SHORT-RUN EMPLOYMENT BEHAVIOUR OF THE LABOUR-MANAGED FIRM : EVIDENCE FROM YUGOSLAVIA 1/

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1. INTRODUCTION

In a recent survey, Estrin and Bartlett (1980) argue that one of the weaknesses of the existing empirical literature on the Yugoslav labour market is its failure to directly test the central predictions of theoretical models of labour-managed firms (LMF's). Rather, the focus has been on indirect issues such as income dispersion and labour mobility.

This paper considers one of the direct theoretical predictions, namely how the enterprise adjusts its employment level in response to short-run variations in demand. Short-run employment functions are derived and then estimated at the industry and aggregate levels using Yugoslav quarterly data. The results are used first of all to examine competing LMF models, secondly to look for any effects of the institutional reforms that took place in 1972 and, finally, to make comparisons with a capitalist economy, the U.K.

2. SPECIFICATIONS FOR SHORT-RUN EMPLOYMENT FUNCTIONS

Assuming price taking behaviour by firms, the simple single variable input, single output Illyrian model posits that the LMF aims to

$$\max_{L} \; y = \frac{PQ-F}{L} \qquad \text{subject to} \quad Q = Q(L,\bar{K})$$

where L is the number of workers, y income per worker, P product price, Q output, F fixed costs and $\bar{K}$ the capital stock which is fixed in the short run.

Maximisation requires $P \frac{\partial Q}{\partial L} = \frac{PQ-F}{L}$.

Lack of data on the capital stock forces us to adopt the usual practice of using the constant and a time trend, T, to pick up the effect of the capital stock and technical progress on employment. If fixed costs were constant the following specification would be appropriate, at time t

$$L_t = f(P_t, T) \qquad (1)$$

Clearly an assumption of constant fixed costs cannot be justified. Instead it is assumed that these costs tend to vary uniformly across industries (reflecting general inflation and levels of taxation) and therefore a more appropriate right-hand side term is the ratio of the product price in industry i to average product prices, RP_t. This gives

$$L_t = f(RP_t, T) \qquad (2)$$

This specification assumes that employment is adjusted instantaneously to changes in RP_t. More realistic is to distinguish desired employment, L^*, from actual employment, L, and replace (2) by

$$L^*_t = f(RP_t, T) \qquad (3)$$

Due to costs in adjusting employment [2/] actual employment may deviate from desired employment in the short-run. Ideally these costs should be used to model the adjustment of L to L^* but this is obviously difficult in practice. Instead a Koyck partial adjustment mechanism is assumed:

$$\frac{L_t}{L_{t-1}} = \left(\frac{L^*_t}{L_{t-1}}\right)^{\lambda} \qquad 0 < \lambda \leq 1 \qquad (4)$$

where λ is the speed of adjustment of actual to desired employment.

Combining (4) with a multiplicative form of (3) and taking logs gives the following estimating equation:

$$\text{Log } L_t = \alpha_0 + \alpha_1 \log RP_t + \alpha_2 \log L_{t-1} + \alpha_3 T \qquad (5)$$

A priori we expect $\alpha_1 < 0$ [3/], $0 < \alpha_2 < 1$, α_3 [4/] ?

The Illyrian model is rejected by Horvat (1972) who argues that the LMF does not aim to maximise income per worker. A more plausible assumption is that the enterprise determines the level of personal incomes, $\hat{y}$, in advance on the basis of factors such as the disposable income of the enterprise, the cost of living and incomes elsewhere. Having done so he asserts that it is then rational for them to maximise total enterprise profits and so, in the short run, the LMF behaves exactly like a profit maximising capitalist firm.

The objective function of a profit maximiser is:

$$\max_{L} \Pi = PQ - \hat{y}L \quad \text{subject to} \quad Q = Q(L,\bar{K})$$

where Π is enterprise profit.

Maximisation requires $\hat{y}/p = \frac{\partial Q}{\partial L}$

Again distinguishing actual and desired employment we can write:

$$L_t^* = g((\hat{y}/p)_t, T) \qquad (6)$$

Applying the Koyck adjustment mechanism, (4), and taking logs yields the following estimating equation:

$$\log L_t = \beta_0 + \beta_1 \log (\hat{y}/p)_t + \beta_2 \log L_{t-1} + \beta_3 T \qquad (7)$$

with expected signs $\beta_1 < 0$, $0 < \beta_2 < 1$, $\beta_3 > 0$.

Both of the above employment functions (5) and (7), are neo-classical in the sense that the firm is assumed to be able to sell as much as it wants at the exogenously given prices. Thus the direction of causality is from prices to quantities. In discussing the capitalist employment function literature Hazledine (1979) points out that there have been few attempts to test purely price dependent employment functions and these (Bechling (1965), Hazledine (1979a)) do not find sensible results. The standard assumption in single equation models is that the firm takes output as exogenous and minimises costs.

If we similarly assume that the LMF takes output as exogenous then the marginal product of labour will be zero for any employment above that necessary to produce the given output level. Thus whether LMF's maximise income per worker or profit the response to variations in demand will be identical as long as they are constrained in what they can sell - they simply adjust employment passively as output varies. Using the same arguments as above we can write:

$$L_t^* = h(Q_t, T) \qquad (8)$$

and hence the estimating equation:

$$\log L_t = \gamma_0 + \gamma_1 \log Q_t + \gamma_2 \log L_{t-1} + \gamma_3 T \qquad (9)$$

with expected signs $\gamma_1 > 0$, $0 < \gamma_2 < 1$, $\gamma_3 < 0$. This is the familiar Ball and St.Cyr (1966) specification which has been estimated on a wide variety of data for capitalist economies with broadly similar results.

3. YUGOSLAV SELF-MANAGEMENT 1945-75

Following the Second World War the Yugoslavs implemented centralisation and collectivisation on the Soviet model with rigid administrative planning. Increasing criticism of this model resulted in a transition from 1952 to a system of partial self-management and decentralisation. However, according to Milenkovitch (1971) it is only after the 1965 economic reforms[5/] that the question of how a Yugoslav enterprise responds to economic signals becomes important. Before 1965 the Yugoslav firm was subject to a "maze of interventions". This period of what Stephen (1976) refers to as "maximal self-management" extended up to 1972, when mounting inflation and unemployment induced the government to reimpose a degree of administrative control over the allocation of the surplus between wages and investment and over the distribution of the wage fund between employees. This suggests that models of LMF behaviour should perform best in the period 1965 to 1972; after 1972 the responses of firms to economic signals will be less clear or perhaps less rapid. This hypothesis was tested by regressing the equations separately for the periods up to 1972 Q1 and from 1972 Q2 to 1975 Q4.

4. EMPIRICAL RESULTS

The employment functions were estimated at the industry level using quarterly data on nineteen industry branches from 1967 Q2 to 1975 Q4. No industry data was available prior to 1967 and a change in the system of industrial classification prevented the use of post-1975 data.

The results for the Illyrian specification (5) are presented in Table 1. Although the fit of the equation is generally good the relative price term performs very badly. A negative coefficient was expected but this only occurred in five cases and in none of these did it approach signifcance. To test the hypothesis that firms would be more likely to behave in the manner predicted by the Illyrian model during the period of "maximal self-management" the regressions were run using data from 1967 Q2 to 1972 Q1. This did not produce any improvement. The Illyrian model may be defended by arguing, firstly, that with more than one variable input the perverse short-run membership response might not occur. However, this requires that the other input be highly complementary to labour and that its marginal product does not decline rapidly. Secondly our inability to measure fixed costs might be an important weakness. On the other hand the results are consistent with the failure, noted above, of purely price dependent employment functions in other countries.

This last point also applied to the estimates from the profit-maximising specification (7) over the period 1967 Q2 to 1975 Q4 reported in Table 2 since real income was insignificant in fourteen out of the seventeen industries. When repeated for the period 1967 Q2 to 1972 Q1 it became insignificant in all cases. Given the failure of this

specification in capitalist countries as well, we cannot conclude that the LMF behaves differently to a profit maximising capitalist firm but only that the perfectly competitive neoclassical model is inappropriate.

Tables 3, 4 and 5 give the results of the Ball and St.Cyr specification (9), estimated over the periods 1967 Q2 - 1975 Q4, 1967 Q2 - 1971 Q1 and 1972 Q2 - 1975 Q4 respectively. Leaving aside the time trend for the moment, the results are more promising. For the period as a whole fourteen of the coefficients on current output, Q_t, are correly signed with four significant at the 95% level and a further two at 90%. Taking the two subperiods separately it can be seen that there are six significant (at the 95% level) coefficients on Q_t in the first period but only four remained significant in the second. In addition, F tests revealed structural breaks at 1972 Q2 in nine of the industries. Thus we have some tentative support for the argument above that firms were less likely to behave in the manner suggested by our theory after the 1972 Reforms. The remainder of the analysis therefore concentrates on the period 1967 Q2 to 1972 Q1 (Table 4).

It can be seen in Table 4 that the time trend is significantly positive in ten industries and negative in two, whereas our a priori expectation was a negative sign. Mencinger (1980) argues that there has been an autonomous growth in employment in Yugoslav independent of fluctuations in output growth and that :

> "this development has been an apparent (conscious or unconscious) way of solving the unemployment problem aggravated by the restricted employment abroad. In this way both registered and hidden unemployment have been partially transformed to 'internal' underemployment in the form of employed but underutilised workers...".

Although at an empirical level this might explain the positive time trend there remains the theoretical problem of how this process can be reconciled with the assumption that the firm maximises income per worker or profits. Further research is necessary here.

In nine industries the coefficient on current output is significant at the 90% level at least. The size of the short-run employment-output elasticity varies considerably across industries, from 0.051 in chemicals to 0.317 in Building Materials. The coefficient on the lagged employment term in these industries takes a value of between zero and unity in seven cases as was expected a priori. The implied values of the adjustment speed parameter, λ, indicate that speeds were fairly low, with less than one third of the adjustment typically occurring in the first quarter. These results support the view that adjustment costs prevent instantaneous adjustment of actual to desired employment. For those industries where current output is insignificant the conclusion to be drawn is that employment does not respond to current output.

We now turn to compare these results with estimates of the Ball and St.Cyr model for a capitalist economy, the U.K. The only industry level study is that by Wilson (1978) which uses annual data over the period 1948-1970. As this is a different period from ours the following

conclusions must be treated with caution.

Table 6 reproduces Wilson's results for those industry groupings most comparable to the Yugoslav industry branches. Examination of Tables 4 and 6 reveals wide differences between the two countries. Firstly, with only one exception the time trends are negative in the U.K. equations and almost all are significantly so. This is consistent with estimates from other countries and, as noted above, the positive coefficients in the Yugoslav equations require further analysis. Secondly, the current output term only fails to achieve significance at the 95% level in three U.K. industries whereas for Yugoslavia the figure is thirteen. Note also that in five of the six industries where Q_t was significant (at the 90% level) in both countries the long-run output-employment elasticity is greater for the U.K.

A similar picture emerges from a comparison between the two countries at a more aggregate level. Table 7 presents the results of estimating the Ball and St.Cyr model for Yugoslav Manufacturing, Mining and Quarrying in aggregate over the periods 1965 Q2 to 1974 Q4 and 1965 Q2 to 1972 Q1. Also shown are Morgan's (1979) estimates for U.K. manufacturing 1963 Q1 to 1976 Q2. These results are exactly as the industry level estimates would lead us to expect with the Yugoslav equations displaying a positive time trend and insignificant coefficient on current output.

It was noted above that the Ball and St.Cyr equation has been estimated for a wide variety of capitalist countries in addition to the U.K. with broadly similar results. Its poor performance with Yugoslav data is therefore an important finding and suggests that the short-run employment behaviour of Yugoslav LMF's is significantly different from capitalist firms.

Earlier it was suggested that the simple Illyrian firm would respond identically to a capitalist firm when facing a quantity constraint. However it can be shown that this might not be the case if the LMF has more than one variable input:

$$\text{Suppose the LMF aims to maximise}_{L,K} \quad y = \frac{P\bar{Q} - rK(\bar{Q},L)}{L}$$

where K is another variable input, r its price, and $\bar{Q}$ the exogenously given level of output. Maximisation with respect to L yields

$$\frac{\partial L}{\partial \bar{Q}} = \frac{LrK_{L\bar{Q}} + P - rK_{\bar{Q}}}{L^2 \quad \frac{\partial^2 y}{\partial L^2}}$$

Since, under normal assumptions $\partial^2 y/\partial L^2 < 0$, $K_{\bar{Q}} > 0$ and $K_{L\bar{Q}}$? the sign of $dL/d\bar{Q}$ is ambiguous.

We could similarly rationalise the failure of the Ball and St.Cyr specification in terms of a variable hours model of the LMF. Suppose, for example, the enterprise is made up of identical members aiming to maximise the utility function $u = y - \beta(\ell)$, where ℓ is hours worked per member.

Let $\ell = \bar{L}/N$ where $\bar{L}$ is the amount of man-hours needed to produce the exogenously given output level, $\bar{Q}$, and N represents the number of members. The utility function can then be rewritten as

$$U = \frac{P\bar{Q}(\bar{L}) - F}{N} - \beta\left(\frac{\bar{L}}{N}\right)$$

Maximisation with respect to N yields

$$\frac{\partial u}{\partial N} = -\frac{(P\bar{Q}(\bar{L}) - F)}{N^2} + \beta'\left(\frac{\bar{L}}{N}\right) \cdot \frac{\bar{L}}{N^2} = 0$$

The membership response to a change in $\bar{L}$, which is equivalent to the response to a change in $\bar{Q}$, is given by:

$$\frac{dN}{d\bar{L}} = \frac{-P\bar{Q}_{\bar{L}} + \beta'\left(\frac{\bar{L}}{N}\right) + \beta''\left(\frac{\bar{L}}{N}\right) \cdot \frac{\bar{L}}{N}}{\beta''\left(\frac{\bar{L}}{N}\right) \cdot \frac{\bar{L}^2}{N^2}}$$

Under normal assumptions $\beta'\left(\frac{\bar{L}}{N}\right)$ and $\beta''\left(\frac{\bar{L}}{N}\right)$ are positive and hence, once again, the sign of the membership response is ambiguous.

Both of these models assume individuals maximise their own self-interest.[6/] Alternatively, solidarity among the membership would provide another explanation of the absence of the output-employment relationship which characterises capitalist economies. A further possibility is that various legal regulations restrict the degree to which enterprises can vary employment in the short run.[7/] Investigation of these and other explanations at the empirical level is an important area of future research.

5. CONCLUSIONS

The paper began by considering the short-run employment predictions of the simple Illyrian and profit-maximising models in which firms are assumed to be price-takers. Employment functions were derived and estimated using Yugoslav quarterly industry level data over the period 1967 to 1975. The results suggested that these models cannot explain the behaviour of LMF's in Yugoslavia. Under the alternative assumption of an exogenously given output level the familiar Ball and St.Cyr estimating equation can be derived from income-per-worker maximising as well as profit maximising objective functions. This specification gave slightly better results and provided some tentative support for the hypothesis that the 1972 institutional reforms had a significant effect on enterprise behaviour. An important finding was that the Ball and St.Cyr specification performed very poorly on Yugoslav data when compared to the U.K. and a wide variety of other capitalist economies. This suggests that the short-run employment behaviour of the Yugoslav LMF is significantly different from capitalist firms. In particular, employment in Yugoslavia seems to be less responsive to variations in current output. Some possible explanations of this result were briefly suggested but this remains an important area for future work.

TABLE 1 - Employment Function Estimates for Yugoslavia

Dependent Variable log L_t
Sample 1967 Q2 - 1975 Q4

Estimation : OLS
t statistics in parenthesis

INDUSTRY BRANCH	CONSTANT	TREND	log RP_t	log L_{t-1}	λ	θ^{α}	R^2	DW
Electricity	2.040 (4.68)	0.006 (4.11)	0.149 (3.55)	0.329 (2.24)	.671	.222	.968	1.801
Coal & Coke	3.152 (3.33)	-0.004 (-1.76)	0.229 (1.85)	0.355 (1.96)	.645	.355	.402	2.098
Crude Petroleum	0.744 (3.06)	0.009 (2.30)	-0.039 (-0.7)	0.467 (2.54)	.533	-.073	.926	2.04
Ferrous Metallurgy	3.595 (5.42)	0.007 (2.62)	0.248 (1.38)	-0.029 (-0.16)	1.029	.241	.769	1.919
Non-Ferrous Metallurgy	2.366 (3.81)	0.005 (3.38)	0.006 (0.06)	0.307 (1.72)	.693	.009	.764	2.024
Non-Metals	0.962 (2.42)	0.003 (3.22)	0.09 (1.08)	0.672 (5.38)	.328	.274	.961	2.209
Metal Products	1.52 (3.11)	0.005 (3.33)	0.032 (0.64)	0.665 (6.28)	.335	.096	.995	1.903
Shipbuilding								
Electrical Engineering	0.865 (2.16)	0.006 (3.01)	0.101 (1.16)	0.695 (6.17)	.305	.331	.992	1.919
Chemicals	2.241 (4.07)	0.009 (4.22)	0.016 (0.42)	0.319 (1.92)	.681	.023	.985	2.113
Building Materials	3.693 (5.48)	0.006 (3.64)	-0.053 (-0.26)	0.01 (0.06)	.09	-.589	.456	1.906
Wood	1.631 (3.07)	0.004 (3.77)	-0.043 (-1.05)	0.6 (4.78)	.4	-.107	.977	2.295
Paper	1.807 (3.79)	0.007 (3.79)	0.017 (0.95)	0.297 (1.63)	.703	.024	.887	2.028
Textiles	0.755 (3.31)	0.003 (5.12)	0.076 (2.01)	0.818 (16.74)	.192	.396	.998	2.102
Leather	0.716 (2.51)	0.004 (2.93)	-0.005 (-0.11)	0.723 (7.04)	.277	-.018	.987	2.645
Rubber Products	0.646 (2.56)	0.005 (2.93)	0.022 (0.3)	0.626 (4.57)	.374	.059	.989	1.641
Food Manuf.	2.446 (3.52)	0.01 (3.99)	-0.118 (-0.47)	0.312 (1.7)	.688	-.172	.934	1.724
Printing & Publishing								
Tobacco	1.817 (3.57)	0.002 (1.89)	0.018 (0.24)	0.295 (1.62)	.705	.026	.264	1.831

α θ is the implied long run employment-relative price elasticity, calculated as: $\frac{\text{Coefficient on logged relative price}}{\lambda}$

TABLE 2 - Employment Function Estimates for Yugoslavia

Dependent Variable $\log L_t$

Sample 1967 Q2 - 1975 Q4

Estimation = OLS
t statistics in parentheses

INDUSTRY BRANCH	CONSTANT	TREND	$\log(\hat{y}/p_t)$	$\log L_{t-1}$	λ	ϕ [b]	R^2	DW
Electricity	2.079 (4.35)	0.006 (4.16)	-0.055 (-2.31)	0.357 (2.19)	.643	-.086	0.962	2.063
Coal & Coke	2.795 (2.33)	-0.000 (-0.09)	-0.092 (-0.93)	0.412 (1.93)	.588	-.156	0.355	2.256
Crude Petroleum	0.550 (1.98)	0.009 (2.98)	0.059 (1.39)	0.458 (2.77)	.542	.109	0.929	1.944
Ferrous Metallurgy	3.501 (4.57)	0.010 (5.03)	-0.077 (-0.74)	-0.015 (-0.08)	1.015	-.076	0.759	1.995
Non-Ferrous Metallurgy	2.348 (3.12)	0.005 (2.97)	0.003 (0.04)	0.309 (1.65)	.691	.004	0.764	2.007
Non-Metals	1.067 (2.32)	0.003 (2.22)	-0.013 (-0.31)	0.658 (4.84)	.342	-.038	0.960	2.26
Metal Products	1.607 (3.22)	0.004 (3.24)	0.019 (0.70)	0.643 (5.80)	.357	.053	0.995	2.101
Shipbuilding								
Electrical Engineering	1.007 (2.78)	0.003 (1.62)	0.077 (1.92)	0.675 (6.19)	.325	.237	0.992	1.862
Chemicals	2.226 (4.04)	0.009 (4.12)	0.011 (0.43)	0.317 (1.91)	.683	.016	0.985	2.04
Building Materials	4.332 (5.95)	0.010 (3.56)	-0.330 (-1.85)	0.015 (0.09)	.985	-.335	0.509	1.881
Wood	1.213 (3.24)	0.003 (2.51)	0.013 (0.31)	0.692 (7.70)	.308	.042	0.976	2.494
Paper	1.940 (3.72)	0.007 (3.75)	-0.014 (-0.91)	0.295 (1.61)	.705	-.02	0.886	2.03
Textiles	0.846 (3.23)	0.002 (2.70)	0.008 (0.45)	0.807 (14.46)	.193	.041	0.997	2.120
Leather	0.890 (3.36)	0.007 (3.75)	-0.086 (-2.07)	0.694 (7.31)	.306	-.281	0.988	2.385
Rubber Products	0.585 (2.49)	0.005 (2.44)	0.034 (1.20)	0.631 (4.93)	.369	.092	0.990	1.845
Food Manuf.	3.212 (5.09)	0.013 (5.09)	-0.222 (-2.36)	0.256 (1.60)	.744	-.298	0.944	1.706
Printing & Publishing								
Tobacco	1.976 (3.79)	0.003 (2.64)	-0.053 (-1.04)	0.280 (1.56)	.72	-.074	0.287	1.841

[b] ϕ is the implied long run employment-real income elasticity, calculated as : $\frac{\text{Coefficient on lagged real income}}{\lambda}$

TABLE 3 - Employment Function Estimates for Yugoslavia

Dependant Variable $\log L_t$ Estimation = OLS

Sample 1967 Q2 - 1975 Q4 t statistics in parenthesis

INDUSTRY BRANCH	CONSTANT	TREND	$\log Q_t$	$\log L_{t-1}$	λ	η [c]	R^2	DW
Electricity	1.994 (4.13)	0.008 (4.86)	-0.087 (-2.18)	0.40 (2.32)	.6	-.145	0.961	2.036
Coal & Coke	1.395 (1.96)	-0.001 (-1.17)	0.159 (1.66)	0.523 (3.51)	.477	.333	0.391	2.45
Crude Petroleum	0.590 (1.70	0.005 (1.57)	0.034 (0.64)	0.515 (3.18)	.485	.153	0.926	2.065
Ferrous Metallurgy	3.000 (4.44)	0.008 (1.76)	0.068 (0.41)	0.014 (0.07)	.986	.069	0.757	1.984
Non-Ferrous Metallurgy	2.780 (3.76)	0.007 (2.54)	-0.141 (-0.10)	0.299 (1.70)	.701	-.201	0.771	2.010
Non-Metals	0.962 (2.25)	0.003 (1.78)	0.014 (0.26)	0.673 (5.30)	.327	.043	0.960	2.312
Metal Products	1.500 (3.02)	0.004 (3.28)	-0.008 (-0.40)	0.678 (6.17)	.322	-.025	0.995	1.753
Shipbuilding	1.044 (2.73)	0.005 (3.11)	-0.091 (-2.91)	0.656 (4.33)	.344	-.265	0.965	2.096
Electrical Engineering	0.983 (2.69)	0.003 (1.70)	0.064 (1.80)	0.668 (6.07)	.332	.193	0.992	1.728
Chemicals	2.098 (3.88)	0.007 (2.85)	0.052 (1.52)	0.344 (2.13)	.656	.079	0.986	2.112
Building Materials	3.125 (10.49)	-0.001 (-0.96)	0.283 (11.51)	-0.011 (-0.14)	1.011	.28	0.896	1.125
Wood	0.966 (2.36)	0.002 (1.13)	0.085 (1.37)	0.700 (7.99)	.3	.283	0.978	2.706
Paper	1.442 (2.40)	0.005 (1.85)	0.055 (0.50)	0.372 (2.11)	.628	.088	0.884	2.054
Textiles	0.594 (2.73)	0.001 (1.47)	0.088 (3.34)	0.807 (18.53)	.193	.456	0.998	2.194
Leather	0.593 (1.85)	0.004 (2.35)	0.040 (0.62)	0.720 (7.22)	.28	.143	0.987	2.666
Rubber Products	0.524 (2.44)	0.004 (2.00)	0.108 (2.61)	0.561 (4.69)	.439	.246	0.991	1.725
Food Manuf.	2.164 (4.34)	0.007 (3.48)	0.196 (4.39)	0.245 (1.80)	.755	.26	0.959	1.598
Printing & Publishing	1.826 (3.58)	0.006 (3.41)	-0.009 (-0.26)	0.418 (2.56)	.582	-.015	0.979	2.153
Tobacco	1.825 (3.89)	0.001 (1.73)	0.110 (2.02)	0.132 (0.70)	.868	.127	0.348	1.722

c η is the implied long run employment-output elasticity, calculated as: $\frac{\text{Coefficient on logged output}}{\lambda}$

TABLE 4 - Employment Function Estimates for Yugoslavia

Dependent Variable : $\log L_t$ — Estimation : OLS

Sample 1967 Q2 - 1972 Q1 — t statistics in parenthesis

INDUSTRY BRANCH	CONSTANT	TREND	$\log Q_t$	$\log L_{t-1}$	λ	η	R^2	DW
Electricity	1.096 (1.99)	0.006 (2.53)	-0.098 (-1.58)	0.684 (3.59)	.316	-.31	0.926	1.324
Coal & Coke	0.609 (1.49)	-0.000 (-0.52)	0.065 (2.29)	0.793 (8.51)	.207	.314	0.949	1.834
Crude Petroleum	0.774 (2.36)	0.014 (2.12)	-0.169 (-1.57)	0.576 (2.66)	.424	-.399	0.966	1.419
Ferrous Metallurgy	0.602 (1.96)	0.002 (1.84)	0.014 (0.42)	0.786 (8.49)	.214	.065	0.983	2.348
Non-Ferrous Metallurgy	1.427 (1.97)	0.002 (1.54)	0.007 (0.16)	0.589 (2.96)	.411	.017	0.956	1.665
Non-Metals	0.674 (2.12)	0.000 (0.07)	0.089 (1.93)	0.721 (7.14)	.279	.319	0.964	1.554
Metal Products	1.718 (3.67)	0.006 (4.47)	-0.026 (-1.18)	0.623 (6.02)	.377	-.069	0.993	2.245
Shipbuilding	1.426 (3.37)	0.007 (3.47)	-0.039 (-2.26)	0.427 (2.45)	.573	-.068	0.984	2.387
Electrical Engineering	1.018 (2.57)	0.005 (2.03)	0.048 (0.94)	0.648 (5.19)	.352	.136	0.988	1.752
Chemicals	1.031 (3.07)	0.003 (1.70)	0.051 (2.98)	0.664 (6.52)	.336	.152	0.996	1.420
Building Materials	3.689 (15.88)	-0.004 (-4.72)	0.317 (16.78)	-0.122 (-2.12)	1.222	.282	0.949	2.147
Wood	0.678 (1.79)	-0.002 (-1.40)	0.241 (3.18)	0.688 (7.62)	.312	.772	0.954	1.636
Paper	1.338 (2.20)	0.005 (1.96)	-0.002 (-0.05)	0.483 (2.04)	.517	-.004	0.970	1.406
Textiles	0.331 (0.873)	0.001 (0.97)	0.080 (1.99)	0.852 (8.88)	.148	.541	0.989	2.205
Leather	0.250 (0.55)	0.002 (1.59)	0.045 (0.61)	0.841 (4.42)	.159	.283	0.971	2.065
Rubber Products	0.805 (2.39)	0.004 (2.12)	0.124 (2.10)	0.415 (2.08)	.585	.212	0.977	1.223
Food Manuf.	3.56 (6.38)	0.007 (3.89)	0.205 (5.75)	-0.051 (-0.35)	1.051	.195	0.916	1.838
Printing & Publishing	2.509 (2.84)	0.011 (2.92)	-0.077 (-1.79)	0.213 (0.71)	.787	-.098	0.989	1.714
Tobacco	3.886 (7.54)	-0.005 (-5.03)	0.115 (4.56)	-0.421 (-2.35)	1.421	.081	0.749	2.103

TABLE 5 - Employment Function Estimates for Yugoslavia

Dependent Variable : log L_t
Sample 1972 Q2 - 1975 Q4

Estimation : OLS
t statistics in parenthesis

INDUSTRY BRANCH	CONSTANT	TREND	log Q_t	log L_{t-1}	λ	η	R^2	DW
Electricity	3.204 (3.78)	.013 (3.89)	-.073 (-1.04)	-.063 (-0.20)	1.063	-.069	0.855	2.276
Coal & Coke	1.780 (1.18)	.004 (0.78)	0.212 (0.84)	0.243 (0.85)	.757	.28	0.298	2.317
Crude Petroleum	2.931 (2.29)	.019 (2.27)	-0.237 (-0.85)	-0.241 (-0.69)	1.241	-.191	0.570	1.954
Ferrous Metallurgy	1.871 (1.09)	.005 (0.39)	0.494 (0.86)	-0.106 (-0.36)	1.106	.447	0.37	1.923
Non-Ferrous Metallurgy	3.020 (2.43)	.015 (2.25)	-0.193 (-0.67)	0.113 (0.39)	.887	-.218	0.566	2.045
Non Metals	1.717 (1.85)	.009 (1.82)	-0.149 (-0.84)	0.517 (1.88)	.483	-.308	0.81	1.830
Metal Products	1.281 (1.17)	.005 (2.13)	-.064 (-1.33)	0.741 (3.05)	.259	-.247	0.98	2.00
Shipbuilding	1.189 (1.82)	.007 (1.59)	-0.149 (-1.53)	0.642 (2.36)	.358	-.416	0.88	2.15
Electrical Engineering	0.600 (0.78)	.003 (0.83)	0.126 (1.73)	0.690 (3.41)	.31	.406	0.96	2.294
Chemicals	2.553 (2.56)	.010 (1.98)	0.102 (0.96)	0.127 (0.44)	.873	.117	0.902	1.900
Building Materials	2.354 (4.32)	.004 (2.11)	0.281 (7.00)	.066 (0.50)	.934	0.301	0.83	2.20
Wood	4.551 (4.06)	.012 (3.65)	0.142 (1.32)	-0.261 (-0.85)	1.261	.113	0.932	2.170
Paper	0.286 (0.22)	.008 (1.25)	0.330 (1.16)	0.254 (0.89)	.746	.442	0.704	2.078
Textiles	1.647 (1.13)	.003 (0.85)	0.060 (1.45)	0.603 (1.93)	.397	.151	0.99	2.215
Leather	3.776 (3.85)	.020 (3.72)	-0.15 (-1.25)	-0.227 (-0.77)	1.227	-.122	0.94	2.097
Rubber Products	1.80 (2.182)	.006 (1.66)	0.169 (1.81)	0.189 (0.67)	.831	.203	0.938	2.110
Food Manuf.	2.893 (3.20)	.010 (2.45)	0.250 (2.63)	-.002 (-.007)	1.002	.25	0.835	2.374
Printing & Publishing	3.604 (2.73)	.012 (3.34)	-.060 (-0.54)	-0.115 (-0.35)	1.115	-.054	0.89	2.127
Tobacco	2.497 (3.24)	.007 (2.01)	0.192 (1.85)	-0.438 (-1.35)	.808	.238	0.46	1.744

TABLE 6 - Employment Function Estimates for U.K. Industries

Estimating Equation : $\log \frac{L_t}{L_{t-1}} = a_0 + a_1 \log Q_t + a_2 \log L_{t-1} + a_3 t$

Data : Annual Data 1948-1970

INDUSTRY BRANCH	CONSTANT	TREND	$\log Q_t$	$\log L_{t-1}$	λ	η	R^2	DW
Electricity	-2.599*	-0.041*	.542*	-.105	.105	5.162	.767	2.525
Coal Mining	-1.573*	-.002	.417*	-.217*	.217	1.916	.824	1.561
Oil & Nat.Gas	2.054*	-.003	-.07	-.394*	.394	-.178	.338	2.305
Iron & Steel	-.29	-.006*	.313*	-.338*	.338	.926	.666	.934
Non-Ferrous Metals	-1.203	-.007*	.554*	-.527*	.527	1.051	.639	1.627
Metal Goods	-.424	-.002	.335*	-.336*	.336	.997	.743	1.058
Shipbuilding	-.536	-.006*	.341*	-.287*	.287	1.188	.596	1.412
Electrical Engineering	-3.753*	-.021*	.511*	-.048	.483	1.058	.518	1.443
Chemicals	-.826	-.011*	.193*	-.082	.082	2.347	.441	1.941
Construction	-.718	-.01	.462*	-.42*	.42	1.102	.242	1.296
Timber & Furniture	1.553	-.007*	.275*	.587*	.587	.469	.739	1.591
Paper & Board	-.519	-.007*	.266*	-.223*	.223	1.193	.547	3.018
Textile Fibres	.909*	-.038*	.461*	-.71*	.71	.648	.681	1.114
Leather etc.	-.275	-.012*	.502*	-.491*	.491	1.022	.713	2.401
Rubber	.422	-.008*	.43*	-.617*	.617	.696	.795	1.003
Food Processing	.768	-.002	.099	-.255*	.255	.388	.739	1.584
Printing & Publishing	.635	-.005*	.232*	-.367*	.367	.632	.691	1.685
Tobacco	1.548	.001	-.09	-.266	.276	-.326	.157	1.421

* Coefficient Significant at 95% Level

Source: Wilson (1978).

TABLE 7 - Aggregate Employment Function Estimates for Yugoslavia and the U.K.

	CONSTANT	TREND	log Q_t	log L_{t-1}	λ	η	R^2
Yugoslavia[1] 1965 Q2-1975 Q4	.642 (1.92)	.001 (2.27)	-.018 (-.42)	.922 (16.04)	.078	-.231	.992
1965 Q2-1972 Q1	.204 (.25)	.002 (1.77)	-.045 (-.57)	.995 (6.79)	.005	- 9	.96
U.K.[2] 1963 Q1-1976 Q2	1.57 (3.8)	-.002 (-6.5)	.158 (5.6)	.75 (14.4)	.25	.632	.981

t statistics in parenthesis

Source: U.K. Results : Morgan (1979)

1 Mining, manufacturing and quarrying

2 Manufacturing industry.

Footnotes

1/ Thanks are due to Norman Ireland, Ben Knight and Peter Law for their valuable comments.

2/ Costs involved in hiring, firing, training etc. For a model with training costs see Sapir (1980).

3/ The simple Illyrian model predicts that, although income per worker diminishes when the product price falls, the enterprise wishes to recruit additional workers. The severity of Yugoslavia's unemployment problem over the period leads us to assume that workers will be forthcoming even at a lower income.

With more than one variable input $\alpha_1 > 0$ is possible but this requires both that the marginal product of the other input declines very slowly and that it is highly complementary with labour.

4/ This will depend on the nature of technical progress.

5/ The reforms involved leaving more of the surplus within the firm by reducing corporate taxation, and allowing workers considerable freedom in determining how the surplus should be distributed.

6/ Self-interest is however pursued in a short-sighted manner since they fail to take account of the possibility of their own dismissal. This was pointed out by Steinherr and Thisse (1979).

7/ For example, by law the Yugoslav firm can lay off its workers only if it eliminates the jobs they perform.

DATA

All the data used in the regressions were obtained from "INDEKS : Mesecni Pregled Privredne Statistike SFR Jugoslavije" (INDEX : Monthly Review of Yugoslav Economic Statistics) published by the Federal Statistical Office.

All series are seasonally unadjusted and March, June, September and December values were used as the quarterly observations.

EMPLOYMENT[1]

Persons employed in working and other organisations of the social sector.

OUTPUT

Index of the physical volume of production[2]. 1975 = 100.

RELATIVE PRICE

This shows the ratio of the index of producers prices[3] for the industry in question to the index for all manufactured goods. 1975 = 100.

REAL INCOME

This is the ratio of the net personal income per worker[4] (Dinars) in a particular industry to the index of producers prices (1975 = 100) for that industry. Thus it is the real income relevant to the enterprise not the worker.

1. Zaposleno Osoblje
2. Indeksi Industrijske Proizvodnje
3. Indeks Cena Proizvodaca
4. Nominalna Primanja.

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