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On the Backwardness in Macroeconomic Performance of European Socialist Economies

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Abstract:

This paper aims to compare the macroeconomic performance of three European socialist economies (Hungary, Poland, Yugoslavia) with developing and developed countries during the eighties. Using panel data for 87 countries, we measure macroeconomic performance with two frontier efficiency techniques: the stochastic frontier approach, and the time-varying WITHIN model proposed by Cornwell, Schmidt and Sickles (1990). We conclude in favor of the underperformance of socialist countries in relation to developed countries but also to developing countries, which may be explained by the features of the socialist economic system.

Keywords: productivity analysis, socialist system, stochastic frontier approach, growth.

JEL Classification : C21, C23, O4, P20.

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1. Introduction

As regularly emphasized by Soviet leaders[1], the major economic objective of the Soviet model of socialist economy, which was introduced in the whole Eastern Europe after 1945 was growth. This purpose was notably motivated by the catching-up of the most advanced countries to prove the superiority of socialism. The slowdown of growth in European socialist economies in the 80s was therefore very negative for these regimes, as they had still not caught up Western economies at that time.

This slowdown may be linked to the extensive nature of growth in socialist economies. Indeed, these economies have increased their production through labor and capital accumulation during decades. However, labor accumulation reached a predictable limit, while capital suffered from decreasing returns since the end of the 50s. The extensive growth in socialist economies has therefore to be relied to the result of recent literature on growth (Easterly and Levine, 2001) that the leading driving force behind growth performances may not be the evolution of productivity rather than factor accumulation. It therefore appears that what matters for growth is not only the amount of factors of production with which a country is endowed or which it has accumulated but also, and chiefly, the way in which it combines those factors. This may explain the slowdown of growth in European socialist economies in the 80s but also more generally the failure of these economies in the catching-up of Western economies at that time.

It is consequently of the highest interest to determine the ability of European socialist economies to make the most of their factor endowment in order to check the relevance of this view. To this end, we apply frontier efficiency techniques to estimate macroeconomic performance of a large set of countries including some European socialist countries. Namely, we assess technical efficiency, which measures how close a country's production is to what a country's optimal production would be for using the same bundle of inputs. Thus, it brings some evidence with respect to the relative total factor productivity of a country. In comparison with our study, most studies on the measurement of aggregate productivity of socialist countries use standard tools of performance such as output per worker or more sophisticated measures such as total factor productivity (e.g. Bergson, 1987).

[1] Gros and Steinherr (1995) mention that Stalin's claim in 1947 that he would catch up with Western countries in ten years was repeated ten years later by Khrushchev.

Frontier efficiency techniques provide sophisticated measures of performance, the efficiency scores, which have three advantages in comparison with other measures of performance. First, it provides synthetic measures of performance. Indeed, unlike basic productivity measures (e.g. per capita income), the efficiency scores allow to include several input dimensions in the evaluation of performances. As a result, the income of a country is not only compared to labor stock, but also to stocks of physical capital and human capital. Second, it computes relative measures of performance. Namely, a production frontier is estimated which allows the comparison of each country to the best-practice countries. As a result, the efficiency score assesses how close a country's production is to what a country's optimal production would be for using the same bundle of inputs. It then directly provides a relative measure of performance. Third, whereas total factor productivity measures assess performance by the whole residual from the production frontier for each country, econometric frontier efficiency techniques (e.g. both approaches applied in this work) allow to disentangle the distance to the production frontier between an inefficiency term and a random error, taking exogenous events into account.

Two studies have formerly adopted frontier efficiency techniques to compare macroeconomic performance of European socialist economies with Western economies (Moroney and Lovell, 1997, Koop et al. 2000). These works both use econometric frontier techniques to estimate technical efficiency at the aggregate level. We provide three major additions to these former studies.

First, we include human capital as an input in the analysis. Indeed, the cross-country differences in human capital must be taken in the measures, unless technical efficiency would be incorrect. However both applications of efficiency frontiers take labor and capital into account but neglect human capital. Second, both frontier efficiency studies compare productivity studies compare productivity of European socialist economies only with Western economies. However, it is also relevant to proceed to a comparison of these economies with economies at other stages of development. Indeed, the collapse of socialist systems in Europe may be such that socialist countries would be even below developing countries. The inclusion of human capital may notably play a role on this issue, as socialist countries may have better-skilled labor force than developing countries, without succeeding in having a greater output per worker.

Third, we apply two different approaches to estimate technical efficiency. Indeed the results of the frontier efficiency applications might be sensitive to the adopted methodological choices. It has to be stressed that literature in banking, in which these techniques are

commonly resorted to, provides ambiguous evidence with respect to the robustness of these techniques (Weill, 2004). Therefore, the use of two techniques appears a natural robustness check of our results. We utilize the stochastic frontier approach, which is commonly adopted in empirical works appraising macroeconomic technical efficiency (e.g. Adkins et al., 2002, Méon and Weill, 2004). Furthermore, the use of panel data allows us to apply the time-varying WITHIN model proposed by Cornwell et al. (1990). Both techniques use econometric tools to compute technical efficiency and consider that the distance from the frontier includes an inefficiency term and a random error. However they differ on the method adopted to separate random error from inefficiency term. While the stochastic frontier approach makes some assumptions on the distributions of random error and inefficiency term, the WITHIN model takes advantage of the panel data not to impose such assumptions.

Technical efficiency is therefore estimated at the aggregate level on a panel sample of 87 countries for the period 1980-1987. The sample includes all groups of countries, meaning developed and developing countries apart from the European socialist countries. We consider three of these latter countries: Hungary, Poland, and Yugoslavia. We restrict our analysis to these three countries because of limitations to have comparable data. They represent however a particularly interesting set of socialist economies because, as mentioned by Whitesell (1985), they correspond to three different kinds of what a socialist economy in Europe was in the 80s.

The Polish economic system was very similar to the Soviet model in application in most Eastern European socialist countries. However the introduction of the New Economic Mechanism in 1968 and the reforms implemented in the early 80s put Hungary into reforms. The most notable changes were the policies in favor of private ownership and the efforts to introduce some economic rationality in prices, concluded by price liberalization in 1985. Furthermore, the country adhered to IMF and World Bank already in 1982. In comparison with the Hungarian economy, the Yugoslavian one was even farer of the Soviet model. The most striking feature was workers' self-management of industrial companies since the 50s, which resulted in a decentralized decision-making. Moreover, the degree of openness of the economy was relatively high with notably export incentives for firms and allowance of joint-ventures with Western companies.

The structure of the paper is as follows. Section 2 describes the theoretical and empirical background of the differences in productivity between socialist economies and market economies. Methodology is described in section 3, followed by data and variables in section

4. Section 5 develops the empirical results. Finally, we provide some concluding remarks in section 6.

2. Background

There is a commonly accepted view that market economies benefit from higher productivity than socialist economies. This view is supported by a set of theoretical arguments and empirical studies, briefly surveyed in this section. Several theoretical arguments can be advanced in favor of a backwardness in productivity for socialist economies in comparison with market economies. They are linked to the characteristics of these economies, such as public ownership, planning, or right to work.

First of all, public ownership of means of production may have negative consequences on productivity (Shleifer, 1997), which result from failures in the innovation process but also in the incentives to reduce costs. Indeed, the owner of a private company receives more rewards of his innovations and of his efforts to cut costs than the manager of a public company, sharing all benefits resulting from his positive decisions. Second, the planning system did not favor productivity. Employees and managers were not inclined to surpass plan targets, as the benefits associated with such a performance were very limited. Even more important, planning favored the excessive use of inputs, as plant managers were inclined to ask for more labor to increase the chances that plan targets were met. Finally, in terms of innovation, planning was a considerable impediment to changes, as its hierarchical nature was not accurately adaptable to them, but also because changes complicated planning processes, as observed by Whitesell (1994).

Third, employees had the constitutional right to guaranteed employment[2], while income differentials were limited for egalitarian reasons. Therefore, there was neither stick through the fear of unemployment, nor carrot with hopes of higher wages to provide good incentives for the effort of employees. This argument is supported by Bergson (1994) who emphasized the role of low labor effort in the backwardness in productivity of socialist economies. Moreover Drago (1989) empirically showed a positive link between unemployment and productivity on a sample of socialist and Western market economies. Fourth, the socialist economy was distinguished by the prevalence of seller's markets. Namely, it conveys the idea

[2] The Article 40 of the Soviet Constitution of 1979 states that "Citizens of the USSR have the right to work (that is, to guaranteed employment)."

that the economy was not driven by demand as in market economies, but by supply because of the low attention paid to consumers' desires and of the limited number of suppliers. This feature led to a lower degree of competition, and consequently in lower productivity for companies.

Fifth, a policy choice of the Soviet system, which is not inherent to the socialist ideology, was to favor the national self-sufficiency to be the most independent of the market economies. This characteristic results in a weak openness of socialist economies to foreign trade, which may also influence productivity in a negative way. Indeed, open economies trade goods but also ideas through technological and managerial know-how (Romer, 1993). This point is of utmost interest for backwarded economies, which have on average more to gain from ideas to implement. Therefore, the closeness to trade of socialist economies may also have contributed to the productivity gap between socialist and market economies. Sixth, the socialist economies may have difficulties resulting from the poor quality of institutions, with notably the lack of political freedom, a weak quality of the administration, and corruption. As recent evidence pointed out the negative influence of bad governance on macroeconomic technical efficiency (Adkins et al., 2002, Méon and Weill, 2004), the poor quality of institutions in socialist economies may exert a negative impact on productivity. It has to be stressed that this feature can only explain the lower productivity of European socialist economies in relation to Western economies, but not to developing countries which suffer also from poor quality of institutions, as shown by Kaufmann et al. (1999).

In summary, literature provides a wide range of arguments explaining the negative impact of the characteristics of European socialist economies on productivity. Empirical literature tends to support such a view as described now.

A major study on comparative productivity between European socialist and Western economies is Bergson (1987)'s. Assembling data for four European socialist countries (USSR, Hungary, Poland, Yugoslavia) and 7 Western countries for 1975, he adopts two different techniques to estimate the productivity gap between both groups of countries. On the one hand, he measures output per worker with and without an adjustment with labor quality, and then shows that socialist economies underperform Western economies for a magnitude ranging between 25 and 34%. On the other hand, he estimates a production function including three inputs (labor, capital, land) and a dummy variable for socialist economies. He then concludes to a lower productivity for socialist economies.

Two studies use frontier efficiency techniques to assess technical efficiency of socialist economies in comparison with Western economies. Moroney and Lovell (1997) estimate a

production frontier on a sample of 24 countries, including 7 European socialist economies for the period 1978-1980. They adopt a variant of the stochastic frontier approach for their estimation, and consider capital, labor, and energy as inputs. Their conclusion clearly supports the outperformance of Western economies, with socialist economies 76% as efficiently as Western economies. They also observe a relative heterogeneity of the efficiency scores between socialist economies: the efficiency scores indeed range from 68.8% for Hungary to 82.6% for Bulgaria, representing the production potential of each economy in comparison with market economies.

Koop et al. (2000) adopt a Bayesian stochastic frontier model to estimate technical efficiency. The choice of this model, scarcely adopted in frontier efficiency works, is motivated by the small size of the dataset. Using data for labor and capital for Poland, Yugoslavia and 20 Western economies for the decade 1980-1990, they conclude to an impressive underperformance of Poland with an average efficiency of 45% over the period. Western economies have mean efficiency scores ranging from 80.9 to 97.5%, if we except Greece with 69.4%. Finally, Yugoslavia has a very high efficiency level (93.2%). In summary, this brief survey of empirical literature on the comparative productivity of socialist and market economies tends to support the underperformance of socialist economies relative to developed economies.

A final remark must be stressed here, before turning to the empirical investigation. The countries to which we compare European socialist economies can not be all considered as full market economies. Indeed, even if developed countries are all market economies, developing countries represent different mixes of features from market economies and planned economies: to mention the extremes, our sample of developing countries ranges from China to Chile. However, our arguments to explain the backwardness in productivity for socialist economies in comparison with market economies can be useful to understand the observed results for mainly two reasons. The first reason is that most developing countries have some features of market economies, and consequently at least some of the six theoretical arguments presented above are relevant to explain the possible productivity gap. The second reason is that even developing economies with a socialist system present some differences with the Soviet model of socialist economy, which may also explain some differences in productivity with the European socialist economies.

3. Methodology

Our aim is to measure macroeconomic technical efficiency of countries in the 80s to proceed to a comparison between European socialist countries and other groups of countries in the world. A Cobb-Douglas functional form is assumed for the production frontier.[3] We assume constant returns-to-scale because, as Moroney and Lovell (1997, p.1086) observe it, "at the economy-wide level, constant returns-to-scale is virtually compelling". The production frontier is then as follows:

$$ln\ (Y/L)_i = \alpha_0 + \alpha_1\ ln\ (K/L)_i + \alpha_2\ ln\ (H/L)_i + \varepsilon_i \quad (1)$$

where i = 1,…, 87 indexes countries. *(Y/L)*, *(K/L)*, and *(H/L)* are respectively output per worker, capital per worker, and human capital per worker, and are described below.

A panel data set is used to estimate technical efficiency at the aggregate level with two different techniques. The first technique is the cross-sectional stochastic frontier approach (SFA) to measure technical efficiency at the aggregate level. This approach was adopted in most works on macroeconomic technical efficiency (e.g. Adkins et al., 2002, Méon and Weill, 2004).

Stochastic frontier approach assumes that the error term of the production frontier, ε_i, is the sum of two independent random variables: a random disturbance, v_i, and an inefficiency term u_i. v_i is a two-sided component representing random disturbances, reflecting luck or measurement errors. v_i is assumed to have a normal distribution with zero mean and variance σ_v^2 . u_i is a one-sided component capturing technical inefficiencies. Several distributions have been proposed in the literature for this component: half-normal, truncated normal, gamma, exponential. As is common in the literature, we assume a half-normal distribution with variance σ_u^2 for the inefficiency term.

According to Jondrow et al. (1982), country-specific estimates of inefficiency terms can be calculated by using the distribution of the inefficiency term conditional to the estimate of the composite error term. The estimate of the technical inefficiency is then the mean of its conditional distribution: $E(u_i/\varepsilon_i)=\mu^*+\sigma^*\frac{f(-\mu^*/\sigma^*)}{1-F(-\mu^*/\sigma^*)}$ where $\sigma^2 = \sigma_u^2+\sigma_v^2$, $\mu^* = -\sigma_u^2\varepsilon_i/\sigma^2$, $\sigma^{*2} = \sigma_u^2\sigma_v^2/\sigma^2$, f and F represent the standard normal density and cumulative distribution

[3] Two reasons motivate the choice of the Cobb-Douglas form. First, it is commonly used in empirical works on growth and on aggregate efficiency frontiers technical efficiency. Second, in his estimation of production functions with CES and translog forms for European socialist countries, Whitesell (1985) showed that the Cobb-Douglas was the most appropriate form to describe growth in these countries.

functions. We use the Frontier software version 4.1 by Coelli (1996) to perform the maximum likelihood estimation of the stochastic frontier model. We then estimate a production frontier for each year of the period.

The second technique is the time-varying WITHIN model proposed by Cornwell, Schmidt and Sickles (1990)[4], which has never been employed to our knowledge to compute macroeconomic technical efficiency. By using panel data, this model does not require distributional assumptions on the inefficiency term and the random disturbance. It specifies the inefficiency terms at different periods as a quadratic function of time in which coefficients vary over countries. The inefficiency term at period t u_{it} is then modeled as follows:

$$u_{it} = \theta_{1i} + \theta_{2i}\, t + \theta_{3i}\, t^2 \qquad (2)$$

where i indexes country, t represents time, and the θs are cross-section country-specific parameters.

It has to be stressed that an important difference between both frontier efficiency models is that the SFA model allows the coefficients of the production frontier to vary over time, which permits the technology changes during the period. This may notably lead to some differences in the estimated distributional characteristics of the efficiency scores between both models.

4. Data

If we exclude human capital, data are the same as in Easterly and Levine (2001) and were downloaded from the Penn World Tables 5.6.[5]. We use data for 87 countries for the period 1980-1987. Output (Y) is measured as GDP in purchasing power parity dollars. Capital (K) is measured as aggregate investment, which is a measure of capital stock based on a perpetual inventory method, provided by Easterly and Levine (2001). Labor (L) is assessed by the number of workers. Human capital (H) is measured as the total number of years of schooling in the working-age population over 15 years old, and is taken from the Barro-Lee (2000) education dataset and was downloaded from the Economic Growth Resources website.

[4] An alternative technique would have been the time-varying model proposed by Battese and Coelli (1992). However it assumes identical variations in efficiency for all countries during the period, which is a very strong assumption not allowing the comparative analysis of the evolution of efficiency.

An important remark concerns the importance of the underground economy which may affect the technical efficiency measures. Indeed, it can be argued that our estimates are wrong because they ignore the effective output produced by a country, meaning the sum of official and underground outputs, by considering the official output. However, as observed by Bergson (1987), this underestimation of the effective output of the economy also affects the inputs. Consequently, our estimates of the technical efficiency based on official figures can be considered as satisfactory proxies of the effective technical efficiency, as official figures for outputs and inputs underestimate effective figures in a proportion we can assume similar.

We use a balanced sample for the period 1980-1987. The sample includes 3 European socialist countries (Hungary, Poland, Yugoslavia), and three other groups of countries following the World Bank classification: 25 lower-income countries, 34 middle-income countries (we gather here the so-called 'upper-income' and 'middle-income' developing countries of the classification), and 25 developed countries.

Descriptive statistics of the sample are displayed in table 1a by group of countries, and in table 1b for the three European socialist countries. Our data are consistent with the established view that output per worker is higher in developed countries than in socialist and lower-income countries. Furthermore, socialist and middle-income countries have similar levels of output per worker, representing four times the mean of lower-income countries. We can draw a parallel between these statistics and those for capital per worker. Indeed, we observe a clear hierarchy with in descending order developed, socialist, middle-income and lower-income countries. Therefore, the fact that capital per worker is undoubtedly greater in socialist countries than in middle-income countries, while both groups of countries have similar levels of output per worker, tends to suggest a lower total factor productivity in socialist countries than in middle-income countries. This is a first clue for smaller technical efficiency in socialist countries in comparison with other groups of countries.

Finally, we observe that human capital per worker is greater in the three European socialist countries than in middle-income and lower-income countries, while it is slightly lower than in developed countries. These observations provide information on the possible impact of taking human capital into consideration for technical efficiency measures. Indeed this suggests that, while the inclusion of human capital would not increase the possible

[5] Koop et al. (2000) also used the Penn World Table for their estimation of technical efficiency of Poland, Yugoslavia and Western countries. They consider that "the Penn World Table provides the best currently-available data that allows for reliable cross-country comparisons" (p.186).

backwardness of socialist economies in comparison with developed countries, it would considerably increase it in comparison to lower-income or middle-income countries.

Table 1a
Summary statistics on variables: groups of countries

	Socialist countries	Lower-income countries	Middle-income countries	Developed countries
N	3	25	34	25
Y/L	10,188.23	2,545.53	9,777.47	23,165.43
K/L	31,518.27	2,711.34	15,463.38	57,814.26
H/L	12.78	3.46	9.00	13.80

Y/L, K/L, H/L, are respectively output per worker, capital per worker, and human capital per worker.

Table 1b
Summary statistics on variables: socialist economies

	Hungary	Poland	Yugoslavia
Y/L	10,765.38	7,896.63	11,904.50
K/L	29,565.34	32,109.12	32,880.35
H/L	14.35	12.69	11.31

Y/L, K/L, H/L, are respectively output per worker, capital per worker, and human capital per worker.

The investigation of the three socialist countries points out a hierarchy for output per worker with in descending order Yugoslavia, Hungary, and Poland. Similar levels of capital per worker are observed in Poland and Yugoslavia, suggesting a lower technical efficiency for Poland, while the Hungarian level is smaller. Finally, human capital endowment is the highest in Hungary, followed in descending order by Poland and Yugoslavia. It is consequently difficult to extract some insights on the hierarchy of these three countries in terms of technical efficiency from the descriptive statistics of inputs and output.

5. Results

This section presents the empirical results of the frontier efficiency models. We first display the results obtained with the SFA model in tables 2a and 2b. Several conclusions come out. First, the most striking result is the underperformance of socialist countries in comparison with all other groups of countries. Indeed the average efficiency scores over the period are 70.41%, 76.53%, and 82.15%, respectively for lower-income, middle-income, and developed countries, to be compared with 59.25% for socialist countries. Second, the efficiency gap between socialist countries and other groups of countries rather increased between 1980 and 1987. Indeed a decrease in efficiency occurred for socialist countries during this period (-1.83 points), as it was also the case for middle-income countries, whereas lower-income and developed countries improved their efficiency.

Third, the comparison of efficiency between socialist countries shows very different levels of average efficiency over the period, with in ascending order Poland (48.33%), Hungary (62.31%), and Yugoslavia (67.09%). These rankings tend to support the view that market-oriented reforms favored efficiency in socialist economies, as Hungary and especially Yugoslavia implemented some market economy features. Fourth, in considering the evolution, a catching-up process occurred for Hungary and Poland to Yugoslavia during the 80s, as efficiency fell in this latter country in opposition to the observed improvement in both other countries. Thus, we can point out that the observed reduction in efficiency for socialist countries between 1980 and 1987 is due to the Yugoslavian case.

We now turn to the empirical results obtained with the WITHIN model, which are displayed in tables 3a and 3b. The efficiency scores are then lower than with the SFA model, but this is a likely consequence of the different methodological assumptions made by this model. Notably, this model estimates one production frontier for the whole period, while SFA computes a production frontier for each year, allowing changes over time in the technology. Furthermore, as mentioned above, our focus is not to provide definitive measures of productivity through efficiency scores, but rather to obtain some evidence with respect to comparative issues for socialist countries.

Most conclusions from the stochastic frontier approach are confirmed with the WITHIN model: the hierarchy of groups of countries is the same with socialist countries dominated by all other groups, while the rankings of socialist countries are similar with Yugoslavia above Hungary and Poland. We however observe some differences for the evolution in technical efficiency with the SFA results. In particular, there is now an increase in efficiency for

socialist countries between 1980 and 1987 with this model. This results from the fact that the increases in efficiency for Hungary and Poland are now higher, while the reduction for Yugoslavia is lower, than with the SFA model. The consequence is that we observe a reduction of the productivity gap between socialist countries and developing countries over the period. However this gap still increased between European socialist countries and developed countries, as the improvement in inefficiency was considerably greater in developed countries (+8.40) than in socialist countries (+2.30).

Table 4 records the significance levels for t-tests for comparisons between pairs of groups of countries for the mean efficiency scores in both frontier efficiency models. In both models, we observe that socialist countries have a efficiency mean significantly below than middle-income or developed countries, but not significantly than lower-income countries. Furthermore, when comparing pairwise other groups of countries, we point out a significant hierarchy between lower-income, middle-income and developed countries in ascending order for the SFA model. However, efficiency means with the WITHIN model are not significantly different. To conclude these significance tests, it has to be stressed that if we exclude the specific case of China, which is a lower-income country with a socialist system, the results of these tests are qualitatively similar.

In addition to the wordy analysis of the similarities between both approaches for the estimation of efficiency scores, it is of utmost interest to investigate econometrically the robustness of both frontier approaches. Namely, we aim here to check whether both techniques provide similar rankings of countries for the levels and the evolutions. To do so, we compute the correlations of the rankings of the efficiency scores obtained with both techniques. Spearman coefficients of correlation are computed to compare mean efficiency scores over the period and variations in efficiency over the period. We observe very high positive rank correlations in both cases: the correlation coefficients are 0.986 and 0.816 respectively for mean efficiency scores and for variations in efficiency, with both coefficients significant at the 1% level. This clearly supports the robustness of the frontier efficiency techniques.

Consequently, our main conclusion is the underperformance of the Soviet socialist system in terms of technical efficiency. European socialist economies have lower efficiency levels than developed but also developing countries. Furthermore, the hierarchy of socialist countries supports the view that the market-oriented reforms favored productivity in socialist economies, meaning that the Soviet model of socialist economy is the least efficient one.

Table 2a
Yearly efficiency scores by group of countries: SFA model

	Socialist countries	Lower-income countries	Middle-income countries	Developed countries
N	3	25	34	25
1980	60.67	70.04	78.21	80.68
1981	60.06	70.51	77.75	80.90
1982	59.55	70.44	76.94	81.38
1983	61.74	70.94	76.57	82.27
1984	55.67	67.95	74.28	82.81
1985	57.53	70.35	75.11	82.68
1986	59.90	71.62	76.54	83.21
1987	58.84	71.39	76.86	83.32
Evolution 80-87	-1.83	+1.35	-1.36	+2.64
Average	59.25	70.41	76.53	82.15

All scores in percentage.

Table 2b
Yearly efficiency scores for socialist countries: SFA model

	Hungary	Poland	Yugoslavia
1980	60.88	49.23	71.91
1981	62.26	46.75	71.18
1982	63.25	45.19	70.21
1983	65.34	49.38	70.51
1984	59.04	43.90	64.06
1985	61.12	48.77	62.69
1986	62.96	51.68	65.05
1987	63.64	51.74	61.14
Evolution 80-87	+2.76	+2.51	-10.77
Average	62.31	48.33	67.09

All scores in percentage.

Table 3a
Yearly efficiency scores by group of countries: WITHIN model

	Socialist countries	Lower-income countries	Middle-income countries	Developed countries
N	3	25	34	25
1980	32.45	48.25	53.69	49.39
1981	33.02	49.64	53.36	51.40
1982	33.05	50.02	52.38	52.47
1983	33.38	50.52	52.05	53.90
1984	34.04	51.10	52.35	55.70
1985	35.06	51.81	53.26	57.92
1986	35.61	51.48	53.55	59.16
1987	34.76	48.93	51.85	57.80
Evolution 80-87	+2.30	+0.68	-1.84	+8.40
Mean	33.92	50.22	52.81	54.72

All scores in percentage.

Table 3b
Yearly efficiency scores for socialist countries: WITHIN model

	Hungary	Poland	Yugoslavia
1980	33.19	23.38	40.79
1981	34.48	23.63	40.95
1982	35.09	23.77	40.28
1983	35.91	24.42	39.82
1984	36.93	25.63	39.57
1985	38.18	27.47	39.53
1986	38.73	29.36	38.75
1987	37.54	30.45	36.28
Evolution 80-87	+4.35	+7.07	-4.51
Mean	36.25	26.01	39.50

All scores in percentage

This new evidence needs to be put into perspective with former empirical and theoretical literature on the comparative productivity. Our results are in accordance with Bergson (1987), Moroney and Lovell (1997), Koop et al. (2000) who all found also a greater productivity in developed economies than in socialist economies. In comparison with Koop et al. (2000), we agree as well on the greater productive performance of Yugoslavia than of Poland. Nevertheless, unlike this work, we do not observe a productivity level for Yugoslavia similar to the most efficient countries.

Table 4
Significance levels for t-tests and p-value for difference in means across groups of countries

	SFA model		WITHIN model	
transition vs. lower income	-1.22	(0.2334)	-1.38	(0.1790)
transition vs. middle income	-2.74***	(0.0096)	-2.17**	(0.0367)
transition vs. developed	-8.20***	(0.0001)	-5.65***	(0.0001)
lower income vs. middle income	-1.82*	(0.0737)	-0.57	(0.5689)
lower income vs. developed	-3.72***	(0.0005)	-1.08	(0.2861)
middle income vs. developed	-2.55**	(0.0136)	-0.61	(0.5443)

Absolute *t*-statistics are displayed in parentheses under the coefficient estimates. *, **, *** denote an estimate significantly different from 0 at the 10%, 5% or 1% level.

On a theoretical basis, the possible explanations of the gap in technical efficiency between socialist and market economies are numerous. As described in section 2, the features of the socialist economies, which cross-country differences in their effective implementation, may worsen productivity. Public ownership, planning, lack of competition, and guaranteed employment, may not have provided the best incentives for managers and employees to perform well. Furthermore, the low openness of the economy may have contributed to put a brake on productivity growth by limiting the introduction of productive ideas, while the poor quality of institutions may exert a negative influence on productivity.

6. Conclusion

This research has analyzed the macroeconomic performance of European socialist economies in comparison with developing and developed countries, by estimating technical efficiency. It is indeed of utmost importance to assess the ability of European socialist countries to combine optimally factors of production in the perspective to explain the cross-country differences in per capita income and in growth.

Our major conclusion is the backwardness of European socialist countries in macroeconomic technical efficiency in comparison with developed countries, but also with developing countries. This result was found with both frontier efficiency models, which brings some robustness to this upshot. Furthermore, it emerges a clear hierarchy between the investigated European socialist countries with in ascending order Poland, Hungary, and Yugoslavia. As these rankings are in accordance with the degree of implementation of market-oriented reforms in socialist countries, these results support the view of the underperformance of the European socialist system in terms of macroeconomic technical efficiency. Thus, we conclude in favor of the commonly accepted view of a considerable waste of resources in former socialist economies in Eastern Europe.

Furthermore, the investigation of the evolution of macroeconomic performance shows different results depending of the frontier model. But both models agree on the increase of the gap in technical efficiency between socialist and developed countries during the eighties, which is an important result in the perspective of the failure of socialist countries to reach the income performances of the most advanced countries.

Consequently, we have provided here new evidence to explain the economic failures of the socialist system in Eastern Europe. An interesting extension of this analysis would be the investigation of this issue on other periods to check the time-consistency of our results. It could notably be of utmost interest to know if the 50s, which is commonly admitted as the period of the highest growth of the USSR, was also characterized by a low macroeconomic performance. Therefore, further research is needed to assess and complete our results.

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Annex

Table A.1: Mean efficiency scores with the stochastic frontier approach

Country	Efficiency score	Country	Efficiency score
Algeria	81.16	Kenya	53.96
Argentina	80.71	Korea. Rep.	71.41
Australia	82.71	Lesotho	61.68
Austria	82.51	Malawi	49.72
Bangladesh	91.44	Malaysia	77.44
Belgium	84.11	Mali	82.66
Benin	81.07	Mauritius	85.38
Bolivia	63.98	Mexico	88.14
Brazil	83.38	Mozambique	92.37
Cameroon	83.99	Netherlands	84.66
Canada	87.14	New Zealand	80.94
Central Africa	68.08	Nicaragua	76.71
Chile	72.09	Norway	82.44
China	46.56	Pakistan	82.46
Colombia	80.65	Panama	73.28
Costa Rica	77.84	Papua New Guinea	66.71
Cyprus	73.59	Paraguay	75.89
Denmark	81.03	Peru	70.25
Dominican Republic	76.39	Philippines	59.75
Ecuador	71.07	Poland	48.33
Egypt	92.88	Portugal	78.25
El Salvador	81.59	Rwanda	88.41
Fiji	73.11	Senegal	85.43
Finland	77.97	Singapore	81.53
France	84.69	South Africa	77.02
Gambia	82.83	Spain	81.73
Ghana	71.41	Sri Lanka	78.10
Greece	75.14	Sudan	66.55
Guatemala	87.50	Sweden	83.73
Guinea-Bissau	58.84	Switzerland	81.42
Guyana	43.53	Syria	90.06
Honduras	71.11	Thailand	70.66
Hong Kong	88.83	Togo	45.72
Hungary	62.31	Trinidad and Tobago	91.94
Iceland	84.81	Tunisia	84.88
India	58.95	Turkey	72.06
Indonesia	67.47	Uganda	87.32
Iran	83.99	United Kingdom	86.14
Ireland	78.37	USA	87.49
Israel	82.84	Uruguay	75.55
Italy	85.19	Yugoslavia	67.09
Jamaica	55.98	Zambia	42.30
Japan	76.61	Zimbabwe	63.12
Jordan	87.80		

All scores in percentage.

Table A.2: Mean efficiency scores with the WITHIN model

Country	Efficiency score	Country	Efficiency score
Algeria	53.17	Kenya	31.64
Argentina	53.24	Korea. Rep.	44.73
Australia	54.46	Lesotho	38.71
Austria	54.14	Malawi	29.39
Bangladesh	89.20	Malaysia	50.09
Belgium	56.68	Mali	58.97
Benin	56.54	Mauritius	63.28
Bolivia	38.18	Mexico	67.74
Brazil	56.59	Mozambique	93.85
Cameroon	62.43	Netherlands	57.57
Canada	63.15	New Zealand	52.39
Central Africa	43.48	Nicaragua	49.86
Chile	44.81	Norway	53.33
China	26.65	Pakistan	58.93
Colombia	54.18	Panama	45.79
Costa Rica	50.43	Papua New Guinea	39.45
Cyprus	45.02	Paraguay	50.94
Denmark	52.15	Peru	43.40
Dominican Republic	49.42	Philippines	36.07
Ecuador	43.56	Poland	26.01
Egypt	98.21	Portugal	49.33
El Salvador	56.61	Rwanda	77.03
Fiji	45.83	Senegal	66.12
Finland	47.70	Singapore	53.16
France	56.91	South Africa	48.93
Gambia	61.71	Spain	53.15
Ghana	47.48	Sri Lanka	53.96
Greece	46.44	Sudan	40.23
Guatemala	67.35	Sweden	56.18
Guinea-Bissau	32.93	Switzerland	52.18
Guyana	23.20	Syria	75.57
Honduras	44.62	Thailand	44.31
Hong Kong	70.05	Togo	25.61
Hungary	36.25	Trinidad and Tobago	85.57
Iceland	57.64	Tunisia	60.75
India	35.75	Turkey	43.83
Indonesia	42.44	Uganda	81.65
Iran	57.39	United Kingdom	61.89
Ireland	49.50	USA	64.28
Israel	55.71	Uruguay	48.47
Italy	58.09	Yugoslavia	39.50
Jamaica	31.43	Zambia	22.73
Japan	46.90	Zimbabwe	37.53
Jordan	69.06		

All scores in percentage.

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