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Labour Adjustment and Efficiency in Hungary

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Comments are welcome.

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by

Gábor Kőrösi*

Abstract

Transition from socialist to market economy brought drastic changes to the Hungarian labour market. Employment fell by 1.6 million, *i.e.,* by more than 25% during the early transition period, while unemployment jumped from practically nil to over 14% within four years. The rapid economic growth of the recent years could only create relatively few jobs, even though the unemployment rate continuously declined, and is less than 6% since 2001.

This paper describes labour adjustment after the transitional recession, and its relationship to corporate efficiency during the recovery period, based on a panel of medium-sized and large Hungarian firms. Labour demand is also related to firm level productive efficiency.

Keywords: Labour demand; productive efficiency; firm in transition economy.

JEL Classification: J23, D21, C23.

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1. Introduction

The fast emergence of large-scale unemployment was probably the most striking macroeconomic indicator of transition from socialist to market economy in Hungary, similarly to most transition economies. When the labour market was liberalized (together with most aspects of economic activities) unemployment jumped from practically nil to over 14% (February 1993) within four years; gradually declining ever since. Open unemployment, however, was only one component of the decline in employment. Employment fell by 1.6m, *i.e.,* by more than 25% in the decade between 1987 and 1996. Only a small proportion of this drop can be explained by demographic factors. There were three major exit routes from the labour market: (frequently early) retirement, unemployment and inactivity. Even though unemployment rate fell below 6% in 2001, the relatively fast economic growth of the past five years[1] has only created approximately one hundred thousand jobs (cumulative). Thus, there still are many inactive people, who would want to work if jobs were available. And substantial job creation will be necessary for just maintaining the present rate of unemployment in the forthcoming years. Few people will retire, as most people in that age bracket took early retirement years ago, and as the expansion of the higher education has substantially slowed down, thus, the temporary drop in the number of young people entering the labour market is largely over.

There is a broad consensus in the literature that centrally planned economies achieved full employment at the cost of substantial labour hoarding at the firm level. *Kornai* [1980] gives a detailed description of the mechanisms leading to excess labour demand in a socialist economy. *Köllő* [1998] and *Lehmann and Schaffer* [1995] give two alternative theoretical models of corporate labour demand in reformed socialism.

The 1980's was a period of slow liberalization of many aspects of the economy in Hungary, including labour markets. This liberalization process was greatly accelerated first in 1987-8, second in 1989-90. Labour market liberalization was linked to substantial liberalization of prices, foreign trade, and capital markets, thus firms suddenly faced a very strong competitive pressure. They no longer had any incentive to hoard under-utilised (mostly low-skilled) labour. The collapse of former protected markets and the increased competition lead to a *transitional recession* in 1990-2. Many firms went bankrupt, or were liquidated in the process. Many surviving firms shed labour on a large scale, especially those losing market share.

[1] GDP growth rate has been above 4% in all years after 1996.

Consolidation after the transitional recession started in 1992. The process was accompanied by a substantial restructuring of the corporate sector. Privatisation was an important ingredient of this restructuring; and major Hungarian firms were frequently sold to foreign investors, usually to multinational companies. Thus, foreign ownership became dominant by the end of this consolidation period in 1996. Successful restructuring brought about economic growth: the annual GDP growth rate has been above 4% in each year since 1997, with a rapid expansion of manufacturing production and exports. Aggregate employment decreased throughout the consolidation period, and it only started to increase in 1997.

The government decided to double the minimum wage in two years time (2001-2), which, taking account of expected inflation and changes in social security contribution, amounts to an approximate 75% real increase of labour cost of the cheapest employment. Even though there were few people employed at minimum wage at the firms in our sample in 1999 (there were much more such employees at family firms and other micro enterprises), the wage of approximately 20% of workers at these firms was below the 1999 value of the proposed 2002 threshold in 1999. By effectively raising the cost of unskilled labour, the government risks to halt the rather paltry job creation of the past few years, at least for some important groups of employees. Obviously, the expected effect of the minimum wage increase does not only depend on the wage distribution, it crucially hinges on the elasticity of labour demand with respect to labour cost.

This paper attempts to identify the major variables influencing corporate labour demand, including the relationship between productive efficiency and labour demand. Several important groups of firms are also analysed separately. The sample period of this study is the post-recession period: 1992-9.

The rest of the paper is organised as follows: Section 2 gives a brief survey of the literature on Hungarian labour markets. Section 3 outlines the labour demand models and discusses the theoretical assumptions behind. Estimation results are analysed in Section 4. Section 5 extends the production model to incorporate labour adjustment. Section 6 concludes. Appendix A gives definitions, Appendix B describes the dataset, while the relevant estimation results are collected in Appendix C.

2. Literature on the Hungarian labour markets

The changes in the Hungarian labour market have been extensively analysed from the supply side and from the point of view of the (would be) employees (*c.f., Bardasi et al* [1999], *Galasi and Kertesi* [1996], *Galasi and Nagy* [1999], *Kertesi and Köllő* [1995], [1996], [1999], [2000], [2001a], *Köllő* [2001], *Köllő and Nagy* [1996], or *Micklewright and Nagy* [1996], [1998], and [1999]). Several studies documented that while the slow liberalization phase of the 1980's already brought about substantial changes in the income distribution and in the relative labour market position of various groups of employees, individual strategies on the labour market only changed substantially from the early 1990's with the emergence of large-scale unemployment.

The other side of the labour market, the demand of the firms has been much less extensively studied, with the notable exceptions of *Basu et al.* [1997], *Estrin and Svejnar* [1998] and some works by János Köllő, the most recent of which are *Köllő* [1998] and *Kertesi and Köllő* [2001]. Unfortunately, *Basu et al.* [1997] and *Estrin and Svejnar* [1998] use a very limited dataset on Hungary, and mostly concentrate on the Czech and Slovak Republics. The analysis of the Hungarian labour market is especially marginal in *Basu et al.* [1997].[2] The analysis in *Köllő* [1998] is also hampered by data problems: his dataset only consists of observations from every third year.

Kőrösi [1997] estimated dynamic labour demand equations for large exporting firms in years 1987-95, which included early transition (1987-8), high transition (1989-92), and recovery (1992-5) periods. Adjustment cost proved to be asymmetric, especially in the high transition period. It was found that both output, and especially wage elasticities were extremely high (in absolute terms) during the high transition period, and downwards elasticities were much larger than upwards elasticities in most years. Foreign-owned companies had relatively more stable and less extreme behaviour than other firms.

Halpern and Kőrösi [1998a] studied, how the labour market position of the firms influenced profitability. This paper looks at the opposite relationship, how firm level productive efficiency influences labour market behaviour, if at all.

3. Labour demand models

The base model of our analysis is the following dynamic labour demand equation:

$$\log L_t = \mu \log L_{t-1} + \alpha_0 \log Q_t + \alpha_1 \log Q_{t-1} + \beta_0 \log w_t + \beta_1 \log w_{t-1} \\ [+\gamma_0 \log c_t + \gamma_1 \log c_{t-1}] + b + \varepsilon \ , \quad (1)$$

where L is the number of employees; Q is production; w is labour cost (wage + benefits + wage related taxes and contributions); and c is capital cost. $\varepsilon \sim i.i.d.\mathcal{N}(0, \sigma)$. In the standard model, it is assumed that $\gamma_0 = -\beta_0$ and $\gamma_1 = -\beta_1$.

This model can be derived from a standard theory of profit maximizing firm, facing constrained demand, under a budget constraint represented by a Cobb-Douglas production function. See *Nickell* [1986] and *Mátyás and Sevestre* [1996], Chapter 25 for the derivation. The major assumptions of the theoretical model, used as the general framework, are the following. The existence of a long-run equilibrium is assumed: the production function is linearised in its neighbourhood. Adjustment costs (of labour and capital) are assumed to be quadratic. Exogenous variables are assumed to follow AR(2) processes.

[2] Their results on Hungary are mostly negative which is probably due to their sample period (1988-92). Their findings on the non-existence of the wage curve in Hungary is explained and strongly qualified by *Kertesi and Köllő* [1997].

However, a stable long-run equilibrium path is unlikely to have existed during the transition period. I assume that as Hungary went through different phases of the transition process during the sample period, with different labour market characteristics, and these properties can be used for identifying different phases of the transition process. Thus, labour demand models are estimated for each year separately. It is tested whether downward and upward elasticities are equal, *i.e.,* the validity of the assumption on the adjustment costs.

There can also be characteristic differences among different groups of firms in the behaviour of these firms on the labour market: Some firms could adjust to market conditions relatively easily, for others transition was a much more painful process. Several different groups of firms are identified, and the differences in their behaviour is explored. We look at the heterogeneity of labour demand over the sectors, over the type ownership, and over the size of the firm.

The above base model is, however, only the point of departure in the exploratory work. It is tested whether the function can be simplified either to a quasi differenced form (differencing by $(1-\mu L)$)[3] or to a differenced form $(1-L)$. As the measurement of the cost of capital is very unreliable (*c.f.,* Appendix B) it is also tested whether the cost of capital can be omitted.[4]

Equation (1) was simplified to the following differenced equation:

$$\mathrm{D}\log L_t = \alpha_0 \mathrm{D}\log Q_t + \beta_0 \mathrm{D}\log w_t + b + e \ , \tag{2}$$

where Dlog stands for the logarithmic differences. However, this function was augmented in the next step by several factors: first, by a measure of the productive efficiency, second by dummies describing the ownership and the size of the firm.

The variable describing productive efficiency is taken from a dynamic Cobb-Douglas frontier production function:[5]

$$\log Y_t = c + \alpha \log L_t + \beta \log K_t + \mu \log Y_{t-1} + v_t - u_t \ , \tag{3}$$

where Y stands for the value added, L for labour input, K for capital stock, v is the usual disturbance term (assumed to be $v \sim i.i.d.\mathcal{N}(0,\sigma_v)$), while u is assumed to have i.i.d. truncated normal distribution (for $u>0$), representing firm specific inefficiencies, compared to the 'best-practice' firm in the sample (*c.f., Halpern and Kőrösi* [2000], [2001] for details.) The $(-\widehat{u})$ term represents productive efficiency, and is used in the augmented labour demand equation. Thus the final form is:

$$\mathrm{D}\log L_t = \alpha_0 \mathrm{D}\log Q_t + \beta_0 \mathrm{D}\log w_t + \gamma(-\widehat{u}) + \sum \delta_i D_i + b + e \ , \tag{4}$$

[3] For example, $\alpha_1 = -\mu\alpha_0$, etc.

[4] Omitting the cost of capital may obviously bias the estimation of wage elasticities. However, coefficient estimates usually changed very little with the inclusion/omission of the cost of capital variable, but the standard errors were much larger with included cost of capital, indicating large uncertainty in measurement.

[5] The translog production function only fits very marginally better, and it is hampered by strong multicollinearity, leading to many insignificant coefficients.

where D_i stands for the dummy variables. Output, cost of labour and efficiency are treated as endogenous variables. (*c.f.,* Appendix B)

4. Labour demand estimation results

Selected estimation results of the base model (excluding capital cost) are summarized in Tables 5 to 7 in Appendix C.[6] If one looks at the estimation results based on the entire sample (Table 5), the first obvious observation is that the subsamples for expanding and declining firms give completely different estimates; upwards output and wage elasticities are much smaller (in absolute values) than downwards elasticities, indicating a serious asymmetry in adjustment costs throughout the entire sample period. Except for the initial years, labour demand is very inelastic at the firms which can increase production, while it is much more elastic at downsizing firms, and that is even more true for the years at the end of the decade than for the mid-1990's. Simplification hypotheses for differences were usually rejected, thus, the level form should be maintained. The assumption that the coefficients for $\log(w_t)$ and $\log(w_{t-1})$ are equal to those of $-\log(c_t)$ and $-\log(c_{t-1})$ was rejected in the majority of cases. Although the capital cost was usually significant, its coefficients frequently had very strange estimated values, and their omission had no noticeable influence on the other coefficients, thus the cost of capital could be omitted from the specification without substantially changing conclusions. However, the estimation results are ridden with serious specification problems. The overidentification test indicates that information contents of the instruments is seriously underutilized in the estimation, almost all structural break tests are significant, indicating a substantial heterogeneity of the corporate labour demand. Significant structural breaks with respect to firm size suggest non-linear relationship (or, more precisely, different functional form for the underlying model).

A completely different picture emerges when we estimate the same demand equation for various groups of firms. If we use relatively large groups, like manufacturing, there still are many significant diagnostic tests. The structural break between firms with increasing and decreasing output is frequently significant, but the earlier clear pattern of strong asymmetry is no longer identifiable. The cost of capital variable looses its significance, but the simplification assumptions are still frequently significantly rejected.

After a further disaggregation of the sample, however, specification tests become insignificant.[7] There still are significant structural breaks among consecutive years, but there are no observable systematic discrepancies between expanding and downsizing firms. Ownership does not seem to differentiate the labour demand of the firms. Restrictions leading to the differenced equations are usually insignificant.

Thus, the most striking conclusions, drawn from the demand equation estimated for the entire sample, disappear, if we properly take into account the heterogeneity

[6] Please find the legend to the tables on the first page of Appendix C.

[7] Engineering is included as example. The sector was selected because of the large sample size; the non-significance of diagnostic tests cannot be the consequence of low power due to insufficient sample information.

of the firms. Upwards and downwards elasticities are no longer significantly different, specification tests usually are insignificant. Heterogeneity of labour demand seems to be linked to sectoral, *i.e.,* technological differences. Ownership does not seem to make much difference in the labour market behaviour of the firms after taking into account sectoral differences.[8]

One important common feature of all estimates of the base model is that while the short-run elasticities are usually in the expected range, derived long-run elasticities fluctuate apparently arbitrarily in an unacceptably wide range. Thus, the long-run properties of the model seem to be uncertain, which indicates that the underlying assumption of a long-run equilibrium seems to be invalid. It is not at all surprising for the first half of the sample, which covers the consolidation period after the transitional recession. However, this instability indicates that no stable corporate labour market behaviour emerged by the late 1990's; this still was a transitional period.

As the long-run characteristics of the labour demand equations seem to be uncertain, and the restrictions leading to a differenced form are usually insignificant at the disaggregate level, the analysis is continued with the augmented short run equations of model (4). Estimation results are summarized in Tables 8-11.

The additional regressors of the augmented equation are efficiency, ownership dummies, and size dummies. While ownership does not have a significant effect on the output and wage elasticity of labour demand, a significant coefficient for the ownership dummy indicates an ownership related shift in the labour demand function. Size dummies are included for diagnostic purposes: a significant coefficient indicates incorrect functional form.

Estimation results of the augmented short-run model also were very much influenced by the heterogeneity of the firms for the entire sample. If we look at the sectoral level, most diagnostic tests are insignificant, although the share of significant diagnostic tests clearly exceeds the significance level.

The overall statistical properties of the estimated augmented short-run equations are not substantially better than those of the 'simple' short-run equations. Although most diagnostic tests are insignificant at the sectoral level (trade is the only sector with significant overidentification test for all years), some important information is missing from the specification. However, the additional variables of the augmented model are insignificant in the majority of the cases at the sectoral level.

Productive efficiency, when significant, always had positive effect on labour demand. It suggests that efficient firms are more likely to increase employment, all other factors being equal. However, the evidence for this positive relationship is rather week. It is interesting to note that the inclusion of efficiency frequently exerted a substantial

[8] *Kőrösi* [2000] extensively analysed regional variations, and it was found that there were no significant regional behavioural differences in labour demand, even though the government experimented with various employment-related subsidy schemes in regions with high unemployment, hoping to promote job creation in those regions. Substantial regional variations in aggregate employment dynamics seem to be the consequence of regional differences in the factor endowments of the firms.

influence on the estimated values of the wage elasticity (usually driving it towards zero) even when efficiency itself was insignificant. Its effect on the output elasticity was smaller.[9] Thus, productive efficiency may rather influence labour demand indirectly, making efficient firms less sensitive to changes in the cost of labour. This suggests a more complex relationship of productive efficiency and labour demand. The next section will try to expand the production model along those lines.

Ownership dummies were rarely significant in the sectoral estimates, and their signs are mixed, indicating no substantial ownership effect on labour demand. Size was significant far too frequently, especially for small firms, indicating that Cobb-Douglas production function is probably too simple. However, the overall influence on the output and wage elasticities was negligible.

The labour demand equations fit surprisingly well in the first years of the sample, *i.e.,* in the consolidation period, when far the largest changes occurred. It indicates that those large reductions of employment were indeed driven by the most important economic factors. The fit deteriorated somewhat in the second half of the sample period, but it is still acceptable, given the characteristics of the sample information. (A large cross section of firms, and the dependent variable is the change in employment.)

Output elasticity had a slight decreasing tendency over time for most sectors. Its value tended to be larger in the consolidation period, when its typical value was somewhere in the neighbourhood of 0.5, than in the expansionary period, when its value usually was somewhere between 0.3–0.4. However, the 95% confidence intervals overlap for most sectors, thus the coefficients are only statistically significantly different over time in a minority of sectors. Wage elasticity fluctuated much more over time (and their estimated standard errors tended to be larger, indicating that these estimates are somewhat less reliable). During the consolidation period the wage elasticity rarely was significantly different from -1, although the estimated coefficient usually was on the inelastic side. Later the estimated value of the labour cost elasticity got much closer to zero, and for some sectors it tended to be insignificant in the late 1990's, except for 1999, when demand became somewhat more elastic in most manufacturing sectors.

The international evidence on labour demand is rather mixed. Different studies use different assumptions and thus specifications, and the characteristics of the datasets vary considerably. However, comparing the labour demand models estimated for Hungary to the ones estimated either to developed market economies (for some recent studies *c.f., Arellano and Bond* [1991], *Bresson, Kramarz and Sevestre* [1992], *Hamermesh* [1992] and for more comprehensive results *Hamermesh* [1993]), or other transition economies (*Basu et al.* [1997], *Estrin and Svejnar* [1998],[10] *Grosfeld and Nivet* [1997] or *Singer*

[9] The inclusion of the dummies alone usually had very little effect on the estimated wage and output elasticities.

[10] The elasticities in the labour demand equations estimated for Hungary in both *Basu et al.* [1997] and *Estrin and Svejnar* [1998] are also lower than my estimates here or in *Kőrösi* [1997]. Those two studies basically use the same rather small sample, derived from survey data, which may be less reliable than the official financial accounts of the firms.

[1996][11]) the Hungarian output and wage elasticities were relatively large in the consolidation period. Coefficient estimates for the post-1995 period are much more in line with elasticities estimated for market economies.

5. Labour adjustment in production models

An alternative to the labour demand model, derived from the production function is the modification of the production function to account for the possibility of labour adjustment. This model explains the inefficiency of the frontier production model as a function of the imperfect labour adjustment. The maintained hypothesis is that as labour adjustment is costly, full adjustment is suboptimal.[12] Thus companies will hoard labour, and will pay somewhat higher wages than absolutely necessary to minimise adjustment cost. Two alternative treatments were attempted.

5.1 Direct heterogeneity of labour

Here we also take into account the heterogeneity of labour. Two types of labour input are distinguished: skilled and unskilled workers.[13] The Cobb-Douglas production function of equation (3) is modified: the inefficiency term u is replaced by variables describing the labour market conditions of the firm.

$$\log Y_t = c + \alpha \log L_t + \beta \log K_t + \mu \log Y_{t-1} + X\beta + v \ ,$$

where X stands for the following additional variables:

Dlog(L): change of log employment;

$\log(L_s/L_u)$: log of the ratio of skilled/unskilled workers;

$\log(w_s^*)$: the deviation from the outside option wage of skilled workers;

$\log(w_u^*)$: the deviation from the outside option wage of unskilled workers;

and the ownership dummies previously used.

Wage for outside option is measured by a Mincerian wage equation: it is assumed that other firms, lacking any other information, would pay according to standard observable human capital characteristics, while the current employer will have additional information on the worker's abilities. Table 12 summarizes the estimates for the underlying wage equations.

Unfortunately, we only have sufficient sample on the employees for a relatively small number of firms. Thus, this model is only estimated for the largest firms in the

[11] Singer uses monthly observations, thus the elasticities in that study correspond to a very different time frame.
[12] See *Blanchard and Sevestre* [1999] for details.
[13] *Kertesi and Köllő* [2002] describe the dataset in detail.

sample.[14] Thus, this estimation is treated as a kind of experiment. Estimation results are presented in Table 13.

The most important factor influencing productive efficiency is the skill distribution of labour. High share of skilled labour has a strong positive effect on production. The effect of all other variables seems to be unstable: while they are jointly significant in all years, the individual coefficients fluctuate substantially. It is interesting to observe, how little ownership effect remains after taking into account the labour adjustment and the quality of labour. Nevertheless, the small sample size clearly invalidates inference, thus the direct treatment of skill heterogeneity had to be abandoned.

5.2 Indirect heterogeneity of labour

Following the logic of *Blanchard and Sevestre* [1999] and *Blanchard et al* [2002], the skill heterogeneity of labour is treated indirectly. Full adjustment of productive inputs to changed market conditions may not be optimal for the firm, thus labour and capital may be underutilised or productive capacity may be constrained by the actual input level. This partial adjustment of input use obviously influences productive efficiency. This problem is especially relevant in a transition economy like Hungary. Dynamic firms could increase output by an average 30% annually between 1992 and 1999, while production at downsizing firms also declined substantially.[15] (*C.f.,* Table 2 for details.) Obviously, full adjustment of all inputs to such large shifts is difficult and it may be very expensive. We assume that the adjustment can only be partial on the short run.

The production process cannot reach the efficiency frontier with suboptimal allocation of inputs. In the previous sections we just applied a measure of this inefficiency, but the above argument also provides us with an explanation. We identify three possible sources of inefficiencies: slack or insufficient use of labour, capital and skills.

Maintaining the Cobb-Douglas technology of equation (3), we augment it with a variable S_t, representing the skill composition of labour, and put structure into the inefficiency term u. Instead of using distributional assumptions for its measurement, as in the previous section, we assume that inefficiency is the consequence of insufficient adjustment to the optimal level of inputs:

$$u_t = \alpha_s \log(L_t^*/L_t) + \beta_s \log(K_t^*/K_t) + \omega_s \log(S_t^*/S_t) + \epsilon_t \ , \tag{5}$$

where asterisk denotes the (unobservable) optimal level of input use. α_s, β_s and ω_s 'slack' elasticities measure the contribution of insufficient labour, capital and skill adjustment to inefficiency.

As skill level is unobservable, we use the wage as a proxy, assuming that it is set according to skills. As optimal use of factor inputs is also unobserved, partial adjustment

[14] Due to the small number of observations reliable frontier estimation was not feasible. It is assumed that inefficiency is fully accounted for by the above factors.

[15] More than 10% of the firms in the sample at least doubled output (in real terms) every year after 1995.

is assumed. Straightforward derivation (*c.f., Blanchard et al* [2002] for details) leads to the following extended dynamic production function:

$$\log Y_t = c + \mu \log Y_{t-1} + \alpha \log L_t - \alpha\mu \log L_{t-1} + \beta \log K_t - \beta\mu \log K_{t-1} + \omega \log w_t - \omega\mu \log w_{t-1} - u_t + \mu u_{t-1} + v_t \ . \qquad (6a)$$

After substituting formula (5) we get:

$$\log Y_t = c + \mu \log Y_{t-1} + (\alpha + \alpha_s) \log L_t - (\alpha\mu + \alpha_s) \log L_{t-1} + (\beta + \beta_s) \log K_t - (\beta\mu + \beta_s) \log K_{t-1} + (\omega + \omega_s) \log w_t - (\omega\mu + \omega_s) \log w_{t-1} + v_t \ . \qquad (6b)$$

Table 14 presents the estimation results annually for the entire sample, while Tables 15 and 16 summarizes comparable results for manufacturing and engineering. Labour and capital elasticities are largely in line with expectations, especially if estimates for the entire sample are considered. However, capital elasticity is surprisingly high in manufacturing sectors. Skill elasticity is also very high, especially in the early transition period, but also towards the end of the sample, in the fast recovery period.

The driving force behind inefficiencies mostly seems to be the inadequate capital adjustment. Labour adjustment problems seem to hamper the manufacturing sector most, but that may just be the consequence of structural breaks in the parameters (reflecting technological heterogeneity of sectors), as a more detailed analysis of individual manufacturing sectors do not usually suggest such a relationship. The adjustment in the skill composition of labour seems to be slightly more problematic than adjustment of the level of employment, especially when insufficient capital adjustment causes inefficiencies.

6. Conclusions

The behaviour of the firms in a transforming economy can be reasonably described by a standard dynamic labour demand model. However, if the heterogeneity of corporate behaviour is ignored, empirical results may offer a very tempting, but also very misleading interpretation. Probably the most important conclusion of the present exercise is that disregarding sectoral differences may lead to invalid conclusions.[16]

Although most labour demand functions, estimated for Hungary for the years 1992-9, are rather similar to empirical labour demand models of mature market economies, corporate behaviour is unstable both over time and over sectors. Even after a decade of transition to market economy no stable long-run corporate labour market behaviour emerged, which indicates a continuing substantial uncertainty of the corporate sector.[17]

[16] *Konings* [2001] also emphasizes the importance of sectoral differences in the analysis of transitional labour markets.

[17] *Grosfeld and Nivet* [1997] suggested that the bulk of the adjustment occurred in one single transition year (1991) in Poland. The sample period ends too early in both *Basu et al.* [1997] and *Estrin and Svejnar* [1998], but their results for the Czech Republic may also indicate a kind of normalization for 1993.

These estimates for Hungary clearly reject the suggestion that transition was completed in 1992 on the labour market.[18] This also suggests that labour market policy should be cautious with sudden large changes as consequences may be less predictable in Hungary than in a mature market economy. The estimated wage and output elasticities characterise the Hungarian labour market as a rather inflexible one towards the end of the 1990's, which may explain the relatively low overall job-creation in the period of rapid growth with moderate increases in the cost of labour.

An important negative result of this study is that ownership had no discernible effect on the Hungarian corporate labour market behaviour after 1992.[19] This is a somewhat surprising finding, as it contradicts to the conclusions of most studies on transition economies.[20]

On the other hand, the overwhelming presence of foreign firms does seem to have a strong dynamic effect on the corporate labour market behaviour. Labour demand was much more elastic both with respect to output and wages in Hungary in the initial years of transition than in most Western European economies. By the end of the sample period, labour demand in Hungary had very similar characteristics than in a typical European market economy, indicating that 'Western' behavioural rules were gradually imposed on the Hungarian firms, even if they are domestically owned. This indicates that the Hungarian labour market can be swiftly integrated into the labour market of the European Union at accession, as the basic behavioural patterns are practically identical. However, this labour market conformity will make it more difficult to achieve the ambitious Lisbon employment targets.

Skill composition seems to be an important ingredient in labour adjustment. Apparently, inproper adjustment to skill requirement was an important factor of productive inefficiencies at the early phase of transition. The high elasticity of skilled labour indicates that it is essential for firms, and there seem to be some adjustment problems at the end of the sample period. This is analagous to the findings in *Kertesi and Köllő* [2001b] (or [2001a]): economic recovery created jobs almost exclusively for skilled workers, and apparently firms cannot find enough skilled workers on the (local) labour market.

Finally, productive efficiency seems to have little direct influence on labour demand. If efficiency is significant, it has a positive effect, thus more efficient production *ceteris paribus* increases employment. This effect, however, is small. The changes in estimated wage elasticities from the standard to the augmented short-run labour demand model point to a more substantial indirect efficiency effect. While labour hoarding does not seem to cause substantial loss in productive efficiency, capital adjustment seems to be a more serious problem, probably due to liquidity constraints emerging from the financial sector.

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[18] This is very much in line with results on other aspects of corporate behaviour analysed in *Halpern and Kőrösi* [1998a], [1998b] and [2001].

[19] *Kőrösi* [1997] found that the labour market behaviour of foreign-owned firms was more stable than that of other firms in the early years of transition.

[20] *Halpern and Kőrösi* [2001] found significant ownership effect in other aspects of the behaviour of practically the same firms. *Kertesi and Köllő* [1999] and [2001a] found a fast decreasing, but persistent wage premium at foreign-owned firms.

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Appendix A: Definitions

All variables (except employment) were deflated, usually with four digit sectoral producer price indices. There were some—usually small—sectors, where the price index was only available at a higher level of aggregation (2 or 3 digit sectors). Variables are measured in million Forints at 1991 prices. The variables are:

Labour (L): Annual average full-time employment at the firm.

Labour cost (w): The average annual wage and payroll tax (social security contribution) of an employee.

Output (Q): Sales total, net of revenue from asset sales and other extraordinary sources.

Capital (K): Fixed assets. See data section for qualifications.

Capital cost (c): Depreciation over fixed assets. See data section for qualifications.

Valued added (Y): Sales total (Q) less broadly defined material costs.

Efficiency: The error term $(-\widehat{u})$ of the frontier production function of equation (3).

Profit margin: Pre-tax profits relative to sales.

Large firm: A firm where the number of employees is greater than 500, or the value of fixed assets is greater than 1bn. 1991 forints or sales volume is greater than 1.5bn. 1991 forints.

Small firm: A firm where the number of employees is less than 50, or the value of fixed assets is less than 20m. 1991 forints or sales volume is less than 25m. 1991 forints.

(Domestic) private firm: A firm where named persons (investors, employees and managers) owned more than 50% of the equity capital. Firms owned indirectly (by domestic firms) are excluded, as the parent company can be a SOE.

State owned firm: A firm where the central and local governments together owned more than 50% of the equity capital.

Foreign owned firm: Foreign investors owned more than 50% of the equity capital.

Important foreign minority ownership: Foreign investors owned 25-50% of the equity capital. This category may include firms, which are present at other ownership categories.

'Other' ownership: No clear majority owner by type, or more than 50% of the equity capital is indirectly owned (*i.e.,* by another corporation). (Indirect ownership frequently meant state ownership in the early 1990's; it was usually domestic private ownership by the end of the decade.)

Appendix B: Data issues[21]

The dataset consists of variables obtained from the financial accounts of Hungarian firms between 1990 and 1999.[22] The sample is based on the wage survey, described in *Köllő* [2001]. The wage survey covers firms employing more than 20 (until 1995) or 10 (later years) people; however, it does not include all such firms. Sampling is heavily biased towards large firms; almost all firms employing more than 500 people are included.

A large number of new firms were established during this period, while many old firms disappeared, either because they went bankrupt, or were broken up during the reorganization process. Some new firms were *de novo* enterprises founded by domestic or foreign investors, but many were created from the assets of existing SOEs. In our dataset firms are identified by their tax file number. However, whenever a firm is reorganized, *e.g.,* corporatized, it receives a new tax file number, even if there was no real change in assets or activities. A major task when compiling the dataset was to identify firms in case of which commercialisation only meant the change of the name. In other cases they were treated as totally new entities following the natural way of entry and exit. Unfortunately, a crucial sector of the labour market is largely omitted due to the lack of sample information: the emerging small enterprises. Table 1 summarizes coverage. Manufacturing is obviously overrepresented, but the sample covers more than 60% of employment even in other sectors.

Many observations, however, had to be excluded due to data problems, *e.g.,* missing observations, so the actual sample size of the estimations is smaller, but the coverage, measured by employment or sales, is still high in all years.

Employment is measured in annual average number of full-time employees. It is not possible to correct for part-time employment, however, that is usually negligible. Employment figures also include an unknown number of people on long-term unpaid leave (child care and military service). These uncertainties may also have an effect on the labour cost. All other variables are measured in million Forints at 1991 producer prices.

Capital stock of firms was not measured reliably in the sample period. The capital stock of a firm could have been revalued several times after 1990: once when the firm was corporatized, at least once, but in case of larger firms frequently 3–4 times before privatisation and usually after privatisation as well. These revaluations in some cases repeatedly substantially changed the size of the capital stock without incurring any new (dis)investment. As timing and magnitude of these revaluations are unknown, no adjustment is feasible.

[21] I would like to express my gratitude to Mr. József Becsei (CSO) and his collaborators for their assistance in compiling the database. I maintain and use the database together with László Halpern. This research would not have been possible without his cooperation.

[22] The analysis starts with 1992, observations from the first two years are only used for lagged (perhaps also differenced) variables.

Table 1: Summary statistics on the representativeness of the sample

Variable	1992	1993	1994	1995	1996	1997	1998	1999
Manufacturing								
Total number of firms	11146	13234	13953	15089	16936	18927	20153	20830
Firms in sample	3315	3870	4003	4090	4551	5068	4387	4182
Share (%)	29.7	29.2	28.7	27.1	26.9	26.8	21.8	20.1
Employment, % share	87.1	88.3	88.3	88.2	89.4	88.9	85.9	82.3
Sales total, % share	86.3	87.9	88.8	88.8	92.8	92.7	91.2	89.8
Value added, % share	90.7	90.8	91.9	92.2	96.2	94.5	93.1	91.3
Exports, % share	92.1	92.3	92.0	92.8	99.4	98.0	98.0	96.9
Other sectors								
Total number of firms	45581	58266	65839	75134	88707	101496	110682	117488
Firms in sample	6958	8587	8540	8663	9751	11496	8569	8108
Share (%)	15.3	14.7	13.0	11.5	11.0	11.3	7.7	6.9
Employment, % share	83.8	80.9	82.8	80.5	77.4	75.5	68.7	63.2
Sales total, % share	70.8	70.5	65.9	64.8	68.0	69.1	64.4	60.7
Value added, % share	78.9	84.1	80.7	84.7	85.5	85.8	80.5	76.5
Exports, % share	66.0	61.0	56.3	52.8	67.8	75.8	78.4	68.6
All firms								
Total number of firms	56727	71500	79792	90223	105643	120423	130835	138318
Firms in sample	10273	12457	12543	12773	14302	16564	12956	12290
Share (%)	18.1	17.4	15.7	14.2	13.5	13.8	9.9	8.9
Employment, % share	85.0	83.5	84.8	83.3	81.8	80.6	75.2	70.3
Sales total, % share	75.6	75.9	73.0	72.8	76.2	77.4	73.7	70.8
Value added, % share	83.4	86.7	85.1	87.8	90.0	89.6	85.8	82.6
Exports, % share	80.6	79.0	78.6	79.0	90.2	92.4	93.3	90.6

The cost of capital was measured as the effective average rate of depreciation which may be influenced by these revaluations. However, that probably is the minor source of measurement error in the cost of capital. There are many firms with clearly invalid reported depreciation: For more than 10% of the sample depreciation is either greater than half the net value of fixed assets, or less than 1% of the value of fixed assets, both of which is impossible. Apparently some firms use depreciation as a balancing item in their books: this is the only relatively large expenditure item which does not have to be substantiated by bills. Approximately 25% of the firms reported 0 profits with the precision of our observations (one million forints); for more than half of these firms the rounding error was less than 0.5% of the sales total. We suspect that many such firms applied creative accounting practices to avoid the necessity of reporting either losses or profits.

Table 2 presents the means of some important variables in all years for the entire sample and for some relevant subsamples, while Table 3 gives similar descriptive statistics on manufacturing firms.[23] Many firms could increase their output considerably,

[23] The sample changes from year to year partly because some firms disappear from the sample, others enter, and also because firms may move from one subset to another in consecutive years. Percentage changes were computed to facilitate a better temporal comparison: It is the weighted average change of the variable from the previous year for the firms in the

Table 2: Sample means of all firms, subsamples by output

Variable	1992	1993	1994	1995	1996	1997	1998	1999
Entire sample								
Number of observations	4287	6992	8507	9254	9858	11448	11485	11207
Employment	290	174	165	152	138	124	126	123
Employment (% change)	-16.8	-12.7	-4.0	-8.6	-3.5	-1.3	0.7	-3.0
Labour cost ('000 Ft./cap)	380.4	461.5	463.8	417.1	395.2	396.6	417.2	444.8
Labour cost (% change)	7.2	6.4	2.9	-9.5	-4.5	-0.1	1.9	6.4
Output (m Ft.)	542.1	443.5	453.8	430.7	428.8	435.5	498.7	562.4
Output (% change)	-16.0	0.0	8.0	0.2	3.7	9.8	13.5	11.9
Profit margin (%)	-36.2	-42.7	-31.5	-3.2	-13.1	1.1	-22.7	-10.1
Change of output > 0								
Number of observations	917	3125	4463	3873	4269	5473	6713	5633
Employment	331	179	166	167	144	130	136	150
Employment (% change)	1.7	-1.5	6.4	3.4	4.3	6.8	7.0	3.9
Labour cost ('000 Ft./cap)	471.7	513.4	495.7	447.5	426.6	425.3	443.0	464.8
Labour cost (% change)	8.7	8.7	4.2	-5.9	-0.7	3.8	1.1	7.5
Output (m Ft.)	966.8	545.8	578.6	581.7	560.3	602.5	614.5	776.9
Output (% change)	69.4	36.0	27.8	25.3	28.2	32.9	31.3	30.5
Profit margin (%)	-4.4	-21.4	-7.0	14.3	-4.5	1.9	4.6	-5.8
Change of output ≤ 0								
Number of observations	3370	3867	4044	5381	5589	5975	4772	5574
Employment	278	171	163	141	134	119	113	96
Employment (% change)	-21.4	-20.4	-13.5	-16.9	-9.1	-8.2	-8.3	-12.4
Labour cost ('000 Ft./cap)	355.5	419.5	428.6	395.2	371.2	370.4	380.9	424.6
Labour cost (% change)	6.7	4.3	1.3	-12.3	-7.7	-3.8	3.3	5.2
Output (m Ft.)	426.5	360.8	316.1	322.0	328.4	282.5	335.8	345.7
Output (% change)	-35.9	-24.5	-17.8	-20.6	-16.9	-18.0	-15.9	-15.5
Profit margin (%)	-44.9	-59.9	-58.5	-15.8	-19.7	0.4	-61.0	-14.5
No foreign owner								
Number of observations	3588	5422	6656	7254	7739	8894	8954	8739
Employment	299	166	151	134	116	102	102	97
Employment (% change)	-17.7	-13.0	-7.3	-10.4	-4.8	-3.1	-1.2	-4.6
Labour cost ('000 Ft./cap)	347.3	408.9	413.0	370.8	343.8	331.2	348.8	369.8
Labour cost (% change)	7.9	7.3	1.6	-10.0	-6.1	-1.5	0.2	5.8
Output (m Ft.)	499.5	362.3	323.1	268.3	242.4	220.2	239.3	241.5
Output (% change)	-18.0	-6.0	1.1	-5.4	-2.1	-0.4	6.6	2.0
Profit margin (%)	-39.3	-46.1	-36.2	-8.6	-12.1	-4.7	-29.7	-7.8
Important foreign owner								
Number of observations	212	395	431	411	393	458	408	373
Employment	222	215	276	269	260	247	192	164
Employment (% change)	-11.3	-7.9	18.9	-18.3	-3.6	-2.7	-1.4	-11.7
Labour cost ('000 Ft./cap)	527.4	579.1	584.7	490.7	471.4	522.8	527.8	561.7
Labour cost (% change)	2.8	8.6	3.1	-12.5	-6.0	2.5	2.8	7.0
Output (m Ft.)	568.5	689.9	785.0	1641.3	1741.5	1638.0	924.0	887.3
Output (% change)	-16.8	12.9	11.5	4.9	2.9	5.6	2.0	-2.9
Profit margin (%)	-13.8	-8.7	-14.6	-8.8	-3.0	-3.0	-0.3	-78.4
Majority foreign owner								
Number of observations	348	964	1193	1367	1500	1887	1935	1919
Employment	233	194	182	203	209	194	221	227
Employment (% change)	-7.9	-3.1	3.4	2.3	0.9	4.1	6.2	2.3
Labour cost ('000 Ft./cap)	588.0	681.5	683.6	629.1	634.2	666.5	701.5	752.0
Labour cost (% change)	5.7	4.2	6.6	-7.3	-0.1	3.0	5.9	7.5
Output (m Ft.)	807.9	771.2	856.0	934.3	1052.1	1155.1	1606.5	1950.4
Output (% change)	11.0	18.6	27.2	8.4	12.9	23.8	21.0	20.8
Profit margin (%)	-9.6	-19.1	-16.0	29.6	-21.1	31.6	5.2	-7.9

(sub)sample in the current year.

Table 3: Sample means, manufacturing, subsamples by output

Variable	1992	1993	1994	1995	1996	1997	1998	1999
Entire sample								
Number of observations	1458	2215	2811	3066	3251	3793	3914	3844
Employment	314	215	191	178	170	155	159	158
Employment (% change)	-15.8	-13.6	-5.6	-1.9	-1.6	2.0	2.9	-2.0
Labour cost ('000 Ft./cap)	367.4	425.8	438.8	411.1	392.8	392.8	402.7	425.6
Labour cost (% change)	9.0	12.6	3.0	-5.6	-3.1	1.1	6.4	7.8
Output (m Ft.)	688.7	530.5	544.3	557.4	564.8	593.6	677.0	810.3
Output (% change)	0.4	5.6	10.2	10.2	7.3	19.1	16.7	18.6
Profit margin (%)	-40.3	-17.0	-19.7	-9.5	-4.6	15.3	0.4	-1.4
Change of output > 0								
Number of observations	424	1209	1665	1594	1536	1970	2315	1901
Employment	327	218	197	192	174	181	154	167
Employment (% change)	-1.9	-8.7	1.0	5.5	7.7	8.7	11.2	7.5
Labour cost ('000 Ft./cap)	417.3	445.5	465.2	439.8	422.7	409.9	423.2	454.2
Labour cost (% change)	12.7	17.0	3.1	-0.1	2.9	5.6	9.1	10.0
Output (m Ft.)	1250.8	643.0	708.0	756.9	609.5	891.8	760.3	1075.4
Output (% change)	87.2	28.7	24.2	25.1	35.9	38.1	41.6	43.7
Profit margin (%)	-4.7	-4.0	-1.7	-0.9	2.7	3.0	3.9	3.3
Change of output ≤ 0								
Number of observations	1034	1006	1146	1472	1715	1823	1599	1943
Employment	309	210	182	163	166	127	167	148
Employment (% change)	-20.7	-19.1	-14.5	-10.0	-9.1	-6.9	-6.4	-10.7
Labour cost ('000 Ft./cap)	346.9	402.2	400.4	380.1	366.0	374.3	372.9	397.6
Labour cost (% change)	7.3	7.3	2.7	-11.8	-8.7	-3.9	2.2	5.6
Output (m Ft.)	458.2	395.2	306.6	341.3	524.8	271.4	556.5	551.0
Output (% change)	-33.9	-21.9	-20.2	-14.4	-12.0	-20.0	-13.4	-11.0
Profit margin (%)	-54.8	-32.6	-45.7	-18.8	-11.2	28.6	-4.7	-6.1
No foreign owner								
Number of observations	1063	1457	1873	2033	2176	2528	2598	2559
Employment	324	199	164	149	134	113	112	106
Employment (% change)	-17.5	-11.3	-8.7	-4.0	-3.4	-0.8	0.6	-5.1
Labour cost ('000 Ft./cap)	326.6	371.2	382.2	355.6	334.7	327.5	337.5	358.9
Labour cost (% change)	10.0	14.1	-0.5	-9.0	-5.5	-1.8	6.7	8.5
Output (m Ft.)	704.9	460.4	306.1	294.6	249.0	226.3	222.7	222.1
Output (% change)	2.0	-1.1	1.2	4.2	-3.1	3.3	5.0	2.1
Profit margin (%)	-50.6	-20.6	-17.1	-10.7	-5.5	-1.6	-0.2	-2.0
Important foreign owner								
Number of observations	131	197	222	212	199	221	212	190
Employment	284	245	251	300	290	289	230	189
Employment (% change)	-12.2	-9.7	-5.3	-3.4	-4.1	-0.1	-0.3	-9.1
Labour cost ('000 Ft./cap)	454.1	509.2	522.7	446.9	423.2	431.2	439.6	464.3
Labour cost (% change)	4.6	13.2	8.6	-6.3	-3.3	3.0	4.3	7.1
Output (m Ft.)	638.5	661.6	739.0	1896.4	1968.9	1981.7	817.7	629.0
Output (% change)	-9.9	7.9	9.1	6.2	0.3	7.1	-2.5	-5.5
Profit margin (%)	-9.3	-8.4	-21.8	-3.0	-3.4	0.8	-1.8	-1.1
Majority foreign owner								
Number of observations	216	504	647	755	811	982	1036	1029
Employment	251	234	218	223	234	225	257	272
Employment (% change)	-7.5	-5.2	2.1	2.5	2.7	6.1	7.2	3.4
Labour cost ('000 Ft./cap)	518.8	553.4	572.5	547.0	537.1	551.7	556.8	582.5
Labour cost (% change)	9.8	9.9	7.6	0.0	0.4	5.8	6.3	7.2
Output (m Ft.)	640.9	682.5	813.2	914.4	1085.4	1238.8	1804.0	2322.6
Output (% change)	12.1	21.7	27.2	19.0	19.3	34.2	23.4	25.7
Profit margin (%)	-7.8	-9.9	-26.3	-8.7	-2.5	62.9	2.4	0.4

and some firms could expand at a phenomenal rate during transition. However, it is obvious that most of the expansion came from increased labour productivity.

Real labour cost increased steadily until the 1995 stabilization package. In the early 1990's a part of the labour cost increase was due to the approximately 10 percentage point annual wedge between consumer and producer prices:[24] Employees (and trade unions) strongly resisted cuts in real wages (*i.e.,* their purchasing power), although they could not always avoid it. However, as producer price inflation was substantially below consumer price inflation, steady real wages for the employees meant quickly increasing labour costs for the employers. Another important factor of the apparently fast increasing labour cost was pure composition effect, especially in the early 1990's: Low skilled, and thus low paid workers were much more likely to be fired and much less likely to be hired.

Initially, in 1990, practically all firms in the sample were owned by the state. This is the period of rapid privatisation of the firms. Many firms were sold to foreign investors, frequently to multinational companies. This privatisation process was largely completed by 1997. frequently meant their sale to foreign investors. Widespread foreign ownership became an important feature of the Hungarian economy, especially in manufacturing.

The panel dataset is used as a repeated cross section sample as substantial structural breaks are assumed among the turbulent years of the transition process. Even though the sample is used as a series of cross sections, the basic heterogeneity of a panel model has to be assumed here as well. In case of a dynamic model panel characteristics of the data will not only lead to heteroscedastic errors, but the use of lagged dependent explanatory variable may yield inconsistent OLS estimates, as there may be firm specific effects in corporate labour demand, in which case the lagged dependent variable is not independent of the individual effects incorporated in the error term.

Other explanatory variables may not be independent of the error term either. Wages may not be exogenously set. The possible large measurement error in capital cost may be related to firm specific components. Demand may not always be constrained for all firms, in which case the production function will establish a link between production and the stochastic component of labour. All variables in the model, but the dummies, were treated endogenously to avoid inconsistencies stemming from these possible relationships. As level variables may be related to the firm specific component, and thus to the disturbance term, instrumental variables of the base model are either lagged differences or ratios. Instrumental variables of the differenced model, on the other hand, are lagged levels of variables. Beside these lagged model variables (employment, production and labour cost), sector dummies, properly transformed variables taken from the financial accounts of the firms (*e.g.,* bank cost, payables and receivables, etc.) and relative variables (*e.g.,* export share and share of different types of ownership) were used as instruments.

[24] Consumer prices increased by an annual 23% in 1992, 22.5% in 1993 and 18.8% in 1994, while the producer price inflation was 12.3%, 10.8% and 11.3% in the same years. (Source: CSO Statistical Yearbooks.)

Appendix C: Estimation results

Table 4: Frontier production functions

Variable	1992	1993	1994	1995	1996	1997	1998	1999
All firms								
Constant	0.64 **	0.74 **	0.48 **	0.23 **	0.23 **	0.29 **	0.35 **	0.28 **
Y_{t-1}	0.26 **	0.53 **	0.56 **	0.66 **	0.70 **	0.67 **	0.75 **	0.78 **
log(L)	0.47 **	0.26 **	0.29 **	0.23 **	0.22 **	0.21 **	0.16 **	0.15 **
log(K)	0.14 **	0.11 **	0.11 **	0.11 **	0.09 **	0.12 **	0.09 **	0.09 **
σ	0.94 **	0.89 **	0.78 **	0.72 **	0.74 **	0.71 **	0.70 **	0.69 **
σ_u/σ_v	1.23 **	1.26 **	1.25 **	1.02 **	1.31 **	1.04 **	1.21 **	1.43 **
ret. to scale	0.82 **	0.79 **	0.91 **	0.99	1.03 *	1.00	0.99	1.08 **
Nob	5941	9343	10307	10749	11050	12774	11840	11288
Mean of dep.var	3.19	3.07	3.17	3.06	2.96	2.84	3.03	3.04
S.dev of dep.var	1.33	1.40	1.42	1.50	1.55	1.58	1.52	1.57
R^2	0.69	0.75	0.81	0.84	0.86	0.86	0.87	0.89
Mean ineff. (%)	-18.08	-17.85	-15.11	-13.36	-15.55	-14.28	-13.94	-14.52
Manufacturing								
Constant	0.61 **	0.75 **	0.50 **	0.22 **	0.18 **	0.31 **	0.33 **	0.20 **
Y_{t-1}	0.29 **	0.50 **	0.49 **	0.60 **	0.68 **	0.63 **	0.67 **	0.74 **
log(L)	0.46 **	0.25 **	0.30 **	0.25 **	0.22 **	0.24 **	0.19 **	0.18 **
log(K)	0.16 **	0.17 **	0.17 **	0.16 **	0.12 **	0.15 **	0.15 **	0.11 **
σ	0.92 **	0.86 **	0.77 **	0.67 **	0.66 **	0.70 **	0.63 **	0.66 **
σ_u/σ_v	1.48 **	1.63 **	1.39 **	0.90 **	1.16 **	1.27 **	1.21 **	1.54 **
ret. to scale	0.89 **	0.84 **	0.93 **	1.01	1.07 **	1.03 *	1.02	1.12 **
Nob	1947	3007	3448	3646	3742	4297	4158	3974
Mean of dep.var	3.23	3.23	3.35	3.31	3.26	3.16	3.34	3.36
S.dev of dep.var	1.36	1.45	1.48	1.56	1.60	1.63	1.57	1.62
R^2	0.74	0.81	0.84	0.87	0.89	0.88	0.90	0.90
Mean ineff. (%)	-18.60	-17.78	-14.60	-10.66	-12.14	-13.73	-11.48	-12.80

Legend: Production functions were estimated by maximum likelihood. Asterisks after the coefficients indicate that the t-test is significant at 0.05 level ($*$) or at 0.01 level ($**$). The null for returns to scale (ν) is that $\nu = 1$. σ denotes the standard error of the compound disturbance term ($\sigma^2 = \sigma_u^2 + \sigma_v^2$), while σ_u/σ_v stands for the ratio of the two standard errors (often denoted by λ). Mean inefficiency is normalized by the mean of the dependent variable. Nob: number of observations.

Legend to the labour demand tables: All equations were estimated by instrumental variables method with heteroscedasticity consistent standard errors. One asterisk (*) indicates significance at 5% level, while two asterisks (**) indicate it at 1%. Wald tests are χ^2 tests for the joint significance of the nulls. In the case of sectors, sectoral dummies are tested as additional regressors. Wald test for capital cost means the joint significance of $\gamma_0 = 0$ and $\gamma_1 = 0$ in eq. (1). Wald test for labour = capital cost: the null hypothesis is: $\beta_0 = -\gamma_0$ and $\beta_1 = -\gamma_1$ in eq. (1). Wald test for differenced form: the null hypothesis is: $\mu = 1$, $\alpha_0 = -\alpha_1$ and $\beta_0 = -\beta_1$ in eq. (1). Wald test for quasy differencing: the null hypothesis is: $\alpha_0 = -\mu\alpha_1$ and $\beta_0 = -\mu\beta_1$ in eq. (1). Possible structural breaks were tested by adding dummy premultiplied non-dummy explanatory variables, and testing their joint significance (Wald test), analogously to the Chow-test in OLS. Nob: number of observations. SEE: Standard error of estimation.

Table 5: Labour demand equations: base model, all firms

Variable	1992	1993	1994	1995	1996	1997	1998	1999
log employment, lagged	0.81 **	0.89 **	0.94 **	0.93 **	0.92 **	0.92 **	0.95 **	0.90 **
log production	0.77 **	0.69 **	0.63 **	0.75 **	0.87 **	0.57 **	0.60 **	0.84 **
log production, lagged	-0.62 **	-0.59 **	-0.54 **	-0.67 **	-0.75 **	-0.45 **	-0.51 **	-0.72 **
log labour cost	-0.85 **	-0.62 **	-0.53 **	-0.74 **	-0.62 **	-0.78 **	-0.52 **	-0.94 **
log labour cost, lagged	0.67 **	0.54 **	0.47 **	0.72 **	0.57 **	0.64 **	0.46 **	0.84 **
constant	0.12	-0.10	-0.25 **	-0.16 **	-0.30 **	-0.43 **	-0.27 **	-0.27 **
long-run prod. elasticity	0.75 **	0.93 **	1.41 **	1.09 **	1.44 **	1.57 **	1.66 **	1.26 **
long-run wage elasticity	-0.94 **	-0.68	-0.91	-0.26	-0.65 *	-1.88 **	-1.14 *	-1.05 **
Nob	3590	4326	6642	7889	8736	10045	10566	10767
Mean of dep. variable	4.91	4.45	4.21	4.10	3.98	3.86	3.89	3.83
S.dev of dep. variable	1.15	1.20	1.19	1.21	1.23	1.24	1.20	1.21
R^2	0.92	0.93	0.93	0.94	0.92	0.94	0.95	0.93
SEE	0.32	0.32	0.31	0.31	0.35	0.31	0.28	0.32
Overidentification test	4.87 **	7.21 **	3.66 **	3.70 **	5.60 **	14.90 **	14.01 **	13.54 **
Wald test for capital cost	11.98 **	3.24	14.12 **	10.04 **	1.44	7.99 *	10.47 **	12.93 **
Wald test for lab=cap cost	105.89 **	24.66 **	16.67 **	63.54 **	33.57 **	0.48	8.54 *	12.93 **
Wald test for sectors	22.33 **	37.19 **	49.16 **	27.25 **	46.13 **	96.67 **	50.63 **	58.32 **
Wald test for diff'ed form	53.95 **	60.01 **	40.96 **	51.02 **	63.72 **	78.33 **	68.06 **	73.60 **
Wald test for quasy diff.	0.23	5.06	15.77 **	15.07 **	23.65 **	53.53 **	38.89 **	11.28 **
Break at $q_t > q_{t-1}$	16.24 **	28.09 **	25.73 **	36.17 **	26.39 **	33.62 **	54.33 **	49.28 **
Break at foreign ownership	14.76 *	22.16 **	7.26	20.47 **	19.49 **	19.31 **	8.24	21.32 **
Break at majority for. own.	7.48	17.10 **	10.85	10.37	19.14 **	25.82 **	5.58	27.95 **
Break at private own.	0.76	1.62	6.46	5.91	8.88	28.33 **	11.50 *	12.53 *
Break at 'other' own.	22.17 **	19.77 **	18.59 **	21.27 **	17.06 **	7.54	10.38	19.34 **
Break at state own.	23.31 **	8.24	3.23	3.71	14.68 *	12.60 *	9.56	14.83 *
Break at small firms	17.00 **	12.49 *	29.91 **	15.12 *	3.79	15.41 **	12.57 *	26.81 **
Break at med-sized firms	12.89 *	14.08 *	13.72 *	9.02	24.71 **	20.71 **	13.81 *	44.50 **
Break at large firms	20.75 **	12.15 *	4.96	19.42 **	21.66 **	21.02 **	22.35 **	45.57 **
Change of production > 0								
log employment, lagged	0.71 **	0.84 **	0.95 **	0.98 **	0.97 **	0.92 **	0.96 **	0.96 **
log production	0.97 **	0.66 **	0.19	0.28	0.00	0.34 **	0.27 *	0.03
log production, lagged	-0.65 **	-0.49 **	-0.18 *	-0.27	0.03	-0.26 *	-0.23	0.04
log labour cost	-1.27 **	-0.73 **	-0.03	-0.13	0.17	-0.47 **	-0.15	-0.14
log labour cost, lagged	0.55 **	0.48 **	0.14	0.28 *	-0.02	0.42 **	0.20	0.18
constant	-1.08 **	-0.37	0.25	0.16	0.20	-0.15	0.02	-0.08
long-run prod. elasticity	1.09 **	1.01 **	0.28	0.57	1.04	1.13 **	1.16 **	1.63 **
long-run wage elasticity	-2.53 **	-1.56 **	2.18	7.38	4.75	-0.75	1.59	0.90
Nob	574	1603	3303	3163	3680	4683	6145	5375
Mean of dep.var	4.81	4.40	4.26	4.21	4.10	3.97	3.98	3.97
R^2	0.91	0.94	0.93	0.93	0.92	0.94	0.95	0.96
SEE	0.41	0.30	0.32	0.31	0.35	0.29	0.27	0.26
Overidentification test	1.80 *	4.17 **	2.64 **	3.75 **	5.84 **	11.75 **	9.05 **	11.90 **
Change of production ≤ 0								
log employment, lagged	0.86 **	0.92 **	0.95 **	0.94 **	0.91 **	0.91 **	0.93 **	0.85 **
log production	0.68 **	0.70 **	0.76 **	0.63 **	0.94 **	0.64 **	0.50 **	0.86 **
log production, lagged	-0.58 **	-0.66 **	-0.71 **	-0.54 **	-0.86 **	-0.51 **	-0.39 *	-0.72 **
log labour cost	-0.79 **	-0.10	-0.48 **	-0.69 **	-0.41 **	-0.68 **	-0.62 **	-1.30 **
log labour cost, lagged	0.78 **	0.22	0.57 **	0.69 **	0.44 **	0.57 **	0.54 **	1.17 **
constant	0.28 *	0.26	0.12	-0.21	0.12	-0.31 *	-0.35	-0.10
long-run prod. elasticity	0.71 **	0.60 *	1.01 **	1.50 **	0.96 **	1.45 **	1.79 *	1.00 **
long-run wage elasticity	-0.08	1.46	1.82	-0.06	0.33	-1.18	-1.31	-0.87 **
Nob	3016	2723	3339	4726	5056	5362	4421	5392
Mean of dep.var	4.92	4.48	4.17	4.03	3.90	3.76	3.77	3.70
R^2	0.94	0.90	0.92	0.95	0.92	0.94	0.95	0.92
SEE	0.29	0.37	0.34	0.29	0.36	0.31	0.29	0.36
Overidentification test	4.95 **	4.71 **	1.03	3.14 **	1.58	7.11 **	10.25 **	5.68 **

Table 6: Labour demand equations: base model, manufacturing

Variable	1992	1993	1994	1995	1996	1997	1998	1999
log employment, lagged	0.88 **	0.83 **	0.95 **	0.96 **	0.98 **	0.97 **	0.93 **	0.94 **
log production	0.73 **	0.85 **	0.52 **	0.74 **	0.76 **	0.45 **	0.76 **	0.98 **
log production, lagged	-0.64 **	-0.70 **	-0.48 **	-0.69 **	-0.71 **	-0.41 **	-0.69 **	-0.92 **
log labour cost	-0.82 **	-1.11 **	-0.61 **	-0.75 **	-0.62 **	-0.50 **	-0.66 **	-0.91 **
log labour cost, lagged	0.68 **	0.77 **	0.52 **	0.68 **	0.66 **	0.53 **	0.59 **	0.84 **
constant	0.09	-0.27 *	-0.09	-0.16 **	-0.16 **	-0.03	-0.13 *	-0.06
long-run prod. elasticity	0.76 **	0.91 **	0.79 **	1.02 **	3.32	1.42 *	1.06 **	0.91 **
long-run wage elasticity	-1.10 *	-1.99 **	-1.80 *	-1.77 *	2.56	1.06	-0.93 **	-1.17 *
Nob	1175	1406	2172	2620	2882	3358	3591	3682
Mean of dep. variable	4.98	4.65	4.45	4.37	4.30	4.18	4.23	4.21
S.dev of dep. variable	1.25	1.25	1.24	1.25	1.25	1.27	1.23	1.22
R^2	0.94	0.94	0.96	0.95	0.96	0.96	0.95	0.95
SEE	0.30	0.32	0.26	0.27	0.27	0.27	0.27	0.28
Overidentification test	3.72 **	1.09	3.36 **	2.61 **	6.60 **	5.66 **	2.74 **	4.94 **
Wald test for capital cost	4.68	0.15	3.69	2.61	12.02 **	5.17	4.90	4.93
Wald test for lab=cap cost	21.96 **	31.47 **	25.60 **	18.23 **	44.89 **	16.41 **	12.45 **	27.70 **
Wald test for sectors	11.83	11.40	16.57 *	10.71	23.04 **	14.27 *	11.13	11.48
Wald test for diff'ed form	5.88	19.15 **	5.49	5.88	32.70 **	10.47 *	31.92 **	16.28 **
Wald test for quasy diff.	0.27	12.97 **	3.32	2.34	32.68 **	9.72 **	6.10 *	0.77
Break at $q_t > q_{t-1}$	13.05 *	4.74	14.40 *	19.48 **	25.79 **	17.15 **	10.94	39.95 **
Break at foreign ownership	11.48 *	2.71	9.86	8.36	21.93 **	7.23	2.13	26.29 **
Break at majority for. own.	9.61	6.66	8.52	10.98	10.43	20.61 **	4.69	9.64
Break at private own.	0.98	3.29	6.52	5.49	7.27	18.60 **	3.89	4.47
Break at 'other' own.	8.28	5.22	2.12	5.11	13.66 *	9.21	1.98	17.76 **
Break at state own.	8.61	3.45	4.42	3.69	11.28 *	4.41	2.08	5.25
Break at small firms	7.86	3.97	4.68	14.30 *	23.80 **	15.76 **	10.39	16.24 **
Break at med-sized firms	5.43	3.25	9.42	5.85	15.51 **	13.18 *	7.38	9.19
Break at large firms	3.88	5.03	13.12 *	12.06 *	20.96 **	8.71	7.41	8.40
Change of production > 0								
log employment, lagged	0.79 **	0.86 **	0.92 **	0.98 **	1.03 **	1.00 **	0.95 **	0.98 **
log production	0.65 **	0.72 **	0.39 **	0.39 *	0.46 **	0.36 **	0.64 **	0.96 **
log production, lagged	-0.44 *	-0.56 **	-0.35 **	-0.37 *	-0.42 **	-0.35 **	-0.58 **	-0.92 **
log labour cost	-0.92 **	-0.92 **	-0.59 **	-0.40 *	-0.39 **	-0.48 **	-0.49 **	-0.52 *
log labour cost, lagged	0.47 *	0.60 **	0.43 **	0.37 *	0.47 **	0.51 **	0.44 **	0.44
constant	-0.54	-0.49 **	0.00	-0.07	-0.23 *	0.00	-0.17 *	-0.29 **
long-run prod. elasticity	0.99 **	1.13 **	0.54 **	1.07	-1.03	-17.78	1.21 **	1.92
long-run wage elasticity	-2.18 *	-2.27 **	-2.10 **	-1.58	-2.36	-48.07	-0.88	-3.67
Nob	278	713	1238	1324	1316	1705	2108	1810
Mean of dep.var	4.94	4.70	4.51	4.47	4.40	4.30	4.28	4.26
R^2	0.94	0.95	0.96	0.96	0.95	0.97	0.96	0.96
SEE	0.32	0.27	0.24	0.26	0.28	0.24	0.25	0.25
Overidentification test	3.03 **	1.92 *	2.68 **	3.02 **	4.13 **	5.77 **	3.51 **	7.29 **
Change of production ≤ 0								
log employment, lagged	0.99 **	0.91 **	1.02 **	0.96 **	1.00 **	0.94 **	0.97 **	0.88 **
log production	0.72 **	0.73 **	0.81 **	0.72 **	1.12 **	0.68 **	0.52 **	0.63 **
log production, lagged	-0.70 **	-0.66 **	-0.83 **	-0.67 **	-1.11 **	-0.61 **	-0.47 **	-0.52 **
log labour cost	-0.72 **	-0.56 **	-0.42	-0.33	-0.58 **	-0.49 *	-0.77 **	-1.19 **
log labour cost, lagged	0.79 **	0.43 *	0.51	0.36	0.66 **	0.54 *	0.73 **	1.10 **
constant	0.20	-0.01	0.13	0.00	0.19	0.04	-0.13	-0.06
long-run prod. elasticity	1.40	0.80 **	0.79	1.23	3.23	1.15 **	1.57 *	0.95 **
long-run wage elasticity	4.96	-1.42	-3.54	0.54	22.82	0.72	-1.16	-0.67 **
Nob	897	693	934	1296	1566	1653	1483	1872
Mean of dep.var	5.00	4.60	4.36	4.26	4.21	4.05	4.15	4.15
R^2	0.95	0.95	0.94	0.96	0.95	0.95	0.96	0.97
SEE	0.29	0.28	0.32	0.27	0.31	0.30	0.26	0.23
Overidentification test	1.90 *	1.06	0.21	1.12	1.63	1.63	2.02 *	5.80 **

Table 7: Labour demand equations: base model, engineering

Variable	1992	1993	1994	1995	1996	1997	1998	1999
log employment, lagged	0.95 **	0.62 **	0.88 **	0.98 **	0.87 **	0.91 **	1.00 **	0.87 **
log production	0.73 **	0.89 *	0.76 **	0.56 **	0.78 **	0.74 *	0.59 **	1.04 **
log production, lagged	-0.65 **	-0.45 *	-0.64 **	-0.52 **	-0.62 **	-0.64	-0.57 **	-0.94 **
log labour cost	-0.97 *	-1.32	-1.28 **	-0.59 *	-0.49	-0.90	-0.49	-1.12 **
log labour cost, lagged	0.84 **	0.52	0.84 **	0.64 **	0.48	0.81	0.52 *	1.01 **
constant	-0.18	-1.11	-0.42	-0.08	-0.27	-0.20	-0.08	0.03
long-run prod. elasticity	1.51	1.15 **	0.98 **	1.45	1.26 **	1.16 **	-7.66	0.74 **
long-run wage elasticity	-2.50	-2.11 **	-3.47	2.39	-0.13	-0.92	-12.61	-0.80
Nob	384	451	758	895	978	1175	1281	1308
Mean of dep. variable	4.70	4.46	4.27	4.19	4.17	4.10	4.18	4.17
S.dev of dep. variable	1.18	1.20	1.23	1.25	1.24	1.24	1.23	1.24
R^2	0.93	0.91	0.91	0.95	0.94	0.95	0.95	0.94
SEE	0.32	0.40	0.38	0.28	0.31	0.27	0.29	0.30
Overidentification test	0.37	0.26	0.39	1.01	2.83 **	1.44	3.10 **	3.52 **
Wald test for capital cost	0.40	0.79	2.89	0.62	3.88	1.41	2.43	1.76
Wald test for lab=cap cost	8.59 *	2.76	6.41 *	9.59 **	13.48 **	3.05	0.83	6.91 *
Wald test for sectors	0.14	3.49	2.56	0.29	1.58	2.09	0.12	0.03
Wald test for diff'ed form	1.89	5.23	4.34	1.69	16.17 **	6.76	8.60 *	11.18 *
Wald test for quasy diff.	1.37	5.71	4.25	1.49	10.17 **	0.78	6.87 *	0.69
Break at $q_t > q_{t-1}$	0.87	2.92	3.46	6.35	0.92	12.68 *	1.43	6.43
Break at foreign ownership	1.82	5.06	2.35	4.44	4.70	14.99 *	0.33	4.83
Break at majority for. own.	0.48	1.39	1.96	2.98	3.36	8.18	0.43	0.57
Break at private own.	0.00	0.55	2.98	3.68	0.47	1.01	3.39	4.68
Break at 'other' own.	1.79	4.78	4.59	5.84	4.16	10.10	3.80	13.54 *
Break at state own.	1.96	2.92	0.16	3.42	1.18	2.44	2.87	4.79
Break at small firms	2.22	5.90	0.84	2.82	4.44	7.08	2.14	9.51
Break at med-sized firms	2.15	3.16	5.98	2.38	10.26	1.92	0.30	6.91
Break at large firms	2.35	4.18	2.43	7.49	7.37	18.28 **	3.32	3.96
Change of production > 0								
log employment, lagged	1.05 **	0.64 **	1.00 **	0.98 **	0.98 **	0.99 **	1.05 **	1.09 **
log production	0.03	1.06 *	0.20	0.49 **	0.53 **	0.70 **	0.43 **	-1.29
log production, lagged	-0.06	-0.57	-0.22	-0.47 **	-0.48 **	-0.63 **	-0.44 **	1.26
log labour cost	0.36	-1.69	-0.08	-0.57 **	-0.11	-1.10 **	-0.08	1.55
log labour cost, lagged	0.57	0.63	0.15	0.53 **	0.25	0.91 **	0.15	-1.25
constant	0.90	-1.85	0.15	-0.12	-0.09	-0.54 *	-0.06	0.23
long-run prod. elasticity	0.54	1.39 **	5.58	1.23	3.11	6.43	0.35	0.30
long-run wage elasticity	-18.48	-2.99 **	-20.22	-2.10	8.72	-15.51	-1.63	-3.32
Nob	85	261	451	535	519	642	818	724
Mean of dep.var	4.58	4.50	4.37	4.33	4.33	4.30	4.27	4.28
R^2	0.78	0.90	0.95	0.95	0.93	0.96	0.94	0.84
SEE	0.60	0.47	0.29	0.27	0.33	0.27	0.30	0.57
Overidentification test	0.47	0.17	0.72	1.49	2.97 **	1.23	1.49	0.96
Change of production ≤ 0								
log employment, lagged	0.88 **	0.75 **	1.10 **	0.92 **	0.90 **	0.82 **	0.99 **	0.88 **
log production	0.79 **	0.52 *	0.56 **	0.69 **	0.96 **	0.84 **	0.67 *	0.36
log production, lagged	-0.65 **	-0.27	-0.65 **	-0.61 **	-0.82 **	-0.65 *	-0.63	-0.25
log labour cost	-0.91 *	0.03	-1.06 **	-0.27	-0.66	-0.54 *	-1.21 *	-1.50 **
log labour cost, lagged	0.72 *	-0.22	1.12 **	0.46	0.64 *	0.61 *	1.18 **	1.24 **
constant	-0.11	-0.30	0.07	0.18	-0.20	0.02	-0.11	-0.24
long-run prod. elasticity	1.15 **	0.98 **	0.98 **	0.95 *	1.52 **	1.07 **	3.41	0.96 *
long-run wage elasticity	-1.51	-0.76	-0.62	2.33	-0.30	0.41	-2.90	-2.10
Nob	299	190	307	360	459	533	463	584
Mean of dep.var	4.73	4.40	4.12	3.98	4.00	3.85	4.00	4.04
R^2	0.94	0.90	0.90	0.94	0.95	0.93	0.94	0.96
SEE	0.30	0.38	0.40	0.31	0.30	0.31	0.34	0.24
Overidentification test	0.24	0.53	0.11	0.32	0.90	0.72	1.34	1.53

Table 8: Labour demand equations: augmented short-run model, all firms

Variable	1992	1993	1994	1995	1996	1997	1998	1999
diff of log production	0.56 **	0.54 **	0.47 **	0.41 **	0.33 **	0.35 **	0.29 **	0.35 **
diff of log labour cost	-0.80 **	-0.61 **	-0.55 **	-0.53 **	-0.37 **	-0.19 **	-0.16 *	-0.20 **
efficiency	-0.06	0.22 **	0.18 **	0.35 **	0.32 **	0.27 **	0.36 **	0.28 **
owner: state	0.02	0.04 **	0.00	0.00	-0.04 **	-0.04 **	-0.03 *	-0.02 *
owner: domestic private	0.00	0.02	0.00	0.01	-0.03 **	-0.05 **	-0.04 **	-0.04 **
owner: foreign	0.07 **	0.05 **	0.03 **	0.05 **	0.02	0.01	0.00	0.02 *
small firm	-0.02	0.01	-0.01	-0.02 **	-0.05 **	-0.02 **	-0.04 **	-0.04 **
large firm	0.05 **	-0.01	0.02	-0.01	0.00	-0.01	0.00	-0.04 *
constant	0.00	0.07	0.05	0.08 *	0.14 **	0.13 **	0.18 **	0.13 **
Nob	2791	3876	6134	7349	8099	9328	9864	10027
Mean of dep. variable	-0.21	-0.13	-0.05	-0.05	-0.04	-0.01	0.00	-0.04
S.dev of dep. variable	0.41	0.44	0.37	0.36	0.33	0.34	0.30	0.32
R^2	0.62	0.62	0.53	0.48	0.39	0.32	0.29	0.34
SEE	0.26	0.27	0.26	0.26	0.26	0.28	0.25	0.26
Overidentification test	8.72 **	3.99 **	5.75 **	5.23 **	4.40 **	3.64 **	2.83 **	7.90 **
Wald test for sectors	43.16 **	39.69 **	60.39 **	39.67 **	22.80 **	10.60	12.75	11.01
Break at $q_t > q_{t-1}$	38.08 **	0.16	1.10	15.89 **	7.90 *	4.81	0.04	11.50 **

Table 9: Labour demand equations: augmented short-run model, manufacturing

Variable	1992	1993	1994	1995	1996	1997	1998	1999
diff of log production	0.63 **	0.59 **	0.54 **	0.42 **	0.40 **	0.47 **	0.38 **	0.45 **
diff of log labour cost	-0.78 **	-0.67 **	-0.60 **	-0.39 **	-0.54 **	-0.48 **	-0.20	-0.30 **
efficiency	-0.09	0.03	0.00	0.17	0.27 **	0.19	0.19	0.01
owner: state	-0.01	0.02	-0.01	-0.04 *	-0.03 *	-0.02	0.02	-0.04
owner: domestic private	0.03	-0.01	-0.01	0.00	-0.03 **	-0.03 **	-0.04 **	-0.05 **
owner: foreign	0.02	-0.01	0.02	0.03 *	0.02	0.01	0.00	0.00
small firm	-0.08 **	-0.01	-0.02 *	-0.01	-0.04 **	-0.04 **	-0.04 **	-0.03 **
large firm	0.04	-0.01	-0.02	-0.01	0.01	-0.02 *	0.01	-0.02
constant	0.05	0.02	-0.01	0.03	0.12 **	0.11 *	0.12 *	0.03
Nob	887	1300	2059	2494	2753	3215	3455	3541
Mean of dep. variable	-0.16	-0.07	-0.03	-0.01	0.00	0.01	0.03	-0.02
S.dev of dep. variable	0.41	0.37	0.32	0.30	0.32	0.34	0.29	0.28
R^2	0.64	0.61	0.52	0.42	0.49	0.51	0.34	0.43
SEE	0.25	0.23	0.22	0.23	0.23	0.24	0.24	0.22
Overidentification test	3.80 **	1.39	2.63 **	1.87 *	5.07 **	1.72 *	1.61	3.48 **
Wald test for sectors	14.69 *	5.16	10.43	6.14	28.12 **	9.43	22.24 **	11.10
Break at $q_t > q_{t-1}$	6.81 *	0.74	1.39	0.29	7.76 *	2.48	4.11	7.35 *

Table 10: Labour demand equations: augmented short-run model, engineering

Variable	1992	1993	1994	1995	1996	1997	1998	1999
diff of log production	0.62 **	0.51 **	0.45 **	0.37 **	0.49 **	0.32 **	0.22 **	0.50 **
diff of log labour cost	-0.87 **	-0.52 **	-0.54 **	-0.54 **	-0.66 **	-0.35 **	0.40	-0.55 **
efficiency	-0.29	-0.08	0.24	0.62 *	0.19	0.56 *	0.36	0.00
owner: state	0.03	-0.01	-0.01	-0.01	-0.04	-0.08	-0.14 *	-0.04
owner: domestic private	0.00	0.02	-0.01	0.02	-0.03	-0.04 *	-0.07 **	-0.08 **
owner: foreign	0.09	0.00	0.03	0.02	0.06 **	0.04 *	0.01	-0.02
small firm	-0.09 **	-0.03	-0.06 **	-0.02	-0.04 **	-0.05 **	-0.05 *	-0.05 **
large firm	0.02	-0.04	-0.05	0.00	0.08	-0.02	0.02	-0.02
constant	-0.09	-0.06	0.12	0.19	0.08	0.26 **	0.16	0.07
Nob	291	422	721	846	937	1142	1237	1273
Mean of dep. variable	-0.17	-0.06	-0.02	0.01	0.01	0.03	0.04	-0.02
S.dev of dep. variable	0.39	0.34	0.37	0.34	0.37	0.33	0.29	0.32
R^2	0.63	0.47	0.49	0.43	0.58	0.46	0.10	0.53
SEE	0.25	0.25	0.26	0.25	0.24	0.24	0.28	0.22
Overidentification test	2.05 **	0.54	0.90	0.52	2.21 **	0.67	0.30	3.58 **
Wald test for sectors	1.12	0.93	2.58	3.19	1.54	8.02 **	3.26	0.62
Break at $q_t > q_{t-1}$	3.75	3.42	5.89	2.17	9.52 **	1.11	0.39	10.63 **

Table 11: Labour demand equations: augmented short-run model, chemical industry

Variable	1992	1993	1994	1995	1996	1997	1998	1999
diff of log production	0.82 **	0.50 **	0.43 **	0.47 **	0.36 **	0.29 *	0.65 **	0.52 **
diff of log labour cost	-0.73 **	-0.56 **	-0.83 **	-0.45 **	-0.55	-0.19	-0.73 *	-0.18
efficiency	-0.04	0.21	0.19	0.01	0.30	0.31	0.14	-0.13
owner: state	0.05	0.03	-0.01	0.02	-0.05	-0.03	0.42	-0.09
owner: domestic private	0.00	0.01	-0.03	0.06	-0.02	0.01	0.02	0.03
owner: foreign	0.06	0.01	0.05	0.13 **	0.03	0.05 *	-0.04	0.08 **
small firm	0.00	-0.03	0.00	0.02	-0.03	-0.02	-0.02	0.00
large firm	0.04	-0.04	-0.01	-0.02	-0.01	-0.05	0.02	0.00
constant	0.14	0.12	0.09	-0.10	0.14	0.13	0.11	-0.08
Nob	77	133	196	235	252	293	328	337
Mean of dep. variable	-0.08	0.02	-0.01	0.01	0.02	0.02	0.06	0.00
S.dev of dep. variable	0.42	0.37	0.26	0.25	0.26	0.22	0.38	0.26
R^2	0.70	0.63	0.51	0.44	0.41	0.27	0.75	0.52
SEE	0.24	0.24	0.19	0.19	0.21	0.19	0.19	0.18
Overidentification test	0.56	0.63	0.54	0.56	0.69	0.57	0.94	0.41
Wald test for sectors	1.61	1.02	0.48	0.86	2.20	2.17	1.53	2.30
Break at $q_t > q_{t-1}$	2.94	0.59	1.49	1.84	0.30	4.77	2.13	0.86

Table 12: Wage equations

Variable	1993	1994	1995	1996	1997	1998	1999
Gender	0.244 **	0.238 **	0.219 **	0.224 **	0.216 **	0.210 **	0.217 **
Experience/100	2.537 **	2.369 **	2.258 **	2.149 **	2.141 **	1.920 **	2.073 **
$Exp^2/10000$	-3.590 **	-3.150 **	-3.050 **	-2.841 **	-2.878 **	-2.631 **	-3.141 **
Education							
Max. 8 classes	0.112 **	0.081 **	0.051 **	0.129 **	0.171 **	0.145 **	0.114 **
Vocational	0.238 **	0.206 **	0.158 **	0.255 **	0.286 **	0.258 **	0.229 **
Secondary	0.348 **	0.311 **	0.256 **	0.343 **	0.384 **	0.367 **	0.336 **
Tertiary	0.756 **	0.692 **	0.645 **	0.765 **	0.824 **	0.824 **	0.813 **
Position							
Manager	0.670 **	0.790 **	0.691 **	0.810 **	0.776 **	0.791 **	0.747 **
Professional	0.227 **	0.232 **	0.198 **	0.244 **	0.252 **	0.240 **	0.262 **
Location							
Budapest	0.193 **	0.239 **	0.232 **	0.209 **	0.224 **	0.242 **	0.226 **
Other town	0.022 **	0.066 **	0.067 **	0.070 **	0.064 **	0.062 **	0.054 **
Constant	9.235 **	9.593 **	10.428 **	9.868 **	10.372 **	10.149 **	10.182 **
Nace 2 sect. (F)	253.090 **	255.800 **	206.000 **	201.970 **	188.800 **	179.100 **	191.580 **
Number of obs	99043	150680	152689	98502	91226	103264	104477
R^2	0.479	0.502	0.473	0.486	0.493	0.486	0.498
RMSE	0.384	0.402	0.403	0.414	0.440	0.444	0.449

Legend: All equations were estimated by OLS with heteroscedasticity consistent standard errors. One asterisk (*) indicates significance at 5% level, while two asterisks (**) indicate it at 1%. Gender: male=1, female=0; experience is measured in years, all other variables are dummies. Sectoral dummies are tested as additional regressors by joint F-test. RMSE: root mean squared error.

Table 13: Production functions with skill-specific labour

Variable	1993	1994	1995	1996	1997	1998	1999
All firms							
log(L)	1.15 **	1.12 **	1.05 **	0.98 **	0.84 **	0.96 **	0.94 **
log(K)	0.10 *	0.00	0.02	0.07	0.17 **	0.12	0.10 *
Dlog(L)	1.10 **	0.69 *	1.37 *	1.00 *	1.04 *	1.69	1.21 *
$\log(L_s/L_u)$	0.31 **	0.57 **	0.69 **	0.57 **	0.70 **	0.86 **	0.83 **
$\log(w_s^*)$	0.06	0.04	0.06	0.09 *	0.10 *	0.09 *	0.06
$\log(w_u^*)$	0.06	0.14 **	0.03	0.10 *	0.04	0.04	0.04
owner: state	-0.04	-0.29 *	-0.26 *	-0.07	-0.08	-0.09	0.13
owner: domestic private	-0.07	-0.11	-0.06	-0.09	-0.13	-0.25 *	-0.07
owner: foreign	0.49 **	0.29 *	0.14	0.28 *	0.12	0.09	0.01
Constant	-1.57 **	-0.36	-0.23	0.18	0.36	0.11	0.15
Nob	177	250	326	317	233	363	359
Mean of dep.var	5.63	5.72	5.80	5.67	5.71	5.70	5.58
S.dev of dep.var	1.12	1.20	1.10	1.23	1.38	1.41	1.53
R^2	0.82	0.78	0.68	0.80	0.79	0.76	0.75
SEE	0.50	0.59	0.69	0.59	0.68	0.74	0.81
Overidentification test	1.46	1.44	1.44	1.93 *	1.75 *	3.92 **	2.46 **
Manufacturing							
log(L)	0.89 **	0.99 **	0.92 **	0.83 **	0.84 **	0.91 **	0.83 **
log(K)	0.15 **	0.04	0.10	0.17 **	0.17 *	0.18 *	0.16 **
Dlog(L)	0.74 **	0.43	1.29	0.74	1.56 **	0.97	0.87
$\log(L_s/L_u)$	0.24 **	0.54 **	0.63 **	0.42 **	0.56 **	0.82 **	0.65 **
$\log(w_s^*)$	0.03	0.04	0.07	0.08 *	0.16 **	0.09	0.02
$\log(w_u^*)$	0.09 **	0.23 **	0.08	0.08	0.05	0.06	0.10 *
owner: state	0.03	-0.42 **	-0.45 **	-0.13	-0.30	0.13	-0.02
owner: domestic private	-0.06	-0.14	-0.02	-0.09	-0.07	-0.30 *	-0.09
owner: foreign	0.42 **	0.32 *	0.16	0.33 **	0.15	0.01	0.08
Constant	-0.39	0.26	0.22	0.40	0.39	0.06	0.33
Nob	119	177	220	207	171	265	269
Mean of dep.var	5.77	5.74	5.89	5.87	5.81	5.79	5.61
S.dev of dep.var	1.00	1.11	1.03	1.13	1.32	1.36	1.48
R^2	0.81	0.73	0.64	0.78	0.79	0.74	0.74
SEE	0.46	0.60	0.69	0.56	0.65	0.75	0.78
Overidentification test	1.16	1.39	1.47	2.33 **	2.00 *	3.56 **	2.95 **

Legend: All equations were estimated by instrumental variables method with heteroscedasticity consistent standard errors. One asterisk (*) indicates significance at 5% level, while two asterisks (**) indicate it at 1%. w_s^* stands for the opportunity wage of skilled employees, while w_u^* for that of unskilled ones. Nob: number of observations. SEE: Standard error of estimation.

Table 14: Dynamic production functions with slack, all firms

Variable	1992	1993	1994	1995	1996	1997	1998	1999
$\log(Q_{t-1})$	0.78 **	0.82 **	0.86 **	0.90 **	0.91 **	0.88 **	0.90 **	0.90 **
$\log(L_t)$	1.03 **	1.00 **	0.93 **	0.89 **	0.83 **	0.83 **	0.81 **	0.84 **
$\log(L_{t-1})$	-0.82 **	-0.86 **	-0.82 **	-0.81 **	-0.78 **	-0.74 **	-0.74 **	-0.76 **
$\log(K_t)$	0.07 **	0.13 **	0.14 **	0.11 **	0.12 **	0.12 **	0.09 **	0.09 **
$\log(K_{t-1})$	-0.07 **	-0.10 **	-0.12 **	-0.08 **	-0.10 **	-0.09 **	-0.07 **	-0.06 **
$\log(w_t)$	0.94 **	0.88 **	0.82 **	0.69 **	0.67 **	0.70 **	0.66 **	0.65 **
$\log(w_{t-1})$	-0.64 **	-0.68 **	-0.66 **	-0.61 **	-0.61 **	-0.62 **	-0.56 **	-0.55 **
constant	0.29 **	0.31 **	0.31 **	0.17 **	0.22 **	0.15 **	0.20 **	0.16 **
Long-run coefficients								
α	0.95 **	0.81 **	0.79 **	0.81 **	0.61 **	0.78 **	0.70 **	0.76 **
β	-0.01	0.13 **	0.13 **	0.28 **	0.26 **	0.27 **	0.26 **	0.26 **
ω	1.38 **	1.10 **	1.12 **	0.81 **	0.71 **	0.67 **	0.95 **	0.94 **
Slack coefficients								
α_s	0.08	0.20 **	0.14	0.07	0.22 *	0.05	0.11	0.08
β_s	0.08 *	0.00	0.01	-0.17 **	-0.14 **	-0.15 **	-0.17 **	-0.17 **
ω_s	-0.44 **	-0.22 *	-0.30 **	-0.12	-0.03	0.03	-0.30 **	-0.29 **
Nob	3807	4372	5357	6016	6298	6990	7106	6981
Mean of dep.var	4.55	4.32	4.39	4.36	4.32	4.29	4.43	4.42
S.dev of dep.var	1.39	1.42	1.47	1.54	1.56	1.58	1.55	1.57
R^2	0.92	0.92	0.93	0.94	0.94	0.94	0.95	0.95
SEE	0.40	0.40	0.40	0.36	0.37	0.38	0.35	0.33
Reset test	30.17 **	4.44 *	4.29 *	2.12	6.69 *	23.35 **	2.66	20.99 **

Legend to all dynamic production functions with slack: All equations were estimated by OLS with heteroscedasticity consistent standard errors. One asterisk (*) indicates significance at 5% level, while two asterisks (**) indicate it at 1%. α, β and ω are employment, capital and wages elasticities, while α_s, β_s and ω_s are the respective slack coefficients. Nob: number of observations. SEE: Standard error of estimation. Reset: Ramsey's Reset test for specification errors, using squared fitted values.

Table 15: Dynamic production functions with slack, manufacturing

Variable	1992	1993	1994	1995	1996	1997	1998	1999
$\log(Q_{t-1})$	0.77 **	0.83 **	0.88 **	0.89 **	0.92 **	0.87 **	0.87 **	0.90 **
$\log(L_t)$	1.04 **	1.07 **	0.95 **	0.94 **	0.90 **	0.86 **	0.81 **	0.83 **
$\log(L_{t-1})$	-0.86 **	-0.94 **	-0.87 **	-0.86 **	-0.86 **	-0.79 **	-0.75 **	-0.77 **
$\log(K_t)$	0.08 **	0.10 **	0.14 **	0.10 **	0.09 **	0.11 **	0.09 **	0.07 **
$\log(K_{t-1})$	-0.05 *	-0.07 **	-0.10 **	-0.06 **	-0.06 **	-0.05 *	-0.03	-0.03
$\log(w_t)$	1.02 **	0.92 **	0.84 **	0.74 **	0.75 **	0.74 **	0.72 **	0.65 **
$\log(w_{t-1})$	-0.69 **	-0.71 **	-0.72 **	-0.63 **	-0.70 **	-0.65 **	-0.61 **	-0.54 **
constant	0.41 **	0.31 **	0.27 **	0.27 **	0.22 **	0.23 **	0.32 **	0.18 **
Long-run coefficients								
α	0.79 **	0.77 **	0.62 **	0.67 **	0.40 **	0.54 **	0.43 **	0.62 **
β	0.10 *	0.18 **	0.32 **	0.34 **	0.42 **	0.43 **	0.44 **	0.38 **
ω	1.45 **	1.25 **	0.99 **	1.03 **	0.63 **	0.67 **	0.85 **	1.00 **
Slack coefficients								
α_s	0.24 **	0.30 **	0.32 **	0.26 **	0.50 **	0.32 **	0.38 **	0.21 *
β_s	-0.03	-0.08	-0.19 **	-0.24 **	-0.33 **	-0.32 **	-0.35 **	-0.31 **
ω_s	-0.43 **	-0.33 **	-0.15	-0.29 *	0.12	0.07	-0.13	-0.35 **
Nob	1906	2305	2886	3276	3447	3941	4044	4015
Mean of dep.var	4.56	4.43	4.52	4.53	4.50	4.45	4.58	4.59
S.dev of dep.var	1.56	1.54	1.59	1.64	1.66	1.67	1.64	1.67
R^2	0.93	0.94	0.95	0.95	0.96	0.96	0.96	0.97
SEE	0.41	0.37	0.37	0.35	0.33	0.35	0.33	0.30
Reset test	17.85 **	4.60 *	4.94 *	5.90 *	1.35	31.80 **	3.46	25.08 **

Table 16: Dynamic production functions with slack, engineering

Variable	1992	1993	1994	1995	1996	1997	1998	1999
$\log(Q_{t-1})$	0.75 **	0.77 **	0.84 **	0.86 **	0.84 **	0.87 **	0.86 **	0.85 **
$\log(L_t)$	1.11 **	0.97 **	0.83 **	0.94 **	0.92 **	0.89 **	0.75 **	0.84 **
$\log(L_{t-1})$	-0.86 **	-0.82 **	-0.71 **	-0.85 **	-0.84 **	-0.78 **	-0.69 **	-0.72 **
$\log(K_t)$	0.08	0.15 **	0.13 **	0.12 **	0.15 **	0.08 *	0.09 **	0.03
$\log(K_{t-1})$	-0.10 *	-0.09 *	-0.11 **	-0.07 **	-0.10 **	-0.05	-0.03	0.02
$\log(w_t)$	1.02 **	0.91 **	0.85 **	0.75 **	0.75 **	0.85 **	0.73 **	0.76 **
$\log(w_{t-1})$	-0.66 **	-0.62 **	-0.68 **	-0.63 **	-0.63 **	-0.72 **	-0.64 **	-0.62 **
constant	0.39 **	0.54 **	0.36 **	0.31 **	0.41 **	0.21 *	0.33 **	0.23 **
Long-run coefficients								
α	0.99 **	0.63 **	0.71 **	0.62 **	0.52 **	0.79 **	0.45 **	0.74 **
β	-0.10	0.25 **	0.18 *	0.37 **	0.29 **	0.25 **	0.46 **	0.30 **
ω	1.41 **	1.27 **	1.01 **	0.82 **	0.78 **	0.98 **	0.67 **	0.92 **
Slack coefficients								
α_s	0.13	0.34 **	0.12	0.31 **	0.40 **	0.09	0.31 *	0.09
β_s	0.18 *	-0.10	-0.04	-0.25 **	-0.14 *	-0.17 *	-0.37 **	-0.27 **
ω_s	-0.39	-0.35 **	-0.16	-0.07	-0.03	-0.13	0.06	-0.16
Nob	641	784	1012	1146	1201	1418	1444	1427
Mean of dep.var	4.33	4.34	4.43	4.44	4.48	4.46	4.66	4.74
S.dev of dep.var	1.40	1.39	1.47	1.54	1.59	1.64	1.62	1.65
R^2	0.89	0.92	0.92	0.94	0.95	0.96	0.95	0.97
SEE	0.46	0.39	0.41	0.38	0.36	0.34	0.37	0.31
Reset test	3.55	9.19 **	14.08 **	0.32	0.00	11.06 **	1.84	39.55 **