-2}, Δy_{t-3}, $\Delta(w-p)_{t-2}$ and $\Delta(w-p)_{t-3}$ were used as instruments in the levels equation.

associated with changes in revenues and wages. The estimated coefficient ($\rho_6<0$) is consistent with "error correcting" behavior. The validity of lagged levels dated $t-3$ and $t-4$ as instruments in the first-differenced equations, combined with lagged first-differences dated $t-2$ and $t-3$ as instruments in the levels equations, is accepted based on Sargan–Hansen statistics (see the p-values in Tables 2 and 3).

Hypothesis 1 ($\rho_2^L>0$ and/or $\rho_4^L<0$) of firms engaging in defensive labor restructuring is strongly supported by the estimated coefficient values in Table 2. The short-run elasticity of employment with respect to sales (ρ_2^L) is estimated at 0.73, and the short-run elasticity of employment with respect to the labor costs per employee (ρ_4^L) has a value of -1.35. Similarly, Hypothesis 2 ($(1+\rho_7^L)/(-\rho_6^L)>0$ and/or $\rho_8^L/(-\rho_1^L)<0$), stating that firms engage in strategic restructuring of labor, is strongly supported by the data, with the point estimate of the long-run elasticity of employment to sales being 0.68 and the long-run employment elasticity with respect to labor cost per worker being -1.46.

The estimated values of the above-mentioned coefficients and statistical significance of ρ_6^L confirm Hypothesis 3, stating that the number of employees above the desired level is associated with lower future hires, and indicating that firms are approaching a new long-term equilibrium of employment with respect to wages and output they produce.

The estimated coefficients ρ_9^L, ρ_{10}^L, ρ_{11}^L, ρ_{12}^L, and ρ_{13}^L provide strong evidence against the hypothesis that insider privatization, employee ownership and employee control through board membership are associated with higher employment intensity.[30] In particular, the estimate of the effect of the form of privatization is statistically insignificant, thus giving support to Hypothesis 4b ($\rho_9^L=0$). The employment effects of greater lagged ownership by the state (OWNERFUNDS), by privatization investment funds (OWNERPIFS), by other firms (OWNERFIRMS), and by other owners (OWNEROTHER) are also not statistically different from zero, thus providing support for Hypothesis 4b ($\rho_{11}^L=\rho_{12}^L=\rho_{13}^L=0$). Finally, since the estimates of the effect of greater representation of non-employee-outsiders on the supervisory board of the firm is statistically insignificant, our results provide support for Hypothesis 5b ($\rho_{14}^L=0$) rather than Hypothesis 5a or Hypothesis 5c. These results are important, because they suggest that greater employee representation on the supervisory boards does not lead to excess employment, *ceteris paribus*. We have also tested an encompassing hypothesis that all five coefficients related to internal *vs* external privatization, ownership, and control are jointly statistically not different from zero ($\rho_{10}^L=\rho_{11}^L=\rho_{12}^L=\rho_{13}^L=\rho_{14}^L=0$) and we cannot reject this hypothesis.[31]

Interestingly, we found support for Hypothesis 6c ($\rho_{15}^L<0$), stating that firms selling a larger proportion of their output on the domestic (home) market exhibit a lower rate of employment growth, *ceteris paribus*, than firms that sell a larger proportion on foreign markets. The estimate of ρ_{15}^L in Table 2 is 16%, and it is statistically significant at the 10% test level. This result suggests that foreign (primarily EU) markets are more demanding in terms of labor services and exporting firms, and hence adopt more labor-intensive techniques of production methods than firms selling more on the domestic market. We have checked the robustness of this result by splitting the firms into non-exporting ones and various categories of export intensity. We have found that the result holds throughout the spectrum of export orientation.

Investment

Estimated GMM system coefficients of Eq. (13), relating to restructuring of firms through investment, are reported in Table 3. The estimated coefficients for all types of investment support the "error-correcting" behavior, which is significant at conventional levels in most specifications (except marketing in domestic and foreign markets).

In all equations, the short-run elasticities of investment with respect to sales, internal funds, and excess wages are not significantly different from zero, whereas the long-run effects are significant. We therefore do not find support for Hypothesis 7a ($\rho_2^I>0$), but find strong support for Hypothesis 7b ($(1-\rho_5^I)/\rho_4^I>0$) that firms' restructuring through investment in fixed capital, R&D, marketing on domestic and foreign markets, and training is positively related to the demand for their product, as reflected in the firms' sales revenues effect in the long run.

The elasticity of investment with respect to internal funds, Π^a, is significant and positive in the short run only in the case of marketing on the domestic market, thus supporting Hypothesis 8a ($\rho_6^I>0$) in this case but rejecting it in the four other cases. The long-run elasticity is positive and significant at the 10% test level in the case of R&D investment, thus supporting Hypothesis 8b ($(\rho_6^L+\rho_7^L+\rho_8^L)/(-\rho_4^L)>0$) in this case, but it is

Table 3 Investment in fixed assets, R&D, marketing, and training

Regressors	*Coefficients*	I_t/K_{t-1} (1)	$I_{RD,t}/K_{t-1}$ (2)	$I_{MD,t}/K_{t-1}$ (3)	$I_{MF,t}/K_{t-1}$ (4)	$I_{T,t}/K_{t-1}$ (5)
Dep. variable$_{t-1}$	ρ_1^I	0.373***	0.005	0.101	0.135	0.744***
		(0.119)	(0.017)	(0.085)	(0.158)	(0.079)
Δy_t	ρ_2^I	0.083	0.225	−0.016	−4.115	−0.197
		(0.138)	(0.161)	(0.279)	(8.555)	(0.148)
Δy_{t-1}	ρ_3^I	−0.031	−0.089	−0.054	1.486	0.147
		(0.075)	(0.102)	(0.137)	(3.406)	(0.110)
$(k-y)_{t-2}$	ρ_4^I	−0.112*	−0.221***	−0.253	2.416	−0.022**
		(0.068)	(0.062)	(0.199)	(4.526)	(0.011)
y_{t-2}	ρ_5^I	0.009	−0.052	0.096	−1.497	−0.018
		(0.035)	(0.050)	(0.172)	(3.002)	(0.013)
Π_t^a/K_{t-1}	ρ_6^I	0.032	0.001	0.152**	0.289	−0.000
		(0.060)	(0.005)	(0.059)	(0.417)	(0.000)
Π_{t-1}^a/K_{t-2}	ρ_7^I	−0.059	0.003	−0.084**	−0.020	−0.000
		(0.043)	(0.003)	(0.035)	(0.039)	(0.000)
Π_{t-2}^a/K_{t-3}	ρ_8^I	−0.084	0.006	−0.058*	−0.082	0.000
		(0.087)	(0.004)	(0.033)	(0.124)	(0.000)
$(WL-W^aL)_t/K_{t-1}$	ρ_9^I	0.029	−0.017	−0.184**	0.066	−0.000
		(0.116)	(0.020)	(0.072)	(0.104)	(0.000)
$(WL-W^aL)_{t-1}/K_{t-2}$	ρ_{10}^I	0.084	0.001	0.056	−0.007	0.000
		(0.355)	(0.006)	(0.040)	(0.020)	(0.001)
$(WL-W^aL)_{t-2}/K_{t-3}$	ρ_{11}^I	0.047	−0.026	0.118	Dropped	−0.000
		(0.310)	(0.019)	(0.073)		(0.001)
EXTPRIV	ρ_{12}^I	0.018	−0.004	−0.039	−0.240	−0.014
		(0.030)	(0.059)	(0.210)	(2.621)	(0.015)
OWNERFUNDS$_{t-1}$	ρ_{13}^I	0.117	−0.157	0.148	0.190	0.048
		(0.123)	(0.194)	(0.546)	(6.973)	(0.042)
OWNERPIFS$_{t-1}$	ρ_{14}^I	0.054	−0.381**	−0.775	2.283	0.033
		(0.107)	(0.172)	(0.588)	(10.859)	(0.054)
OWNERFIRMS$_{t-1}$	ρ_{15}^I	0.091	−0.266*	−0.337	−1.891	0.030
		(0.096)	(0.154)	(0.410)	(5.511)	(0.029)
OWNEROTHER$_{t-1}$	ρ_{16}^I	0.055	0.345**	−0.375	4.939	0.036
		(0.117)	(0.161)	(0.553)	(10.464)	(0.039)
EXTBOARD$_{t-1}$	ρ_{17}^I	0.013	0.104	−0.047	−2.113	0.013
		(0.063)	(0.116)	(0.519)	(5.399)	(0.025)
HOMEMKT$_t$	ρ_{18}^I	−0.044	−0.105	NA	NA	0.003
		(0.051)	(0.097)			(0.016)
Year dummies		Yes	Yes	Yes	Yes	Yes
Constant	ρ_0^I	−0.176	0.556	−1.805	26.206	−0.419
		(0.516)	(0.751)	(2.937)	(49.782)	(0.247)
Industry dummies		Yes	Yes	Yes	Yes	Yes
Region dummies		Yes	Yes	Yes	Yes	Yes
Short-run elasticity of INV to Y	ρ_2^I	0.083	0.225	−0.016	−4.115	−0.197
		(0.138)	(0.161)	(0.279)	(8.555)	(0.148)
Long-run elasticity of INV to Y	$1-\rho_5^I/\rho_4^I$	1.082***	0.761***	1.381**	1.619***	1.827***
		(0.338)	(0.228)	(0.582)	(0.471)	(0.424)
Short-run elasticity of INV to Π^a	ρ_6^I	0.032	0.001	0.152**	0.289	−0.000
		(0.060)	(0.005)	(0.059)	(0.417)	(0.000)
Long-run elasticity of INV to Π^a	$-(\rho_6^I+\rho_7^I+\rho_8^I)/\rho_4^I$	−0.992	0.048*	0.040	−0.076*	−0.000
		(0.728)	(0.027)	(0.145)	(0.046)	(0.009)
Short-run elasticity of INV to W	ρ_9^I	0.029	−0.017	−0.184**	0.066	−0.000
		(0.116)	(0.020)	(0.072)	(0.104)	(0.000)

Table 3 Continued

Regressors	*Coefficients*	I_t/K_{t-1} (1)	$I_{RD,t}/K_{t-1}$ (2)	$I_{MD,t}/K_{t-1}$ (3)	$I_{MF,t}/K_{t-1}$ (4)	$I_{T,t}/K_{t-1}$ (5)
Long-run elasticity of INV to *W*	$-(\rho^I_9+\rho^I_{10}+\rho^I_{11})/\rho^I_4$	1.435	−0.192**	−0.037	−0.024*	−0.020
		(1.861)	(0.074)	(0.183)	(0.012)	(0.017)
Short-run elasticity of INV to EXTPRIV	ρ^I_{12}	0.018	−0.004	−0.039	−0.240	−0.014
		(0.030)	(0.059)	(0.210)	(2.621)	(0.015)
Long-run elasticity of INV to EXTPRIV	$-\rho^I_{12}/\rho^I_4$	0.162	−0.022	−0.156	0.099	−0.628
		(0.268)	(0.266)	(0.816)	(1.055)	(0.651)
Short-run elasticity of INV to OWNERFUNDS$_{t-1}$	ρ^I_{13}	0.117	−0.157	0.148	0.190	0.048
		(0.123)	(0.194)	(0.546)	(6.973)	(0.042)
Long-run elasticity of INV to OWNERFUNDS$_{t-1}$	$-\rho^I_{13}/\rho^I_4$	1.048	−0.710	0.587	−0.078	2.131
		(0.857)	(0.928)	(1.936)	(2.825)	(1.960)
Short-run elasticity of INV to OWNERPIFS$_{t-1}$	ρ^I_{14}	0.054	−0.381**	−0.775	2.283	0.033
		(0.107)	(0.172)	(0.588)	(10.859)	(0.054)
Long-run elasticity of INV to OWNERPIFS$_{t-1}$	$-\rho^I_{14}/\rho^I_4$	0.486	−1.725**	−3.061	−0.945	1.450
		(0.930)	(0.816)	(3.288)	(4.077)	(2.462)
Short-run elasticity of INV to OWNERFIRMS$_{t-1}$	ρ^I_{15}	0.091	−0.266*	−0.337	−1.891	0.030
		(0.096)	(0.154)	(0.410)	(5.511)	(0.029)
Long-run elasticity of INV to OWNERFIRMS$_{t-1}$	$-\rho^I_{15}/\rho^I_4$	0.812	−1.205*	−1.333	0.782	1.321
		(0.703)	(0.747)	(2.119)	(2.309)	(1.480)
Short-run elasticity of INV to OWNEROTHER$_{t-1}$	ρ^I_{16}	0.055	0.345**	−0.375	4.939	0.036
		(0.117)	(0.161)	(0.553)	(10.464)	(0.039)
Long-run elasticity of INV to OWNEROTHER$_{t-1}$	$-\rho^I_{16}/\rho^I_4$	0.495	1.560*	−1.482	−2.044	1.618
		(0.831)	(0.882)	(2.558)	(2.106)	(2.082)
Short-run elasticity of INV to EXTBOARD$_{t-1}$	ρ^I_{17}	0.013	0.104	−0.047	−2.113	0.013
		(0.063)	(0.116)	(0.519)	(5.399)	(0.025)
Long-run elasticity of INV to EXTBOARD$_{t-1}$	$-\rho^I_{17}/\rho^I_4$	0.117	0.471	−0.187	0.874	0.584
		(0.556)	(0.571)	(2.035)	(1.664)	(1.171)
Sargan–Hansen (p-value)		0.30	0.23	0.90	0.65	0.61
N		307	226	288	193	300

(Standard errors are reported in parentheses.)
Notes: ***, ** and * denote statistically significant values at 1, 5 and 10% on a two-tail test, respectively.
NA=not applicable.
In column 3 variable *y* refers to proportional share of sales on domestic market, while in column 4 it refers to proportional share of sales on foreign markets.
Specifications are estimated by Blundell–Bond two-step estimator for dynamic panel data with finite sample correction (Windmeijer, 2006).
Sargan–Hansen is a test of the overidentifying restrictions (p-value reported).
In columns 1 to 5 we instrument Δy_{it}, π^a_t/K_{t-1} and $(wL-w^aL)_t/K_{t-11}$ by using $y_{i,t-3}$, $y_{i,t-4}$, π^a_{t-3}/K_{t-4} and $(wL-w^aL)_{t-3}/K_{t-4}$ in the differenced equation, while Δy_{t-2}, Δy_{t-3}, $\Delta(\pi^a_t/K_{t-1})$, $\Delta(\pi^a_{t-1}/K_{t-2})$, $\Delta(\pi^a_{t-2}/K_{t-3})$, $\Delta(wL-w^aL)_t/K_{t-1}$, $\Delta(wL-w^aL)_{t-1}/K_{t-2}$ and $\Delta(wL-w^aL)_{t-2}/K_{t-3}$ were used as instruments in the levels equations.

insignificant in the case of investment in fixed assets, marketing on the domestic market, and training, and it is actually negative and significant at the 10% test level in the case of marketing on foreign markets. We hence find support for Hypothesis 8a in the case of investment in marketing on the domestic market and for Hypothesis 8b in the case of investment in R&D, suggesting that in these areas firms face financial constraints. A 1% increase in internal funds, for instance, results in a 0.048% increase in R&D spending, on average, *ceteris paribus*. However, there is no support for Hypotheses 8a or 8b in the case of investment in fixed capital, employee training, and marketing on foreign markets. The finding that investment in domestic marketing and R&D is related to internal funds makes sense, as these are investment areas where external investors find it difficult to evaluate investment projects because of great information asymmetry and moral hazard (e.g., Arrow, 1962; Himmelberg & Petersen, 1994). In sum, there is some evidence that Slovenian financial markets may have suffered from imperfections in some areas, and firms may have therefore suffered from

credit rationing in these areas but not in other ones. This finding is consistent with the fact that most firms used external financing to a limited extent, with internally generated funds (depreciation and retained profit) constituting the main source of investment funds.[32]

In the case of investment in marketing on the domestic market, we find support for Hypothesis 9a ($\rho_9^I<0$), indicating that short-term elasticity of investment in domestic marketing with respect to excess wages is negative. This implies that employees are able to appropriate funds that would otherwise be used for this type of investment. In the long run we find support for Hypothesis 9b ($(\rho_9^I+\rho_{10}^I+\rho_{11}^I)/(-\rho_4^I)<0$) in the case of R&D and marketing on foreign markets. Neither Hypothesis 9a nor Hypothesis 9b is supported in the case of investment in fixed capital and training, however, with short- and long-run elasticities of excess wages being insignificant in both of these estimations. There is hence no evidence that workers appropriate funds that would be used for investment in fixed capital or training. Overall, our results suggest that above-market wages and fringe benefits are not paid at the expense of investment in fixed capital or employee training, but a trade-off between wages and investment is detected with respect to investment in marketing on domestic and foreign markets, and investment in R&D.

The ownership and privatization terms are jointly significant in the R&D investment function, suggesting that firms privatized primarily to external owners and firms owned more by outsiders than by employee-insiders invest less intensively in R&D, but equally intensively in fixed investment, marketing, and training.[33] Hence, while we find support for Hypothesis 10c ($\rho_{12}^I<0$ and/or $\rho_{13}^I<0$ and/or $\rho_{14}^I<0$ and/or $\rho_{15}^I<0$ and/or $\rho_{16}^I<0$) in the R&D equation, we find support for Hypothesis 10b ($\rho_{12}^I=\rho_{13}^I=\rho_{14}^I=\rho_{15}^I=\rho_{16}^I=0$) in the case of other types of investment. These findings are important, given the substantial theorizing in this area and the frequently expected underinvestment problem under worker ownership. Our results suggest that, compared with other types of ownership, worker ownership results in higher rates of investment in R&D and similar rates of investment in other areas.[34]

A higher percentage of external members on the supervisory board is found in most cases not to be associated with the firm's propensity to invest. Overall, the results therefore support Hypothesis 11b ($\rho_{17}^I=0$) and suggest that insider representation on a supervisory board does not reduce the firm's propensity to invest in any of the key areas.

Unlike the case of labor adjustment, the firm's export *vs* domestic market orientation is unrelated to the intensity of any investment activities. Our estimates hence provide support for Hypothesis 12b ($\rho_{18}^I=0$) that firms oriented more towards the domestic market invest the same as export-oriented firms, *ceteris paribus*.

CONCLUDING OBSERVATIONS

While corporate restructuring plays an important part in all economies, it is of particular significance in the transition countries that started from a communist system characterized by firms dependent on government orders and subsidies, a lack of market-based activities in the factor and product markets, and limited use of modern managerial techniques within firms.[35] Over the last two decades, firms in the transition economies have responded to the major shock and challenge with substantial defensive (reactive) and strategic restructuring as they have tried to catch up with firms in the advanced countries.

Our analysis covers the 1996–2000 post-privatization period of transition, and is based on rich data from a sample of 157 firms in Slovenia, one of the most developed transition countries. The analysis, which uses the GMM system approach in tackling endogeneity of explanatory variables, allows us to draw the following conclusions with respect to employment adjustment.

- Firms actively adjust employment, and the adjustment is of both defensive (short-term) and strategic (long-term) nature. Our results support Hypotheses 1 and 2.
- The nature of the firms' adjustment of employment is consistent with profit maximization, in that the firms reduce their rate of hiring when employment exceeds the desired level (Hypothesis 3 is supported).
- Despite the long-standing debate in the literature about the employment effects of insider ownership and control of firms, we find strong evidence against the hypothesis that institutional characteristics such as insider privatization, employee ownership, and employee control through supervisory board membership are associated with higher or lower employment intensity. Our estimates hence support Hypotheses 4b and 5b.
- With the fall of the communist regime, many transition countries moved virtually overnight

into the ranks of the most open economies in the world, thus defying the widely accepted infant industry thesis. Our results indicate that firms selling a larger proportion of their output on the domestic market increase employment less, *ceteris paribus*, than firms that sell more output on the foreign market. This evidence suggests that export (advanced) markets are more demanding in terms of labor services such as corporate representation, product delivery, service warranty, and repair than domestic markets. Our result provides support for Hypothesis 6c, and implies that less export-oriented firms economize on employment even more than the more export-oriented firms that are exposed to world competition in the export markets.

Our conclusions with respect to strategic restructuring carried out through investment in fixed assets, R&D, marketing on domestic and foreign markets, and employee training are as follows:

- Investment in employee training is small and virtually unrelated to any of the explanatory variables, suggesting that in the first decade of the transition firms have not been treating employee training as an investment. However, we have to stress that this result might be driven by the fact that our data measure only external training, while anecdotal evidence suggests that firms in the post-privatization period mostly relied on internal training owing to undeveloped markets for training and a historical preference for investment in fixed capital.
- We find support for the hypothesis that firms' restructuring through investment is consistent with profit-maximizing behavior. In the context of our model, this is reflected in all types of investment being positively related to the demand for the firm's product. The data hence provide support for Hypothesis 7b.
- While firms rely primarily on internal financing to fund most of their investment, the evidence that restructuring through investment depends positively on the firm's level of internal funds (Hypothesis 8) is strong but not complete. Slovenian financial markets hence appear to have suffered from some imperfections in the second half of the 1990s, and firms may therefore have suffered from credit rationing that made restructuring of the less successful firms more drawn out.
- The ability of workers to appropriate firm's internal funds as above-market wages does not appear to affect restructuring negatively through investment in fixed capital or training, but a trade-off between wages and investment (Hypothesis 9) is detected with respect to investment in R&D and, less robustly, with respect to investment in marketing.
- Evidence about the effect of privatization on external *vs* internal owners is mixed, with the effect of external privatization on investment being insignificant in the case of fixed investment and investment in training (Hypothesis 10b). Interestingly, the effect is negative and marginally significant with respect to R&D, a finding that we discuss in the text.
- We find quite strong support for Hypothesis 11b that firms owned more by outsiders than by employee-insiders invest the same, controlling for other factors. Our findings, covering several areas of investment, suggest that the frequently voiced arguments about the inferiority of employee ownership for investment and long-term prosperity of firms need to be re-examined.
- The proportion of external members *vs* employee representatives on the supervisory board is by and large found to be unrelated to the firm's restructuring through investment. This result supports Hypothesis 12b, and suggests that employee control through board representation may provide voice but does not affect restructuring decisions.
- Unlike the case of labor adjustment, the firm's export *vs* domestic market orientation is found to be unrelated to investment activities. This evidence suggests that the relative openness of the transition economies to world markets has ensured that exporting and non-exporting firms pursue the same restructuring policies, providing support for Hypothesis 13b.

Overall, the fact that after the fall of communism the Central European countries moved rapidly into the ranks of the most open economies in the world creates an important laboratory for observing the relative effects of economic openness *vs* institutional characteristics. Our results suggest that countries that resolutely expose their firms to world competition induce similar economic behavior in all firms, irrespective of their structural and institutional differences. In this sense our study contributes in an important way to the ongoing debate about the role of various types of institution and structural arrangement on economic performance.

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NOTES

[1]Earlier studies are reviewed for instance in Megginson and Netter (2001) and Djankov and Murrell (2002). A survey of both the earlier and more recent studies may be found in Estrin, Hanousek, Kocenda, and Svejnar (2007).

[2]Early surveys of privatization in the transition economies vary from finding no systematic performance effect (Bevan, Estrin, & Schaffer, 1999) to noting that a positive effect probably dominates (Megginson & Netter, 2001), to concluding that the overall effect is positive (Carlin, Fries, Schaffer, & Seabright, 2001; Djankov & Murrell, 2002; Shirley & Walsh, 2000). The recent survey by Estrin et al. (2007) finds a strong positive performance effect of privatization for foreign owners, but a much weaker or insignificant effect for domestic owners. Given that better-performing firms tend to be privatized first (Gupta, Ham, & Svejnar, 2007), it is likely that the positive effect of privatization is often overestimated. Stiglitz (1999) argues that the main reason for relatively poor performance in early transition is that successful privatization requires effective institutional infrastructure. Svejnar (2002) points out that virtually all the transition economies in Central and East Europe (CEE) and the Commonwealth of Independent States (CIS) rapidly carried out Type I reforms (macroeconomic stabilization, price liberalization, break-ups of SOEs and monobank system, small-scale privatization, and reduction of direct state subsidies). However, the CIS countries, Bulgaria, Czech Republic, and Romania were slower in carrying out Type II reforms (effective large-scale privatization, establishment of a market-oriented legal system and accompanying institutions, and further development of the commercial banking and financial system), and also performed worse than the CEE countries that carried out both types of reform. Finally, Estrin (2002) notes that reform policies have been applied more consistently and effectively in the Visegrad countries, the Baltic States, and Slovenia than elsewhere, especially in the rest of the former Soviet Union.

[3]Firms in our sample also differ markedly in the extent to which they carried out restructuring. Our data hence contain sizeable variation in the values of the key variables, and lend themselves to detecting systematic effects.

[4]For earlier studies see Cable and FitzRoy (1980), Clegg (1983), Crouch (1983) and Svejnar (1982).

[5]Most Latin American countries, India and many other Asian economies, and most African countries followed the infant industry prescription in maintaining sizeable tariff and non-tariff protection for decades.

[6]The 1992 Privatization Law allocated 20% of a firm's shares to insiders (workers), 20% to the Development Fund that auctioned the shares to investment funds, 10% to the National Pension Fund, and 10% to the Restitution Fund. In addition, in each enterprise the workers' council or board of directors (if one existed) was empowered to allocate the remaining 40% of company shares for sales to insiders (workers) or outsiders (through a public tender). Based on the decision on the allocation of this remaining 40% of shares, firms can be classified as being privatized to insiders (the internal method) or outsiders (the external method).

[7]Grosfeld and Roland (1997) and Aghion et al. (1997) introduce the theoretical concepts, while Frydman et al. (1999) estimate the effects of ownership on changes in revenues and costs using balance sheet data. We present theoretical models that develop and apply the concepts of restructuring, and we test the predictions using a wide variety of performance indicators.

[8]The formulation nests the fixed proportions ($\sigma=0$) and Cobb–Douglas ($\sigma=1$) production functions.

[9]In the literature there are usually two general approaches, assuming that agents' expectations are either perfect or rational. (See Hamermesh (1993) for further discussion.)

[10]A conceptually important point is that the flexible difference equation (1′) may be viewed as an arbitrary flexible approximation to dynamic adjustment, or it may be derived formally from an underlying cost minimization behavior of the firm (e.g., Nickell, 1984; Bresson, Kramarz, & Sevestre, 1992). In particular, suppose firms face exogenous output constraints and quadratic costs d and e in adjusting their labor L and capital K inputs, respectively, and minimize input costs C_t:

$$C_t = E_t \sum_{\tau=0}^{\infty} \left(\frac{1}{1+r}\right)^{\tau} [c_{t+\tau}K_{t+\tau} + W_{t+\tau}L_{t+\tau} + d(\Delta L_{t+\tau})^2 + e(\Delta K_{t+\tau})^2] \quad \forall t$$

subject to a production constraint

$$Q(L_{t+1}, K_{t+1}) = Q_{t+1} \quad \forall t$$

where E is the expectation operator, c_t is the user cost of capital, $\Delta L_t = L_t - L_{t-1}$, and $\Delta K_t = K_t - K_{t-1}$, respectively. Assuming further that the production function is of the Cobb–Douglas form, that changes in employment from period to period are relatively small, and that the exogenous variables follow an autoregressive process of the second degree, one obtains a log-linear equation such as (1′).

[11]Error correction models were introduced into the investment literature by Bean (1981) and have been considered in the context of firm data estimating demand for capital by Bond, Elston, Mairesse, and Mulkay (1997), while Nickell (1984, 1985) and Bresson et al. (1992) have applied them to employment demand. The models represent a suitable alternative to more structural models (e.g., Q or Euler equations) that are often found to have unexpected signs on key explanatory variables.

[12]Many Slovenian firms introduced transactional management in the period of early transition, which led to lower R&D expenses and the closing down of R&D departments. After firms were privatized, R&D expenditures increased, especially to exchange "old-fashioned" products for new ones and to improve technology.

[13]Slovenian firms are good laboratories because they were "forced" to reorient their business activities in the transition period from the "low demand" ex-Yugoslav market to the "high demand" European market, where they compete for a market share with competitors from all over the world. Moreover, with the liberalization of foreign trade, competition on the domestic markets increased as well.

[14]With testing the null hypothesis of whether the coefficient on the second lagged level of output is equal to zero, we implicitly test the hypothesis that the long-run elasticity of capital with respect to output equals unity.

[15]An alternative interpretation of the case in which the firm's level of investment varies positively with internal funds – one that is consistent with perfectly functioning capital markets – is that the firms can borrow investment funds at a constant market rate, but that this rate exceeds the rate at which the firms can lend because of transaction costs (e.g., Almeida & Campello, 2002; Fazzari et al., 1988; Kaplan & Zingales, 1997).

[16]In the context of the transition to a market economy, the investment–wage issue is especially important. The lifting of central controls and insider privatization gave workers significant powers in enterprises in a number of countries, including Russia and Ukraine. Moreover, with the inability of many firms in these economies to pay wages, the trade-off between using the firm's value-added for financing investment *vs* paying wages and fringe benefits has become particularly acute.

[17]The reservation wage is defined as the wage below which employees would be unwilling to work in the firm.

[18]That is, we capture the fact that employees may try to appropriate as income some funds that could otherwise be used for expenditures on R&D, marketing, and training. We also implicitly assume that the reservation level of these expenditures is zero, which is not unrealistic in the context of the transition economies.

[19]In the case of factor demand estimation, as in investment or labor demand equations, the endogeneity of RHS variables (apart from lagged dependent variable) is quite common, introducing a new source of bias when using OLS or within-firms estimators. Any variable included as an explanatory variable and affected by firm-specific shocks to investments will be endogenous and correlated to the firm fixed effects and error term. Examples of such variables are cash flow or estimates of the shadow values of capital. This means that not only dynamic but also static models of investment might suffer from inconsistencies of parameter estimates described above.

[20]This arises from the magnification of the "noise to signal" ratio (ratio of the variance of the serially uncorrelated measurement error in a variable and the net variance of this variable) by the differencing transformation. This magnification is larger for first differences than for the within differences (or for longer differences) (e.g., Griliches & Hausman, 1986; Mairesse, 1990.)

[21]Arellano (1989) reports that for the simple dynamic error components models, the estimator that uses differences rather than levels for instruments has very large variances over a significant range of parameter values. In contrast, the estimator that uses instruments in levels has much smaller variances and is therefore recommended.

[22]The actual number of firms used is somewhat lower, and varies across regressions (from 109 in the employment equation to 126 in the training equation), depending on the availability of data for particular variables.

[23]Marketing expenses are usually divided into expenses for research, market communication, sales,

and distribution (Preisner, 1996). In order to be able to compare firms across industries, we have excluded expenses related to salespersons employed in retailing positions.

[24]The reservation wage is calculated on the basis of the average wage within each industry in a given region, region-specific unemployment rate, and average annual unemployment compensation:

$$W^a = \mathrm{AIW} \times (1 - \mathrm{UR}) + \mathrm{UC} \times \mathrm{UR}$$

where AIW is the average annual wage per employee in a given industry and region, UR is the average annual unemployment rate in a given region, and UC is the average annual unemployment compensation.

[25]We calculate the stock of intangible (knowledge) capital by using the permanent inventory method, originally proposed by Griliches (1979) for R&D capital. This method assumes that the current state of knowledge is the result of present and past expenditures in knowledge capital. In particular,

$$\mathrm{INT}_{it}^k = (1 - \delta_i^k)\mathrm{INT}_{it-1}^k + R_{it}^k$$

where R_{it} is the current level of soft capital spending, δ_i^k is the firm-specific rate at which the "knowledge" stock depreciates, k denotes different forms of soft capital investment, and INT_{it} is the stock of knowledge capital. Substituting INT_{it-1} by past expenditures on soft capital investment, we obtain

$$\mathrm{INT}_{it}^k = R_{it}^k + (1 - \delta_i^k)R_{it-1} + (1 - \delta_i^k)^2 R_{it-2} + \cdots$$

or

$$\mathrm{INT}_{it}^k = \sum_{\tau=0}^{\infty} (1 - \delta_i^k)^\tau R_{it-\tau}$$

Since our focus is on the sample of firms that underwent ownership transformation in the middle of the 1990s, and were operating in a labor-management system before the process of transition that started in 1991, it makes sense to assume that the process of investing started in 1992, with the initial level of knowledge capital being zero. As our data start in 1996, we assume that the value of investment n knowledge capital in each year is 5% smaller than in the following year. Finally, we assume a depreciation rate of 15%.

[26]The average share of employees fell from 23.5 to 16%, while the managers' share rose on average from 3 to 4%.

[27]Within this category, the average share of state funds declined from 23.4 to 13.2%, while the share of private investment funds increased from 13.6 to 18%.

[28]Within this category, the average share of small shareholders fell from 3.8 to 3%, whereas the average ownership shares of banks and state remained the same at 1.3 and 2%, respectively.

[29]Expenses for training include only payments for the services of external educational institutions. Many firms run internal training programs, the cost of which is not included in our data. Similarly, Milkovich and Boudreau (1997) report that in the United States firms with more than 100 employees paid $10.3 billion on training to external providers, while the total training cost was $52.2 billion in 1995.

[30]We also checked whether ownership structure captures size variations. Exploring correlation coefficients between ownership variables and typical size variables (number of employees, amount of fixed assets, and capital), we found that none of them is higher than 0.3.

[31]The chi-squared result χ^2=3.69 (p-value 0.59) does not permit us to reject the null hypothesis.

[32]The average firm in our sample financed more than 60% of its investment in fixed capital by depreciation, 10% by retained profit, 10% by long-term loans, 5% by short-term loans, 5% by state funds and loans from other firms, 5% by disinvestments, and less than 1% by issues of shares. As to investment in R&D, the sampled firms on average financed 90% of this investment from internal funds, 3% by loans, less than 2% by funds firms received from the National Fund for Technology and Development, and 2% by funds from partners.

[33]Wald tests of the joint significance ownership variables are 1.20 (p-value 0.87), 34.9 (0.00), 2.24 (0.69), 0.40 (0.98), and 1.59 (0.81) for fixed investment R&D investment, marketing investment on domestic market, marketing investment on foreign markets, and employee training, respectively.

[34]Although it is usually perceived that workers are less risk averse and therefore less likely to support R&D investment, evidence from Slovene firms suggests that in the early post-privatization period other types of domestic owners behaved as short-term rent-seekers who tried to maximize dividends and other transfers of funds from firms. Moreover, foreign owners tended to reduce R&D in the acquired firms and concentrate it in a few Western locations: see Prašnikar and Gregorič (2002). We would like to thank Bernard Yeung for encouraging us to pursue the analysis in this direction.

[35]In the early phases of restructuring, many of these firms broke up into several units or spun off parts of the original firm (Lizal, Singer, & Svejnar, 2001).

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