EMPLOYMENT DETERMINATION IN ENTERPRISES UNDER COMMUNISM AND IN TRANSITION: EVIDENCE FROM CENTRAL EUROPE

SWATI BASU, SAUL ESTRIN, and JAN SVEJNAR*

The authors present a comparative analysis of employment determination in four transition economies as they moved from central planning to a market economy in the early 1990s. They use firm-level panel data sets from the Czech Republic, Hungary, Poland, and Slovakia to estimate dynamic employment equations for the period from immediately before to immediately after the start of transition. For the most part, firms appear to have been quick to adjust employment to wage levels, and there is little evidence of labor hoarding. There were important cross-country variations in the determinants of employment during the reform process, however. Hungarian and Polish firms started the transition already substantially reformed, and became even more responsive to market signals as transition proceeded. In contrast, firms in the Czech and Slovak Republics started in the completely unresponsive mode characteristic of central planning, but rapidly caught up with their counterparts in Hungary and Poland.

In this paper we present a comparative analysis of the employment behavior of firms as they moved from the communist economic system of the late 1980s into the transition to a market economy in the early 1990s. Large panels of annual data on industrial enterprises in the Czech Republic, Hungary, Poland, and Slovakia are used to explore employment determination at the enterprise level, across countries and with the change in the economic system. Dynamic labor demand equations are estimated using two-year panels with firm-level data for these Central European countries before and during the transition from central planning.

In our analysis, we address some important questions that have arisen in the de-

*Swati Basu is Faculty Lecturer at McGill University's Business School. Saul Estrin is Adecco Professor of Business and Society, London Business School. Jan Svejnar is Everett E. Berg Professor of Business Administration and Professor of Economics at the University of Michigan, and Visiting Professor at CERGE-EI in Prague.

In undertaking the research for this paper, Saul Estrin and Jan Svejnar were in part supported by World Bank research grants for research on Enterprises in Transition and Labor Markets in Transition, respectively, and by ACE PHARE grant No. P96–6095-R. Svejnar in part also benefited from NSF grant No. SES–0111783. The authors would like to thank Olivier Blanchard, Tito Boeri, Simon Commander, George Johnson, and participants in seminars at Princeton University, the London Business School, the University of Pittsburgh, and the Davidson Institute Annual Workshop on Transition Economics for valuable comments. They are also indebted to Lubomir Lizal, Miroslav Singer, Lina Takla, and Chris Walters for valuable computer assistance.

Industrial and Labor Relations Review, Vol. 58, No. 3 (April 2005).
0019-7939/00/5803 $01.00

bate about the nature of the centrally planned system and the subsequent transition to a market economy. The first concerns the extent to which significant intercountry differences existed in the behavior of firms under the communist system up to late 1980s and whether these differences began to disappear after the transition was launched. An influential school of thought has argued, but not proved with micro data, that the behavior of firms in Hungary and to a lesser extent Poland in the pre-transitional period reflected the decentralizing reforms of the previous decade, while firms in the Czech Republic and Slovakia operated under a classical communist system of central planning (World Bank 1996).

We also investigate whether and to what extent firms in the Czech Republic, Hungary, Poland, and Slovakia hoarded labor or allocated labor efficiently from a private or social standpoint. We test whether firms in these economies operated on the labor demand curve or on a more labor-intensive contract curve and whether their behavior changed systematically as they moved from central planning into the transition period. In terms of the economics of transition, we provide the first systematic evidence testing the widely maintained assumption that under communism firms hoarded labor and thus entered the transition with excess employment. Many theoretical models of the transition, for instance, assume that communist firms enter the transition with excess labor and that enterprise restructuring should therefore initially consist of labor shedding. (See, for example, Aghion, Blanchard, and Burgess 1994; Blanchard and Kremer 1997.)

Finally, we explore the relative performance of newly established (*de novo*) and existing state-owned firms. The establishment of new firms is widely viewed as a key ingredient of a successful transition process since, in comparison with the state-owned enterprises (SOEs), the *de novo* firms are considered to be more market-oriented and to operate under hard budget constraints. (See, for example, World Bank 1996; EBRD Transition Report 1998, 1999.) Our Czech and Slovak data permit us to examine whether the SOEs behaved differently from the *de novo* firms, with the latter category being composed of start-ups and spinoffs.

Communism and its accompanying system of central planning constituted some of the most important economic phenomena of the twentieth century. By analyzing how firms behaved under the communist system and during the transition process to a market economy, we provide an understanding of this phenomenon, as well as new insights into the functioning of the market system that we otherwise observe only in a mature steady state. Because the economies of Central Europe were the first to enter the transition process and represent diverse cases in terms of initial conditions, policies, and outcomes, our comparative approach provides important information for policy-makers in these economies as well as those in all the other post-communist countries that launched their transitions later.

Preliminary Descriptive Statistics: The Early Transition

All the former Soviet bloc economies experienced a large fall in output and employment in the first few years of the transition (for some of the hypotheses and evidence, see, for example, Rodrik 1994; Kornai 1995; Blanchard and Kremer 1997). As may be seen from Table 1, the four CEE economies that we study experienced similar (17.5–20.5%) cumulative declines in estimated GDP in the early 1990s, but responded very differently in terms of employment and wage adjustment. In the Czech Republic, employment declined by only 9% but real product wages fell by 24% in the 1990–92 period.[1] In contrast, in Hungary employment declined by 20.5% but real product wages actually increased by 17.3%. Poland took a middle way, with employment decreasing by 11% and wages

[1]Real product wages are defined as nominal wages deflated by the producer price index.

Table 1. Comparative Macroeconomic Statistics.

Country	GDP Growth[a]					Change in Employment				
	1989	*1990*	*1991*	*1992*	*1990–92*[b]	*1989*	*1990*	*1991*	*1992*	*1990–92*[b]
Czech Republic	1.4	–0.4	–11.7	–7.3	–18.5	–0.1	–0.9	–5.5	–2.6	–8.9
Slovakia	1.4	–0.4	–14.6	–6.5	–20.5	–0.2	–0.8	–7.9	–5.3	–13.5
Hungary	0.7	–3.5	–11.9	–3.0	–17.5	–0.6	–3.1	–9.6	–9.3	–20.5
Poland	0.2	–11.6	–7.6	2.6	–18.1	–0.8	–6.2	–3.9	–3.1	–10.6

Country	Change in Real Product Wages[c]					Subsidies to Enterprises (% GDP)				Unemployment[d]			
	1989	*1990*	*1991*	*1992*	*1990–92*[b]	*1989*	*1990*	*1991*	*1992*	*1989*	*1990*	*1991*	*1992*
Czech Republic	2.1	–0.8	–31.5	12.0	–23.9	25.0	16.2	7.7	4.9	0.0	0.8	4.1	2.6
Slovakia	5.1	0.1	–31.0	14.5	–20.9				5.2	0.0	1.5	11.8	10.3
Hungary	2.2	4.3	0.6	11.8	17.3	12.0	9.5	7.4	5.5	0.3	1.5	7.5	12.3
Poland	25.3	–31.1	15.2	8.3	–0.5	10.6	7.7	5.1	3.3	0.0	6.3	11.8	13.6

[a]At constant prices.
[b]1989–91 for Poland, where the transition shock occurred one year earlier.
[c]Wages deflated by the producers' price index.
[d]Year-end unemployment.
Sources: EBRD *Transition Report* (1995, 1997, 1998) for GDP growth data in all countries and for employment and wage data in Hungary and Poland; Gao and Schaffer (1998) for data on subsidies to enterprises; Ham, Svejnar, and Terrell (1995) for employment and wage data for the Czech Republic and Slovakia.

by 0.5%. Finally, Slovakia experienced the most profound decline in GDP (20.5%) and registered a substantial fall in both employment and wages (13.5% and 21%, respectively).

It is important to put these figures into the context of hardening budget constraints. Table 1 shows that government subsidies were reduced to the range of 3–6% of GDP in all four countries in the early 1990s.[2] However, Czechoslovakia started transition with a much higher level of subsidies (25% of GDP) than Hungary or Poland. The more severe wage-employment adjustment in the Czech and Slovak Republics may be in part the result of their more precipitous decline in enterprise subsidies during the early 1990s. Moreover, since Slovakia was receiving cross-subsidies within Czechoslovakia, the fact that the most severe decline in employment and wages is observed in Slovakia probably reflects the more substantial subsidy reduction in that republic. The unemployment data in Table 1 show the unemployment rate rising from zero to double digits in Hungary, Poland, and Slovakia, but remaining at or below 4% in the Czech Republic in the early 1990s. The greater rise in unemployment in Hungary and Poland is consistent with the finding, reported later, that these countries opted for a more pronounced reduction in employment than in wages. Slovakia also reduced wages dramatically, though somewhat less than the Czech Republic, and it experienced the strongest negative output shock among the four countries. It suffered a decline in employment and a rise in unemployment, in part perhaps also because of the disproportionate reduction in subsidy (see Ham, Svejnar, and Terrell 1998).

The employment and wage behavior of firms in the transition economies is also an important factor in the political economy of the reform. Countries with large increases in unemployment—Hungary, Poland, and Slovakia—experienced a swift negative political response. The first post-

[2]By the late 1990s the electoral cycle brought the reformers back to power in some countries.

communist governments were quickly rejected by voters in favor of more socially oriented, often reformed communist, governments in the early 1990s. In contrast, the low unemployment rate in the Czech Republic coincided with that country's first post-communist leadership remaining solidly in power until 1996 and surviving in a weaker form until 1998. These different political outcomes suggest that voters in the transition economies were sensitive to reductions in job security and declines in living standards, and that an understanding of the wage and employment behavior of enterprises is important for the ability of policy-makers to pursue successful transition policies.

Conceptual Framework and Estimating Equations

In examining the wage and employment outcomes before and during the transition, we use the conceptual framework depicted in Figure 1. (For the underlying model, see, for example, McDonald and Solow 1981; Svejnar 1982, 1986.) For any given firm, the competitive labor market outcome is given by employment L^* at point A, with the marginal revenue product of labor R_L equaling the competitive (market clearing) wage W_c. Since planners kept wages low and sought to maintain full employment when the communist system was intact, an efficient centrally planned system with full employment may be conceptualized precisely as one that induces firms to operate at point A. At this point, the workers are paid the minimum acceptable wage and the planners appropriate the maximum available profit, as depicted by the iso-profit curve Π = Max.

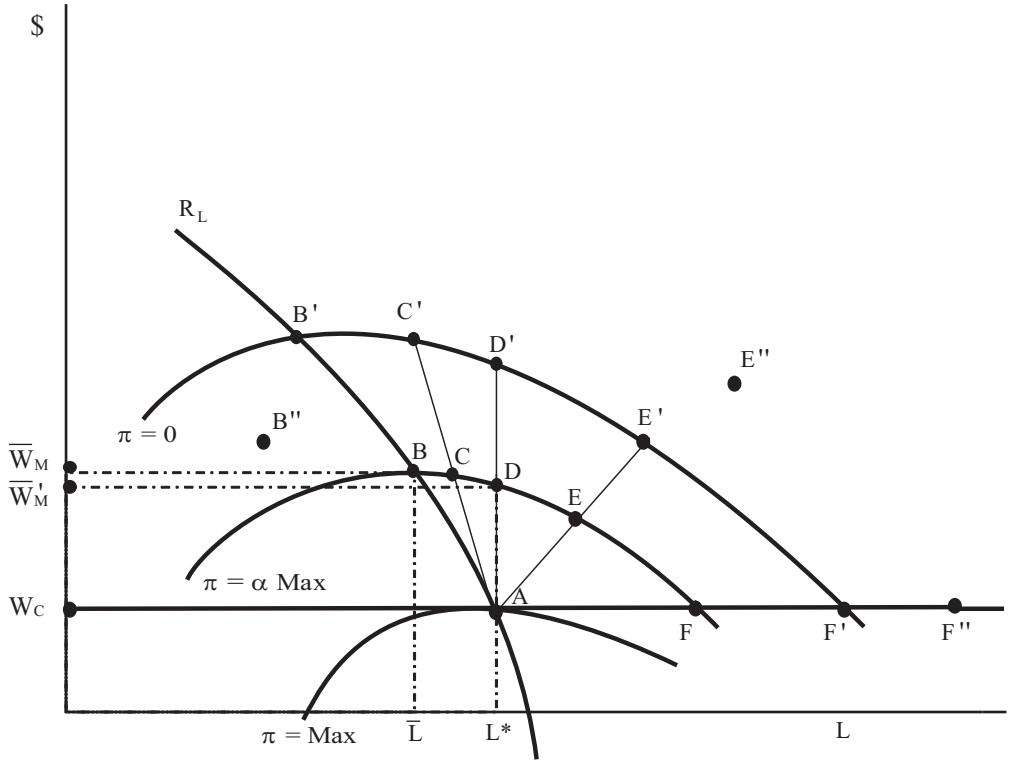
However, in countries such as Hungary and Poland, the communist system had been reformed, largely as a result of pressure from workers and managers, so it is more realistic to conceptualize the workings of the labor market in these economies as bargaining between the planners, managers, and workers. Depending on the preferences and relative power of these three parties, the wage-employment outcome could lie anywhere in the area $AB'F'$ in Figure 1. Points B' and F' lie on the zero profit ($\Pi = 0$) iso-profit curve and reflect the maximization of income per worker and employment, respectively, subject to profit being zero and the wage being at least W_c. The contract curve ABB', which corresponds to the short-run labor demand curve of a profit-maximizing firm, reflects outcomes with varying emphasis on wages and profit (no emphasis on employment), while the horizontal contract curve AFF' corresponds to varying degrees of joint employment and profit maximization (no emphasis on wages above W_c). The outcomes C', D', and E' on the $\Pi = 0$ iso-profit curve reflect varying degrees of emphasis on wages and employment (subject to zero profit). A set of intermediate outcomes wherein the planners appropriate a given level of profits is depicted by the iso-profit curve $\Pi = \alpha$ Max and the corresponding points B, C, D, E, and F.

The socially efficient set of outcomes, corresponding to $R_L = W_c$ and various wage-profit combinations, lies on the vertical contract curve ADD'. These outcomes are also important from an empirical standpoint because they correspond to a situation in which the firm does not adjust employment in response to changes in the wage, *ceteris paribus*. Backward-bending contract curves (for example, ABB' in Figure 1) imply that the firm reduces employment in response to a wage increase, while forward-sloping contract curves (for example, AEE') imply that wages and employment move in the same direction.[3]

Finally, it should be noted that the framework of Figure 1 can capture the phenomenon of soft budget constraints. We can conceptualize soft budget constraints as planners cross-subsidizing loss-making firms from the surplus of profitable ones. In Figure 1, this implies the loss-making firms operating above and the profitable firms

[3]Prasnikar et al. (1994), for instance, found that firms in former Yugoslavia operated along the ACC' curve in Figure 1.

Figure 1. Bargaining Model of Wage and Employment Determination.



See text for explanation.

below the Π = 0 curve. Firms operating at point *F″* would receive a subsidy for hoarding extra labor, while paying the minimum acceptable wage W_c, while firms at *E″* would also use part of the subsidy to pay a wage above the reservation level. Hardening of the budget constraint, be it through elimination of subsidies, privatization, or other means, is reflected in a leftward move for such firms from points such as *F″* and *E″* to the Π = 0 curve or even further to points such as *A, B,* or *B′* on labor's marginal revenue product curve.

Firms in different countries are likely to have started the transition from different wage-employment-profit combinations, and probably exhibited different distributions of power among the planners, managers, and workers. Transition entails macro-stabilization, privatization, the hardening of budget constraints, and a redistribution of power among the government, managers, and workers, and since these factors differed across countries, the resulting behavior of firms is likely to have evolved differently. Given the large number of possible changes, very strong assumptions would be required to identify the changing preferences of the government, managers, and workers over time. Our goal is less ambitious: to assess whether enterprise behavior pre- and post-transition reflected outcomes consistent with being on the labor demand curve or another contract curve, and whether that behavior changed systematically as a result of the transition.

In our empirical work we first derive and estimate a dynamic labor demand equation as characterized by *ABB′* in Figure 1. We obtain elasticity estimates in different periods under the assumption that wages are set either exogenously (by the planners or the market) or by the employer or through bargaining, with the management setting employment in a cost-minimizing way. We go on to derive and estimate an employment equation that includes a proxy for the reservation (alternative) wage of workers, which permits us to interpret the estimated coefficients as indicating whether the outcome deviates from the labor demand curve and hence reflects bargaining over both wages and employment.

In estimating the labor demand equation, we use the specification

$$L = L(W/P, Q, X), \tag{1}$$

where L = number of employees, W = the nominal wage, P = the product price index, Q = the sales or output of the firm, and X = a vector of ownership, legal status, and industry dummy variables that may affect the firm's demand for labor. The specification in equation (1) corresponds to a labor demand function of an enterprise characterized by cost minimization subject to an exogenously given level of output. This approach has been used frequently in studies of Western economies and it is useful as a starting point in our analysis.[4] In fact, the assumption of exogenously set output is arguably more realistic in our setting than in the West, since firms in Central Europe were probably output-constrained as a result of the dramatic output fall that resulted from the imposition of restrictive macroeconomic policies in the late 1980s and 1990s and the disbanding of the common trading area of the Soviet bloc in 1991.

Assuming that wages were set exogenously to the firm by the planners and later by the market and government wage controls, one could estimate equation (1) by ordinary least squares. However, the wage variable we use is constructed by dividing the wage bill by employment, which creates the potential for measurement error. Because of this problem of measurement error, and the possibility that employers had some latitude in setting wages (wages being endogenously determined), we instrument wages. We also test whether the negative output shock imposed an exogenous output (sales) constraint on firms. In the employment equation we therefore instrument wages and test whether sales are to be treated as exogenous by the Hausman test for exogeneity.

The instrumental variables that we use are district dummy variables, two-digit industry dummy variables, preceding year value of enterprise assets interacted with industry dummy variables, firm ownership, and the current and lagged average values of sales, wages, and employment of firms in the neighboring three-digit industry, as well as the average value of lagged assets of firms in the neighboring three-digit industry. The neighboring three-digit industry is the next three-digit industry in relation to the industry the firm belongs to, within the same two-digit industry classification. In the case of the last three-digit industry in the two-digit classification, the three-digit industry classification that is the most similar is chosen. The district-level dummy variables are used as instruments because wages and changes in wages varied across districts in response to changes in the cost of living and other compensating differentials, while technology is likely to have been invariant across districts.[5] The industry and regional dummy variables are also used as instruments to capture factors such as the technical and managerial error components of the underlying production function (Zellner, Kmenta, and Dreze 1966). Finally, by using

[4]For examples of Western analyses using this framework, see, for example, Hamermesh (1986, 1993) and Quandt and Rosen (1989).

[5]In the medium and long run firms would presumably adjust location in response to regional wage differentials, but this phenomenon is absent in the short span of two consecutive years.

as instruments the average values of variables from firms in the nearest three-digit industry within the same two-digit classification, we capture the effect of common external shocks to similar sub-industries within a given two-digit industry, while avoiding the correlation between the error term and regressors that may be brought about by the firm fixed effects and three-digit industry fixed effects (Kmenta 1997:360).[6]

In estimating equation (1), we use a dynamic specification and estimate on consecutive two-year panels of data. Using a dynamic specification is desirable since transition is inherently a dynamic process and it would be unrealistic to assume complete adjustment of variables within a one-year period. We use consecutive two-year panels because of the high incidence of enterprise entry, break-ups, and exit. In particular, we would lose most Czech and Slovak observations if we used panels longer than two years. Using the short panels also allows us to assess how the behavior of firms changed from the pre-transition period into the various phases of the early transition. For each country we therefore use consecutive two-year panels of data and test for the stability of coefficients across the two-year periods.

We specify equation (1) in a log-linear form and introduce a general dynamic framework by allowing the left-hand-side variable and all the principal right-hand-side variables to enter in both current and one-year lagged form. (See, for example, Hendry and Mizon 1978; Nickell 1986; Estrin and Svejnar 1993.) This first-degree general distributed lag model is specified for equation (1) as[7]

$$(1') \qquad \ln L_t = \alpha_0 + \alpha_1 \ln (W/P)_t + \alpha_2 \ln (W/P)_{t-1} + \alpha_3 \ln Q_t + \alpha_4 \ln Q_{t-1} + \alpha_5 \ln X_t + \alpha_6 \ln X_{t-1} + \alpha_7 \ln L_{t-1}.$$

In equation (1'), the short-term elasticity of employment with respect to the wage is given by α_1. We construct the corresponding long-run elasticity as the ratio of the two relevant polynomials in the lag operator $(\alpha_1 + \alpha_2)/(1 - \alpha_7)$ and check for the standard error of this statistic based on the covariance matrix of the underlying coefficients. The short- and long-run employment elasticities with respect to output and the other variables are defined analogously.[8]

Equation (1') represents a relatively general model within which one can test if the appropriate specification is (a) a partial adjustment model $\alpha_2 = \alpha_4 = \alpha_6 = 0$, (b) a static model $\alpha_2 = \alpha_4 = \alpha_6 = \alpha_7 = 0$, or (c) a (first difference) fixed effects model $\alpha_2 = -\alpha_1$, $\alpha_4 = -\alpha_3$, $\alpha_6 = -\alpha_5$, and $\alpha_7 = 1$. In this sense, our specification is more flexible than those found in many other studies. In our empirical work, we test and in most cases reject the above restrictions.

In the second step of our empirical investigation, we allow for bargaining over both wages and employment, with the contract curve deviating from the marginal product curve of labor in relation to the weight that the bargainers place on employment rela-

[6]The Hausman test warranted the instrumenting of the sales variable in some but not all of the reported regressions. In particular, Slovakia appears to have been the most output-constrained of all the countries, as we cannot reject the hypothesis of exogeneity of sales in the employment equation. In Hungary, output appears to have been exogenously determined (constrained) in the pre-transition and early transition periods, but not in the later periods. We reject exogeneity of sales in Poland in almost all runs, and in the Czech Republic in all runs. Interestingly, when we consider only the "balanced panel" of 266 SOEs that existed before and survived the transition in the Czech Republic, the Hausman test suggests that these firms were output-constrained before and at the start of the transition, but ceased to be so in the later years.

[7]While the flexible stochastic difference equation (1') may be viewed as an arbitrary flexible approximation to a dynamic adjustment, it may also be derived formally from an underlying cost-minimization behavior of the firm (see for example, Nickell 1986 and Bresson et al. 1992).

[8]Since we use two-digit industry dummy variables as intercepts and estimate on a two-year panel of annual data, a two-digit producer price variable P would be collinear with the industry dummies. We therefore do not enter the price variable on the right-hand side of equation (1').

tive to wages (that is, *ACC′* and *AEE′* in Figure 1). In particular, following the conceptual frameworks of Brown and Ashenfelter (1986) and Prasnikar et al. (1994), assume that worker preferences over wages and employment are given by a Stone-Geary function

$$U = k(W/P - W^a/P)^{\alpha} L^{(1-\alpha)},$$

where W^a is the alternative (reservation) wage, and that the management (and possibly government) is interested in profit

$$\pi = PQ - WL - H,$$

where H is fixed non-labor cost.[9] A Pareto-efficient contract that equates the marginal rate of substitution between wages and employment in these two objective functions (for example, in a Nash bargaining context) yields the marginal revenue product condition

$$PQ_L = W - \gamma(W - W^a),$$

where $\gamma = (1 - \alpha)/\alpha$ is the weight that the firm places on employment relative to wages. In the context of a particular production technology (for example, CES) one can derive an employment equation of the form

$$(1'') \qquad \ln L = \beta_o + \beta_1 \ln Q + \beta_2 X - \sigma(1 - \gamma)\ln(W/P) - \sigma\gamma\ln(W^a/P),$$

where σ is the constant elasticity of substitution between labor and capital in production. As may be seen from this employment equation, when the firm places no weight on employment ($\gamma = 0$), the coefficient on the alternative wage is zero and the specification reduces to the standard labor demand equation. When the firm places equal weight on wages and employment ($\gamma = 1$), the coefficient on the own wage is zero and employment is driven by the alternative wage. This is the case corresponding to the (socially efficient) vertical contract curve *ADD′* in Figure 1. For $\gamma > 1$, one obtains forward-sloping contract curves such as *AEE′* in Figure 1.

Econometrically, equation (1") represents a relatively straightforward extension of the basic labor demand model. We note, however, that the ability to derive this equation and use the own and alternative wages to identify whether the firm is on or off the demand curve depends on the particular assumptions one makes about worker preferences. We use an approach that is similar to that of Brown and Ashenfelter (1986), but as MaCurdy and Pencavel (1986) showed, some classes of worker objective functions do not lend themselves to this derivation.

The main issue in implementing equation (1") empirically is how to approximate the alternative wage. A number of approaches have been adopted in Western studies, ranging from employing wages in particular regions or sectors and assuming that the alternative wage is proportional to them, to using a local unemployment rate that lowers the alternative wage by exerting downward pressure on wages and decreasing the probability of obtaining employment.[10] In this paper, we follow Brown and Ashenfelter (1986) and postulate that the alternative wage is an inverse linear function of local unemployment and industry dummy variables. We select this approach for two reasons. First, we have accurate district-level data (regional data in Poland) on local unemployment. Second, unlike the mildly varying unemployment rates in mature market economies, our data cover the period when unemployment first appeared and the unemployment rate rose sharply and unevenly across districts. Indeed, during the period of our study, the district-level unemployment rates varied in all countries from near zero to well over

[9]The government may also be interested in employment generation, in which case its objective is congruent with that of workers (Prasnikar et al. 1994).

[10]Note that the alternative wage is given by a weighted average of alternative incomes and the unemployment rate is the weight attached to the relatively low income associated with an unemployment state.

20%. We hence feel that using the local unemployment rate is more appropriate than trying to construct other, less accurate proxy measures of the alternative wage. As with equation (1'), we estimate equation (1") in the general distributed lag form and we include the vector of control variables *X*.

Like most large firm-level data sets, our data come in annual rather than quarterly or monthly frequency. The obvious disadvantage is that annual data contain aggregation over time that smooths short-term changes in variables. Moreover, the need to use short panels prevents us from using more than one lag of variables in our specification. While the first-degree distributed lag specification may be limiting in some contexts,[11] this is a shortcoming that we simply cannot overcome in view of the severe loss of observations that we would face if we were to use longer panels of data.

Data and Summary Statistics

We use annual data from industrial enterprises in four transition economies: the Czech Republic, Slovakia, Poland, and Hungary. These were collected from records that, under communism, enterprises were legally required to submit to the relevant National Statistical Offices and Ministries of Finance. The Czech, Slovak, and Polish data sets contain almost all industrial firms with 25 or more workers. Given the paucity of small firms in planned economies (see World Bank 1996), these data sets provide an almost complete record of the transition of industrial firms in three key transition economies. The Hungarian data set is a large sample of industrial enterprises derived from the National Statistical Office data base. It comprises a panel of the thousand largest Hungarian firms, of which about 400 are industrial firms. The latter are the firms we use in the present analysis. The four data sets together provide a unique snapshot of the effect of transition at an enterprise level that cannot be taken forward into the mid- and late 1990s because communism's demise ended the requirement for enterprises to supply such detailed information to the governments.

Annual summary statistics for the firm-level as well as more aggregate variables used in the analysis are given in Table 2. The data cover the period 1989–93 for the Czech Republic, 1989–92 for Slovakia, 1988–91 for Poland, and 1988–92 for Hungary. In Poland and Hungary, the transition was launched at the start of 1990;[12] in the Czech and Slovak Republics, on January 1, 1991. For the Czech and Slovak data our estimates hence cover the pre-transition period of 1989–90, the start of the transition (big bang) in 1990–91, and the early transition (1991–92 and 1992–93 for the Czech Republic, and 1991–92 for Slovakia). For Hungary and Poland, the estimates cover the pre-transition period of 1988–89, the start of the transition in 1989–90, and the early transition in 1990–91.

The summary statistics in Table 2 yield useful insights that are relevant for our analysis. First, the average number of employees per firm held steady in Poland during the entire 1988–90 period and declined only one year after the big bang event. In contrast, average employment per firm started declining in the Czech and Slovak Republics and Hungary as soon as the transition began, and the decline continued as the transition proceeded. In the case of the Czech Republic and Slovakia, the pattern is influenced more strongly by a major wave of break-ups and spin-offs of firms that occurred at the end of 1990 and in 1991,[13]

[11]Nickell (1986), for instance, showed that if firms optimize over inputs that are aggregated in the data (for example, skill categories of labor), it may be appropriate to include additional lags of the dependent variable in the employment equation.

[12]In Hungary, the reform process dates as far back as 1968 and the transition changes that occurred at the end of the 1980s and early 1990s were hence less fundamental than those in the other countries (see, for example, Kornai 1995).

[13]See Lizal, Singer, and Svejnar (2001) for an analysis of these break-ups and spin-offs.

Table 2. Sample Statistics.
(Standard Deviations in Parentheses)

Statistic	*1988*	*1989*	*1990*	*1991*	*1992*	*1993*
Czech Republic						
Avg. Monthly Wage (000 Kcs)	—	3.16 (0.39)	3.27 (0.39)	3.78 (0.62)	4.38 (0.93)	5.37 (1.22)
Real Product Wage (000 Kcs)	—	3.16	3.14	2.13	2.24	2.42
Avg. Number of Employees	—	1887 (4,901)	1860 (4,753)	1186 (3,106)	755 (2,220)	716 (1,966)
Hungary						
Avg. Annual Wage (000 Fl)	110 (32)	138 (49)	184 (82)	249 (120)	—	—
Real Product Wage (000 Fl)	110	126	137	140	—	—
Avg. Number of Employees	1,735 (6,551)	1,701 (6,698)	1,507 (6,509)	1,214 (6,096)	—	—
Poland						
Avg. Annual Wage (000 Zloty)	2.48 (2.76)	9.69 (10.31)	47.39 (49.32)	106.33 (125)	—	—
Real Product Wage	2.48	3.02	2.31	3.57	—	—
Avg. Number of Employees	726 (1,315)	694 (1,271)	702 (1,293)	576 (1,104)	—	—
Slovakia						
Avg. Monthly Wage (000 Kcs)	—	3.11 (0.32)	3.22 (0.36)	3.73 (0.56)	4.28 (1.07)	—
Real Product Wage (000 Kcs)	—	3.11	3.07	2.11	2.30	—
Avg. Number of Employees	—	1,663 (1,922)	1,597 (1,866)	980 (1,819)	766 (1,625)	—

while in Hungary there was relatively more emphasis on layoffs. The steady employment level in the Polish data may be partly accounted for by the fact that Poland did not create the same giant enterprises as did Czechoslovakia and Hungary in the 1980s. Moreover, we observe that the price liberalization associated with the end of the centrally planned system resulted in price jumps that the workers were able to transmit rapidly into corresponding nominal wage increases in the more reformed economies (Hungary and Poland) but not in the more traditional communist economies (the Czech Republic and Slovakia). Indeed, in the latter countries it took several years for workers to overcome the major declines in real wages that occurred at the start of the transition.

Econometric Results

We commence with our estimates of the labor demand model specified in equation (1'). The principal estimated coefficients based on equation (1') are reported in Tables 3 and 4. The estimated equations have good fits (with an R^2 between 0.96 and 0.99) and the test results indicate that the restrictions implied by the first difference specification are usually rejected by the data. Results of unreported tests also indicate that parameter restrictions related to partial and complete adjustment models are usually rejected, as is the hypothesis that parameter estimates do not differ across the consecutive two-year periods. The results of the Hausman tests differ between countries and suggest that firms in the Czech Republic and Poland were relatively unconstrained in selecting the level of output, while firms in Hungary were constrained in the early but not later periods, and firms in Slovakia were constrained most of the time.

Table 3. IV Employment Elasticities with Respect to Sales.
(Standard Errors in Parentheses)

Elasticity	*1988–89*	*1989–90*	*1990–91*	*1991–92*	*1992–93*
Czech Republic					
Short-Run		–0.022	0.119***	0.591***	0.495***
		(0.035)	(0.030)	(0.064)	(0.057)
Long-Run		n.a.	0.936***	0.944***	0.894***
			(0.031)	(0.093)	(0.046)
		R^2=0.99	R^2=0.99	R^2=0.97	R^2=0.99
		N=761	N=990	N=1,453	N=1,017
Slovak Republic					
Short-Run		0.101***	0.063*	0.328***	
		(0.015)	(0.035)	(0.027)	
Long-Run		n.a.	0.974***	n.a.	
			(0.053)		
		R^2=0.99	R^2=0.99	R^2=0.98	
		N=311	N=426	N=569	
Poland					
Short-Run	0.229***	0.153***	0.187***		
	(0.021)	(0.013)	(0.006)		
Long-Run	n.a.	0.452***	0.233***		
		(0.017)	(0.009)		
	R^2=0.99	R^2=0.99	R^2=0.99		
	N=4,914	N=4,854	N=4,181		
Hungary					
Short-Run	0.604*	0.236*	0.650***	0.459***	
	(0.349)	(0.129)	(0.168)	(0.097)	
Long-Run	n.a.	0.721	0.768***	0.836***	
		(0.475)	(0.096)	(0.238)	
	R^2=0.99	R^2=0.96	R^2=0.97	R^2=0.97	
	N=418	N=398	N=396	N=363	

n.a. = Not applicable since the estimated coefficient on the lagged dependent variable is close to unity.
*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.

As may be seen from Table 3, while the long-term labor elasticity estimates with respect to sales are similar and close to unity in three of the four countries we study, the short-term elasticity estimates show a strikingly varied pattern. The Czech and Slovak firms registered very low short-term labor demand elasticities with respect to sales before and at the very start of the transition. In contrast, the Polish and Hungarian elasticity estimates (0.3 and 0.6 respectively) indicate that firms in these more market-oriented communist economies were already somewhat responsive in their employment adjustment to changes in sales in the 1988–89 pre-transition period.

Moreover, we observe a rise in the estimated short-term labor demand–sales elasticities in all four Central European countries shortly after the start of the transition. In particular, the elasticity rose to 0.3 in Slovakia by 1991–92 (after a temporary decline during the big bang of 1990–91) and from 0.5 to 0.6 in the Czech Republic in the 1991–93 period. In Hungary and Poland one observes a temporary decline in the estimated elasticities at the start of the transition followed by a rise. Hence, while the pre-transition responsiveness of

Table 4. IV Employment Elasticities with Respect to Wages.
(Standard Errors in Parentheses)

Elasticity	*1988–89*	*1989–90*	*1990–91*	*1991–92*	*1992–93*
Czech Republic					
Short-Run		–0.389*	–0.108	–0.959***	–0.611***
		(0.208)	(0.217)	(0.216)	(0.189)
Long-Run		n.a.	–1.190**	–0.464	–0.509
			(0.553)	(1.380)	(.932)
		R^2=0.99	R^2=0.99	R^2=0.97	R^2=0.99
		N=761	N=990	N=1,453	N=1,017
Slovak Republic					
Short-Run		–0.329***	0.403*	–0.249*	
		(0.116)	(0.222)	(0.150)	
Long-Run		n.a.	–0.871	n.a.	
			(0.771)		
		R^2=0.99	R^2=0.99	R^2=0.98	
		N=311	N=426	N=569	
Poland					
Short-Run	–0.401***	–0.477***	–0.573***		
	(0.030)	(0.019)	(0.020)		
Long-Run	n.a.	–0.508***	–0.703***		
		(0.025)	(0.029)		
	R^2=0.99	R^2=0.99	R^2=0.99		
	N=4,914	N=4,854	N=4,181		
Hungary					
Short-Run	–0.352	–0.169	–0.352	–0.829***	
	(0.231)	(0.196)	(0.255)	(0.339)	
Long-Run	n.a.	5.164	–4.762***	–5.023	
		(3.674)	(2.038)	(3.132)	
	R^2=0.99	R^2=0.96	R^2=0.97	R^2=0.97	
	N=418	N=398	N=396	N=363	

n.a. = Not applicable since the estimated coefficient on the lagged dependent variable is close to unity.
*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.

employment to sales was greater in the more market-oriented economies (Poland and Hungary) than in the more traditional centrally planned economies (the Czech and Slovak Republics), the difference disappeared shortly after the start of the transition.

The estimated labor demand elasticities with respect to wages are reported in Table 4. The short-term elasticities suggest that in the pre-transition period the Czech and Slovak firms were at least as responsive in adjusting employment to wages as were their Polish and Hungarian counterparts. The Czech and Slovak pre-transition elasticities range between –0.33 and –0.39, while the Polish point estimate stands at –0.4. The estimate for Hungary is –0.35 but is not statistically significant. The Czech estimate becomes statistically insignificant and the Slovak one temporarily reverses sign during the big bang of 1990–91, but both become negative and statistically significant thereafter. Once again, one finds that shortly after the start of the transition, the wage elasticities of labor demand were negative and statistically significant in all four CEE economies. As we discuss below, it is interesting to note that the Slovak estimate (0.25) is lower than that found for the other three CEE economies (0.57 to 0.96).

Our findings with respect to the labor

demand elasticities are interesting in the context of Table 1, which shows a double-digit unemployment rate in Hungary, Poland, and Slovakia post-transition, as compared to 3–4% in the Czech Republic. The positive estimated elasticities of employment with respect to sales suggest that the fall in employment in all countries was associated with the decline in output. However, the path of wages had a differential effect across the four countries. In the Czech and Slovak Republics, where real wages fell, the negative employment-wage elasticity mitigated the output-driven decline in employment, and the mitigating effect would have been larger in the Czech Republic, where the estimated employment-wage elasticity is higher than in Slovakia. In Hungary, rising wages would have contributed to the employment decline. Finally, in Poland, where real wages were fairly constant over the first three years and increased only in 1991, the wage effect on employment would have been minimal. These effects are broadly consistent with the macro data presented in Table 1.

In Table 5 we report estimates of employment elasticities with respect to own wage and local unemployment rate. These estimates correspond to the contract curve model, given by the dynamic employment equation (1"), with the local unemployment rate proxying for the tightness of the local labor market and hence the alternative (reservation) wage W^a. We find the estimated own wage coefficients to be usually negative and statistically significant, but the estimated coefficients on local unemployment are almost always statistically insignificant. In fact, the unemployment coefficient is positive and statistically significant only in the Czech Republic during its big bang year of 1990–91. In all other cases, the unemployment coefficient is statistically insignificant, occasionally displaying a negative sign. Our findings therefore suggest that at the very start of the transition, only the Czech firms operated to the right of their labor demand curves. The Czech estimate corresponds to an outcome on the vertical contract curve (*ADD'* in Figure 1), which suggests that labor allocation was socially efficient. However, in Poland and Slovakia during the big bang, and in all countries (including the Czech Republic and Hungary) during the subsequent years, the data generate estimates corresponding to an outcome on the demand curve for labor.

In sum, our estimates of equation (1") suggest that outcomes to the right of the demand curve were rare as the CEE countries moved from the pre-transition period to the early transition period. Moreover, as soon as these economies started adjusting to the shock of price liberalization, reduction of subsidies, and loss of markets, the evidence suggests that they started operating on their labor demand curves. In terms of econometric specification, this finding provides support for the labor demand specification of equation (1') during the transition period.

State-Owned Enterprises versus New Firms

While the Polish and Hungarian data sets for the most part contain the same firms during the entire time period, the Czech and Slovak data reflect the entry of new firms and break-ups of existing firms. This high turnover of firms in the Czech and Slovak Republics enables us to check whether the SOEs that existed before and survived into the transition behaved differently from the *de novo* firms. One might hypothesize on the basis of other comparisons in the performance of state-owned and private firms that the former would be less flexible and respond less to market signals (see Estrin 2002).

In Table 6, we report estimated labor demand elasticities that correspond to employment equation (1"), with the wage, sales, and local unemployment elasticities for the SOEs being measured relative to those of the non-SOEs. In the Czech Republic we find that in setting employment the SOEs were more responsive than the other firms to wages and sales, but not unemployment, during the big bang of 1990–91. However, one cannot reject the hypothesis that the employment elasticities

Table 5. IV Employment Elasticities with Respect to Wages and Unemployment. (Standard Errors in Parentheses)

Elasticity	*1989–90*	*1990–91*	*1991–92*	*1992–93*
Czech Republic				
Wage		–0.074	–1.030***	–0.472**
		(0.209)	(0.227)	(0.208)
Unemployment		0.519**	–0.024	0.233
		(0.249)	(0.454)	(0.269)
		R^2=0.99	R^2=0.97	R^2=0.99
		N=990	N=1,453	N=1,017
Slovak Republic				
Wage		0.461**	–0.206	
		(0.202)	(0.169)	
Unemployment		–0.106	0.216	
		(0.173)	(0.366)	
		R^2=0.99	R^2=0.98	
		N=426	N=569	
Poland				
Wage	–0.470***	–0.579***		
	(0.020)	(0.019)		
Unemployment	0.0006	–0.0006		
	(0.0006)	(0.0004)		
	R^2=0.99	R^2=0.99		
	N=4,854	N=4,181		
Hungary				
Wage		–0.499	–2.476***	
		(0.302)	(0.604)	
Unemployment		–0.03	0.024	
		(0.012)	(0.019)	
		R^2=0.96	R^2=0.97	
		N=396	N=363	

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.

of the two sets of firms become identical by 1991–92, reflecting a statistically significant negative elasticity with respect to wages and a statistically significant positive elasticity with respect to sales. In Slovakia, one cannot reject the hypothesis that during the big bang of 1990–91 the three employment elasticities were pairwise identical across the two sets of firms and not statistically significantly different from zero. By 1991–92, the Slovak SOEs displayed sales and unemployment elasticities that did not differ at a statistically significant level from those of the non-SOEs, but they registered a significantly more negative employment elasticity with respect to wages than the non-SOE firms. Our estimates hence do not support the hypothesis that SOEs respond less flexibly to market signals in the early transition period. This finding is consistent with the SOEs facing a similarly hard budget constraint during the period of declining output demand that characterized the early transition.[14]

[14]Our unreported estimated effects of different types of ownership and legal (corporate) status of firms, used as control variables in the present study, indicate that the ownership and legal status of firms do not have strong systematic effects on employment and wages, *ceteris paribus*.

Conclusions

Using large firm-level data sets from four countries at the time when they experienced the systemic shift from central planning to a market system, we find that firms rapidly adjusted their employment behavior and started displaying employment elasticities that are similar to those observed in advanced market economies. Enterprises appear to have behaved as if they were on labor demand curves, with only limited evidence of labor hoarding in the planning era.

We did find important cross-country differences in the pattern of employment determination, consistent with differences in preconditions and transition policies. Our estimates of firm-level employment elasticities with respect to sales suggest that firms in Hungary entered transition substantially reformed (having high, positive, and statistically significant elasticities) and advanced further as the transition proceeded, while firms in Poland went into the transition less reformed but maintained a positive and statistically significant elasticity through the transition years. In contrast, firms in the Czech and Slovak Republics started from what could be termed a stereotypical planned mode (zero or very small elasticities with respect to sales), but caught up quickly.

Interpreting labor hoarding as firms being to the right of the demand curve of labor, we find it to have been the exception rather than the rule, though the post-transition period was also characterized by increased employment responsiveness to sales, which may be connected with excess employment under planning. The behavior of the Polish and Slovak firms during the "big bang" year is consistent with being on the labor demand curve, as is the behavior of firms in all four economies after the start of the transition. Labor hoarding may thus have been less prevalent at the end of communism than is widely believed.

In the Czech Republic, we find that in setting employment the state-owned enterprises (SOEs) were more responsive than the *de novo* firms to wages and sales, but not to unemployment, at the very start during the big bang, and that the employment elasticities of the two sets of firms became indistinguishable later on. In Slovakia, the employment elasticities of the SOEs were indistinguishable from those of the *de novo* firms during the big bang, but the SOEs displayed a statistically significantly more negative employment elasticity with respect to wages than the *de novo* firms later on. The employment behavior of the Czech SOEs during the early transition is hence indistinguishable from that of the *de novo* firms, while the Slovak SOEs exhibited greater employment adjustment with re-

Table 6. IV Elasticities and SOEs.
(Standard Errors in Parentheses)

Elasticity	*1990–91*	*1991–92*
Czech Republic		
Wages	0.686**	–0.563***
	(0.338)	(0.201)
Sales	–0.0645	0.434***
	(0.060)	(0.064)
Unemployment	2.379**	–0.510
	(1.155)	(1.292)
Wages.SOE	–1.021***	–0.102
	(0.408)	(0.289)
Sales.SOE	0.198***	0.032
	(0.068)	(0.086)
Unemployment.SOE	–2.159	1.586
	(1.446)	(2.051)
	R^2=0.99	R^2=0.98
	N=990	N=1,453
Slovak Republic		
Wages	–0.948	–0.093
	(0.897)	(0.216)
Sales	–0.107	0.415***
	(0.191)	(0.070)
Unemployment	–0.714	–0.921
	(1.787)	(1.170)
Wages.SOE	1.372	–0.707***
	(0.872)	(0.283)
Sales.SOE	0.126	–0.122
	(0.190)	(0.107)
Unemployment.SOE	0.777	1.987
	(1.861)	(2.063)
	R^2=0.99	R^2=0.97
	N=426	N=569

*Statistically significant at the .10 level; **at the .05 level; ***at the .01 level.

spect to wages than the new firms—a finding that is consistent with the SOEs facing a harder budget constraint during the period of declining output demand that characterized the early transition.

Transitory cross-national variations aside, the broad implication of our results is that at the level of individual economic agents, in our case firms, the transition was a relatively swift process. This in turn suggests that the severe economic problems encountered by the transition economies during the first decade stemmed from other sources, such as policy measures, legal and institutional features, and external shocks.

The general finding that firms quickly started adjusting employment to variations in wages also provides an explanation for why employment declined and unemployment rose much more in some countries than others. In the extreme, our estimates provide an important possible explanation for the high unemployment rate in East Germany following the legally mandated many-fold increase in real wages after reunification with West Germany.

Looking forward, our results suggest that the accession of the Central European countries to the European Union should not have major negative effects on employment, as real wages have remained much lower in Central Europe than in the West.

REFERENCES

Aghion, Philippe, Olivier Blanchard, and Robin Burgess. 1994. "The Behaviour of State Firms in Eastern Europe, Pre-Privatisation." *European Economic Review,* Vol. 38, No. 6, pp. 1327–79.

Blanchard, Olivier, and Michael Kremer. 1997. "Disorganization." *Quarterly Journal of Economics,* Vol. 112, No. 4 (November), pp. 1091–1126.

Bresson, Georges, Francis Kramarz, and Patrick Sevestre. 1992. "Heterogeneous Labour and the Dynamics of Aggregate Labour Demand: Some Estimations Using Panel Data." *Empirical Economics,* Vol. 17 (Special Edition on Panel Data), pp. 153–68.

Brown, James N., and Orley Ashenfelter. 1986. "Testing the Efficiency of Employment Contracts." *Journal of Political Economy,* Vol. 94, No. 3 (June), pp. S40–S87.

Estrin, Saul. 2002. "Competition and Corporate Governance in Transition." *Journal of Economic Perspectives,* Vol. 16, No. 1 (Winter), pp. 101–24.

Estrin, Saul, and Jan Svejnar. 1993. "Wage Determination in Labor-Managed Firms under Market-Oriented Reforms: Estimates of Static and Dynamic Models." *Journal of Comparative Economics,* Vol. 17, No. 3 (August), pp. 687–700.

European Bank for Reconstruction and Development. 1998, 1999. Transition Report. London.

Ham, John C., Jan Svejnar, and Katherine Terrell. 1998. "Unemployment and the Social Safety Net During Transitions to a Market Economy: Evidence from the Czech and Slovak Republics." *American Economic Review,* Vol. 88, No. 5 (December), pp. 1117–42.

Hamermesh, Daniel. 1986. "The Demand for Labor in the Long Run." In Orley Ashenfelter and Richard Layard, eds., *Handbook of Labor Economics,* Vol. 1. Amsterdam: North Holland, pp. 429–71.

____. 1993. *Labor Demand.* Princeton, N.J.: Princeton University Press.

Hendry, David F., and Grayham E. Mizon. 1978. "Serial Correlation as a Convenient Simplification, Not a Nuisance: A Comment on a Study of the Demand for Money by the Bank of England." *Economic Journal,* Vol. 88, No. 351 (September), pp. 549–63.

Kmenta, Jan. 1997. *Elements of Econometrics.* Ann Arbor, Mich.: University of Michigan Press.

Kornai, Janos. 1995. *Highway and Byways: Studies on Reform and Postcommunist Transition.* Cambridge, Mass.: MIT Press.

Lizal, Lubomir, Miroslav Singer, and Jan Svejnar. 2001. "Enterprise Breakups and Performance during the Transition from Plan to Market." *Review of Economics and Statistics,* Vol. 83, No. 1 (February), pp. 92–99.

MaCurdy, Thomas E., and John H. Pencavel. 1986. "Testing between Competing Models of Wage and Employment Determination in Unionized Markets." *Journal of Political Economy,* Vol. 94, No. 3 (June), pp. S3–S9.

McDonald, Ian M., and Robert M. Solow. 1981. "Wage Bargaining and Unemployment." *American Economic Review,* Vol. 71, No. 5 (December), pp. 896–908.

Nickell, Stephen J. 1986. "Dynamic Models of Labour Demand." In Orley Ashenfelter and Richard Layard, eds., *Handbook of Labor Economics,* Vol. 1. Amsterdam: North Holland, pp. 473–522.

Prasnikar, Janez, Jan Svejnar, Dubravko Mihaljek, and Vesna Prasnikar. 1994. "Behavior of Participatory Firms in Yugoslavia: Lessons for Transforming Economies." *Review of Economics and Statistics,* Vol. 76, No. 4 (November), pp. 728–41.

Quandt, Richard E., and Harvey S. Rosen. 1989. "Endogenous Output in an Aggregate Model of the

Labor Market." *Review of Economics and Statistics*, Vol. 71, No. 3 (August), pp. 394–400.

Rodrik, Dani. 1994. "Foreign Trade in Eastern Europe's Transition: Early Results." In Olivier Blanchard, Kenneth A. Froot, and Jeffrey D. Sachs, eds., *The Transition in Eastern Europe.* Chicago: University of Chicago Press, Chap. 18.

Svejnar, Jan. 1982. "On the Theory of a Participatory Firm." *Journal of Economic Theory,* Vol. 27, No. 2 (August), pp. 313–30.

____. 1986. "Bargaining Power, Fear of Disagreement, and Wage Settlements: Theory and Evidence from U.S. Industry." *Econometrica,* Vol. 54, No. 5 (September), pp. 1055–78.

World Bank. 1996. "From Plan to Market." The World Development Report, Washington, D.C.

Zellner, Arnold, Jan Kmenta, and J. Dreze. 1966. "Specification and Estimation of Cobb-Douglas Production Models." *Econometrica,* Vol. 34 (October), pp. 784–95.