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EXPLANATIONS OF EARNINGS IN YUGOSLAVIA:
THE CAPITAL AND LABOR SCHOOLS COMPARED

by:

Saul Estrin & Jan Svejnar

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Saul Estrin, Department of Economics, Southampton University
Jan Svejnar, Department of Economics, Cornell University and
CORE, Université Catholique de Louvain

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on enterprise performance in Western Europe".

BADIA FIESOLANA, SAN DOMENICO (FI)
1. INTRODUCTION

The primary aim of this paper is to test alternative explanations of earnings in Yugoslav firms, with reduced form wage equations being estimated in the absence and presence of capital rationing. The two capital supply regimes are distinguished so that we can discern between the competing contentions in the Yugoslav literature that earnings differentials are the result of disturbances and imperfections which are transmitted by the system of self-management per se or are a direct consequence of capital rationing by the authorities. In estimating the wage equations on Yugoslav data, we can therefore offer preliminary evidence on whether income dispersion is a systemic problem in a labor-managed economy because of the weakness of labor market forces or is merely a consequence of capital rationing by the authorities.

Although the growing theoretical literature on labor-managed firms [see Vanek (1970), Ireland and Law (1982)] has strong implications about the determination of earnings, empirical studies of earnings rely on relatively ad hoc formulations of the estimating equations [see Wachtel (1972), Vanek and Jovicic (1975), Estrin, Svejnar and Mow (1983)]. This is a particularly serious deficiency in the Yugoslav context where inter-firm wage differentials are sufficiently large to suggest that income determination could be a fundamental policy issue [see Estrin (1981) and (1983)].

Most labor management models assume that workers' earnings are endogenous. From this perspective, any factors which cause profit differences under capitalism must generate inter-firm wage inequalities under labor-management because the workers appropriate the residual surplus as earnings.
This is essentially the argument of a group of economists within and outside Yugoslavia, henceforth called the "labor school", who view inter-firm differences in demand and cost conditions as the primary source of Yugoslav income differentials. Against them, the bulk of institutionalists and policy makers in Yugoslavia regard capital rationing as the main cause of the problem. This "capital school" stresses the scarcity of capital in Yugoslavia and the inefficiency of its rationing with the price being fixed well below the market clearing rate. The enterprise capital stock, itself the consequence of previous planning decisions, is seen as generating implicit rentals (comprising the difference between the capital's marginal product and cost) which are distributed to the workers as incomes. Policy conclusions highlight the distinction between the two schools: labor school analysts are concerned with competitive pressures, enterprise entry and exit and anti-trust policies while members of the capital school stress capital pricing and allocation according to scarcity.

2. EXPLANATIONS OF EARNINGS

In this section we examine the factors influencing the determination of incomes in Yugoslavia. Our assumptions approximately conform to those underlying the labor and capital schools, and capital rationing can be incorporated into the general estimating equation as a special institutional feature which allows us to nest the two hypotheses in a single estimating equation.

Commencing with the standard model of enterprise choice under labor management, let PQ denote revenue, rK capital costs and H other fixed costs, the firm is assumed to maximize income per worker,
\[ y = \frac{PQ - rK - H}{L} \]  

(1)

with respect to the choice variables \( L \) and \( K \), while output price \( P \), capital payments \( r \) and fixed costs \( H \) are assumed to be exogenous. The maximization leads to the reduced form input demand equations:

\[ L^d = L^d(P, r, H) \]

\[ K^d = K^d(P, r, H) \]  

(2)

which are homogeneous of degree zero in \( P, r \) and \( H \). Labor income is a choice variable, and therefore cannot enter the input demand functions conventionally but (1) and (2) can be combined to express \( y \) as an indirect function of the exogenous variables,

\[
y = \frac{PQ[L^d(P, r, H), K^d(P, r, H)] - rK^d(P, r, H) - H}{L^d(P, r, H)} \]

\[= y(p, r, H). \]  

(3)

Excess supply of labor in the social sector guarantees that Yugoslav employment is indeed demand determined. Therefore, traditional labor management theory implies that incomes are a function of prices, capital costs, fixed costs and measures of efficiency implicit in the production function. From this standpoint appropriate policies to reduce Yugoslav income differentials include measures to improve labor mobility and enterprise entry and exit in order to reduce price variance and cost differences among labor-managed firms.

The capital school theorists offer an alternative explanation of Yugoslav income differentials based on the notion that workers appropriate
an implicit rental from the capital allocated to their firms by planners.

In the best known formalization of this view, Vanek and Jovicic (1975) hypothesize that

\[ y = \alpha + \beta \frac{K}{L} \]  

(4)

where \( \alpha \) and \( \beta \) are parameters. Equation (4) can be interpreted as a behavioral relationship between incomes, the marginal product of labor (\( \alpha \)) and the imputed capital rental per head, \( \frac{\partial K}{L} \), the latter comprising the difference between the marginal product of capital (\( \beta \)) and its cost (commonly assumed to be zero in this framework). The short-term policy implications of this model are clear; provided that the marginal product of labor and capital do not vary across firms, the entire dispersion in Yugoslav incomes can be eliminated by charging for capital at its scarcity price, \( \beta \).

In the longer term, one would seek to eliminate the problem altogether by the appropriate reallocation of capital.

Two streams of applied work on Yugoslav wage determination have been developed in the literature, based on various specifications of equations (3) and (4), respectively [see Wachtel (1973), Estrin (1979), Rivera-Batiz (1980), and Staellerts (1982)]. Each appears to be internally consistent and to offer valid representations of the process generating wages in Yugoslavia. However, the explanations offered are mutually inconsistent, one being derived from a capital market clearing assumption and the other from capital rationing. As a result, they cannot be compared empirically since the hypotheses involved are not nested.

Our approach therefore is to use a general estimating framework, into which both the labor and capital school views can be embedded as special
cases. Starting with the capital school equation (4), the labor school would object that, even if incomes were affected by capital rationing, dispersion in demand and cost factors under labor management would generate differences in the labor marginal products, \( \alpha \), and would be reflected in the determination of optimal employment, \( L^d \). Hence one must drop the constant term, \( \alpha \), and employ the labor demand equation (2) derived from the enterprise optimization problem in determining the desired capital-labor ratio. If the capital stock is rationed at \( \bar{K} \),

\[
K^d = \bar{K} \tag{5}
\]

substituting (2) and (5) into equation (4) yields the general specification

\[
y = Y(p, r, H, \bar{K}) . \tag{6}
\]

Both the labor and capital schools are nested in equation (6) according to the significance of the coefficients on \( \bar{K} \) and on \( p, H \) and \( r \), respectively. The two explanations can therefore be tested in a common framework.

Following Lewis (1963) and Svejnar (1981), we use a logarithmic approximation to the income equation (6):

\[
\ln y_{it} = d_0 + d_1 \ln p_{it} + d_2 \ln X_{it} + d_3 \ln r_{it} + d_4 \ln \bar{K}_{it} . \tag{7}
\]

The variables \( X_{it} \) are a vector capturing inter-industry difference in technological and cost conditions implicit in the \( Y \) function of equation (6).
The logarithmic approximation embeds the views of the two schools as follows. Using the standard capital school assumption of fixed coefficients (Leontief-type) technology [e.g. Vanek and Jovicic (1975)], the capital school view in logarithmic form can be expressed as
\[
\ln y_{it} = d'_{1i} + d'_{2i} \ln K_{it}.
\]
Equation (7') is nested in equation (7) according to the joint significance of coefficients \(d_1, d_2\) and \(d_3\). Similarly, re-solving the optimization problem in logarithmic form on the assumption of capital market clearing yields a labor school equation
\[
\ln y_{it} = d''_{1i} + d''_{2i} \ln P_{it} + d''_{3i} \ln X_{it} + d''_{4i} \ln r_{it}
\]
which is also a special case of equation (7). We cannot reject the labor school hypothesis if \(d_a = 0\) and \(d_1, d_2\) and \(d_3\) are jointly significant.

To test the capital school view we estimate equations (7) and (7') and use an F-test to determine the joint significance of \(d_1, d_2\) and \(d_3\) in equation (7). To test the labor school view we employ a t-test on the significance of \(d_a\) in equation (7).

3. EMPIRICAL RESULTS

The earnings equations (7) and (7') are estimated on annual data for 19 Yugoslav industries and the period 1965-1972, the era of maximal self management. The data are derived from Statisticki Godisnjak Jugoslavie, with the price series being derived from the series of nominal and real output, normalized back to 1956, and the centrally determined interest
rate standing as proxy for \( r \). The \( X_{it} \) vector is intended to capture inter-industry dispersion in technological and cost conditions, including \( H \), and in this study it is proxied by minimum efficient scale, denoted \( \text{AVsize} \), and labor productivity, denoted \( \frac{Q}{L} \). \( \text{AVsize} \) is included to take account of the relatively restrictive technical conditions for production under labor management which necessitated the inclusion of \( H \) in the original optimization problem [see Svejnar (1982) and Ireland and Law (1982)]. It is measured by average firm size in the industry.

The role of technical efficiency in profit functions and therefore income functions under labor management is clear but the fact that labor productivity is an endogenous variable in both the labor and capital school views is a potential source of simultaneous equation bias. To deal with this problem, we employ the form of instrumental variable estimation proposed by Brundy and Jorgenson (1971) and also followed by Estrin (1979) in his estimation of labor school wage equations. Specifically, the approach entails estimating a labor productivity equation derived from the relevant model and entering the residuals into the earnings equation to eliminate the simultaneity between productivity and the other determinants of earnings in the earnings equation. For example, for the general formulation of equation (7), the procedure involves estimating

\[
\ln \left( \frac{Q}{L} \right) = a_{0i} + b_1 \ln P_{it} + b_2 \ln r_{it} + b_3 \ln \text{AVsize} + b_4 \ln \overline{K}_{it} + \mu_{it} \tag{8}
\]

and placing the residuals in the earnings equation instead of labor productivity,

\[
\ln y_{it} = d_{0i} + d_1 \ln P_{it} + d_2 \ln r_{it} + d_3 \ln \text{AVsize} + d_4 \mu_{it} + d_5 \ln \overline{K}_{it} + \xi_{it} \tag{9}
\]
where $\xi_{it}$ is the error in the earnings equation. The procedure gives unbiased estimates of the earnings though not the labor productivity equation provided the errors in the former ($\xi_{it}$) are uncorrelated with the errors in the latter ($u_{it}$).

With only 8 observations per industry, it is impossible to employ the most efficient estimation procedure for this problem, Zellner's (1962) seemingly unrelated regressions framework, which would generate industry specific wage equations. To approximate this, we employ ordinary least squares with industry specific dummies separately on each of the two equations—productivity and wages. In order to approximate the covariance model for this cross section time series data set, we include a second degree time polynomial in the wage equations. This can be viewed as proxying for the increasingly egalitarian trend in the earnings dispersion over the period [see Estrin (1981)].

In Table 1 we report the estimate of equation (7) [formulated as (9)] on the Yugoslav data set. The regression displays a very good overall fit with an $R^2 = 0.92$ and all the estimated coefficients being significant and displaying the predicted signs. Incomes vary positively with the product price, productive efficiency and average 'firm size, and the effect of the interest rate is negative. The time variables are significant and indicate that, ceteris paribus, earnings were growing at a decreasing rate between 1965 and 1972, almost certainly the consequence of government policy.6 The nineteen industry specific intercepts which are not reported in the table reveal that considerable differences exist among the individual industries. The overall significance of the equation at the 99% level offers support for the relevance of this model in explaining Yugoslav wage determination.
As we stressed at the outset, the main aim of this paper is hypothesis testing to establish the empirical validity of the labor and capital schools. The significance of the coefficient on the capital stock leads us to reject a strict labor school hypothesis which would claim that incomes are not affected by capital rationing (i.e. contrary to this view we find $d_k > 0$). Similarly, an F-test on the joint significance of the coefficients on price, interest rate and the technological variables finds these coefficients jointly significant (i.e. we do not find $d_1 = d_2 = d_3 = 0$). The test thus leads us to reject the capital school hypothesis which places exclusive emphasis on the rationed stock of capital as a determinant of incomes. We therefore find support for a more general formulation of wage determination in which both labor and capital school views are relevant.

The natural next question concerns the relative quantitative importance of the two explanations. We therefore calculate the fraction of total earnings that can be attributed to capital rationing with the proportion being reported in the first column of Table 2. The proportion is calculated as $\frac{\ln K / \ln Y}{\ln K / \ln Y}$ and, ignoring the covariance of $d_k$ with other coefficients [see Chiswick and Mincer (1972)], it gives an approximation of the true effect of capital on income. On average, the size of the capital rationing effect is very large, accounting for 30% to 59% of sectoral incomes over the period. However, the inter-industry variation in this effect around its mean of 48.3% is rather small, with only one observation exceeding 55% and two observations falling below 41%.

It is particularly striking that these estimates actually exceed those of Vanek and Jovicic (1975), the founders of the capital school approach.
Using only cross-section data and imposing a narrow interpretation of the capital school hypothesis [see Estrin, Svejnar and Mow (1983)], they calculate the capital rationing effect to vary between 5% and 45% of observed earnings in each sector. Hence using a less restrictive version of the capital school view we find both a role for labor school factors and a relatively greater impact of capital rationing on Yugoslav incomes. Finally, it is interesting to note that there is no significant relationship between the proportion of earnings explained by the capital rationing effect in each sector and the absolute level of incomes, displayed in column (2) of Table 2.⁸

4. CONCLUSIONS

In this paper, we estimate an econometric model of wage determination in Yugoslavia into which the competing hypotheses of the "labor" and "capital" schools are nested. The results accord closely to a common sense interpretation of the post-reform period. Contrary to the predictions of many Yugoslav policy-makers and to the empirical findings of, for example, Vanek and Jovicic (1975), we establish that Yugoslav earnings are to some extent influenced by the factors suggested in traditional labor-management models: dispersion in corporate profitability caused by differences in demand and cost conditions and passed on to worker earnings via the institutional arrangements inherent in self-management. This suggests that, as Ward (1958) and Meade (1972) have implied, disturbances in the system under labor-management are reflected in labor incomes, and that labor and product market immobilities in Yugoslavia were sufficiently marked to prevent the eradication of the resulting labor marginal product differences.
over the period. This finding supports the policy prescription of actions to stimulate labor mobility and enterprise entry and exit.

But we also find empirical support for view held widely both within and outside Yugoslavia that income dispersion is caused by the workers' appropriation of monopoly capital rentals derived from the free or cheap use of fixed assets. It is clear that, for example, Wachtel (1973) and Estrin (1979) were incorrect in choosing to ignore the implications of Yugoslav capital rationing and pricing policies for income determination between 1965 and 1972. One must therefore also accept the relevance of policies based on pricing capital at its scarcity value and ultimately eliminating it from dispersion in capital rentals by reallocating fixed assets to equalize capital marginal products across uses.

Our econometrics provides evidence in favor of both the capital and labor school contentions. The dispute therefore reduces to the empirical issue of their relative importance in explaining observed wage differentials over the period. In fact, the sum of the effects from labor and product market immobilities was the greatest source of earnings dispersion, but capital rationing proved to be the largest single source of actual incomes at any time. Thus it would seem that after the right to earn income freely from the existing fixed assets was devolved to each firm in 1965, wage payments were mainly influenced by the firms' initial level of capitalization. However, since the capital stock adjusts much more slowly than variables such as incomes, productivity and prices, it is not surprising that incomes dispersion was primarily determined by the latter variables. The intuition of Yugoslav experts that the arbitrary arrangements for the control and pricing of capital were bound to have ramifications for income
distribution was basically correct, but the same authorities have also
tended to underestimate the way that allocative inefficiencies could be
rapidly transmitted into workers incomes and the distribution of incomes
under self-management
FOOTNOTES

1 This paper is one in a series on Yugoslav wage determination. See also Estrin, Svejnar and Mow (1983) for a critical treatment of the traditional empirical literature in this field and Estrin and Svejnar (1983) for the theoretical modelling underlying our econometrics in this area.

2 Economists in this broad tradition include Ward (1958), Meade (1972), Wachtel (1972) and particularly Estrin (1979). The results are quite general in that they also obtain from other objectives than maximizing the income per worker [see Svejnar, (1982)]. This approach is predicated on the assumption workers cannot bid entry to high earning co-operatives at lower rates of pay, which is illegal in Yugoslavia, and that the reallocation of resources between users by enterprise entry and exit after changes in parameters is minimal. As Estrin (1983) establishes, there was very little corporate mobility over the period.

3 Principal proponents of this approach include Milenkovich (1971), Vanek (1973), World Bank (1975), Vanek and Jovicic (1975), and Staellerts (1981). It should be stressed that we use the terms labor and capital schools as convenient descriptive rather than normative titles.

4 See Estrin and Svejnar (1983) for a model generalizing this argument.

5 This choice of period is justified in Estrin (1983).

6 Estrin (1983) reports that Yugoslav income differentials increased from around 1965-1968 and then began to narrow. This was attributed to increasing enterprise entry and the effectiveness of government incomes policies.

7 Actual incomes are employed for the calculations in Table 2, but predicted incomes give identical results to the second decimal place.

8 The Pearson and Spearman correlation coefficients for the two columns in Table 3 are -0.0004 and 0.707, respectively. Using the entire 152 observations rather than industry means, the two correlation coefficients are -0.051 and -0.08, respectively.
<table>
<thead>
<tr>
<th>Variable</th>
<th>Estimate</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\ln P$</td>
<td>0.1559</td>
<td>0.0275</td>
</tr>
<tr>
<td>$\ln r$</td>
<td>-0.1107</td>
<td>0.0463</td>
</tr>
<tr>
<td>$\ln (\frac{Q}{L})$</td>
<td>0.1892</td>
<td>0.0537</td>
</tr>
<tr>
<td>$\ln (AVsize)$</td>
<td>0.0887</td>
<td>0.0219</td>
</tr>
<tr>
<td>$\ln K$</td>
<td>0.2576</td>
<td>0.0557</td>
</tr>
<tr>
<td>$t$</td>
<td>0.0662</td>
<td>0.0080</td>
</tr>
<tr>
<td>$t^2$</td>
<td>-0.0063</td>
<td>0.0009</td>
</tr>
</tbody>
</table>

Industry-specific Intercepts: YES

$R^2$: 0.92

N: 152

Values in parentheses are standard errors. Variable $\ln (\frac{Q}{L})$ is based on Brundy and Jorgenson (1971) instrumental variable method.
### TABLE 2

Proportion of the Income Attributable to Capital Rationing: Calculations Based on Estimates of Table 1.

<table>
<thead>
<tr>
<th>Industry</th>
<th>Proportion (1)</th>
<th>Income (2)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Electrical generation &amp; distribution</td>
<td>0.59</td>
<td>4.478</td>
</tr>
<tr>
<td>2. Coal and Coke</td>
<td>0.51</td>
<td>4.445</td>
</tr>
<tr>
<td>3. Petroleum</td>
<td>0.50</td>
<td>4.423</td>
</tr>
<tr>
<td>4. Ferrous metallurgy</td>
<td>0.52</td>
<td>4.490</td>
</tr>
<tr>
<td>5. Nonferrous minerals</td>
<td>0.51</td>
<td>4.507</td>
</tr>
<tr>
<td>6. Nonmetallic minerals</td>
<td>0.45</td>
<td>4.475</td>
</tr>
<tr>
<td>7. Metals &amp; metal manufacturing</td>
<td>0.55</td>
<td>4.476</td>
</tr>
<tr>
<td>8. Shipbuilding</td>
<td>0.43</td>
<td>4.478</td>
</tr>
<tr>
<td>9. Electrical machinery</td>
<td>0.48</td>
<td>4.480</td>
</tr>
<tr>
<td>10. Chemicals</td>
<td>0.52</td>
<td>4.491</td>
</tr>
<tr>
<td>11. Construction materials</td>
<td>0.48</td>
<td>4.421</td>
</tr>
<tr>
<td>12. Wood &amp; wood products</td>
<td>0.49</td>
<td>4.442</td>
</tr>
<tr>
<td>13. Paper &amp; paper products</td>
<td>0.48</td>
<td>4.480</td>
</tr>
<tr>
<td>14. Textiles &amp; clothing</td>
<td>0.52</td>
<td>4.492</td>
</tr>
<tr>
<td>15. Leather &amp; leather products</td>
<td>0.41</td>
<td>4.471</td>
</tr>
<tr>
<td>16. Rubber</td>
<td>0.39</td>
<td>4.513</td>
</tr>
<tr>
<td>17. Food processing</td>
<td>0.52</td>
<td>4.473</td>
</tr>
<tr>
<td>18. Printing &amp; publishing</td>
<td>0.43</td>
<td>4.465</td>
</tr>
<tr>
<td>19. Tobacco</td>
<td>0.40</td>
<td>4.452</td>
</tr>
<tr>
<td><strong>AVERAGE</strong></td>
<td><strong>0.483</strong></td>
<td><strong>4.471</strong></td>
</tr>
</tbody>
</table>

Calculations based on predicted incomes \(\frac{d\ln k_i}{\ln y_i}\) were identical to the second decimal point to those based on actual incomes. The reported values for each industry represent an arithmetic average of the annual values between 1965 and 1972.
REFERENCES


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