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12 Prices, Quantities, and Productivity in Industry: A Study of Transition Economies in a Comparative Perspective

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The recent breakup of socialist regimes in Eastern Europe and the troublesome process of transformation of former centrally planned economies into market economies has added a new aspect of interest to the debate on catch-up and convergence. It raises such questions as, What were the main bottlenecks characterizing the slowdown in growth performance in the centrally planned economies (CPEs) relative to the advanced market economies during the 1980s, and how have the basic parameters changed since transition began?[1]

In earlier papers, the present authors and others dealt with the comparative productivity performance of manufacturing in a wide range of countries, including centrally planned economies. Table 12.1 summarizes estimates of levels of manufacturing productivity for twenty-three countries relative to the United States for the period 1970–94 derived from the International Comparisons of Output and Productivity (ICOP) project. These estimates are based on the industry-of-origin method, which is briefly explained in section 12.1.

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1. In this paper, we will use the terms *transition economies* and *centrally planned economies* interchangeably. Both terms, as well as the term *historically planned economies* used by Marer (1991), do not adequately characterize the present or even the historical situation of the countries in this group for the purpose of this paper. For the sake of simplicity, we mostly stick to the terminology *centrally planned economies.*

Table 12.1 **ICOP Estimates of Comparative Levels of Labor Productivity in Manufacturing, 1970–94, United States = 100**

	1970		1980		1987		1994	
	Value Added per Person Employed	Value Added per Hour	Value Added per Person Employed	Value Added per Hour	Value Added per Person Employed	Value Added per Hour	Value Added per Person Employed	Value Added per Hour
China	4.5[a]		4.9		4.5			
India	7.0	5.8	5.6	5.0	7.2	5.7		
Indonesia	7.2		10.6		10.0	8.8		
Taiwan	10.4		14.1	10.1	19.1	14.6	27.5[b]	
Hungary	18.9		22.0		20.1		20.0	
Poland	27.1		26.8		21.2		17.0	
East Germany	27.3		27.6		22.5	23.5	46.5	
Czechoslovakia	26.5		28.8		24.0	18.8		
Portugal	22.2		27.4		24.5			
Soviet Union[c]	25.3	28.1	28.2	29.9	24.8	26.3		
Korea	14.8	10.2	22.1	15.0	26.3	18.2		
Brazil	41.4	38.6	42.7	38.5	30.7	28.4		
Mexico	37.2	34.9	39.7	35.4	30.5			
Spain	27.1	33.8	44.0	64.6	46.5		60.7	67.6
Australia	56.6	55.5	57.4	57.1	48.4	49.9		
United Kingdom	51.8	51.3	48.6	52.3	53.6	58.0	59.3	70.2
Finland	58.8	59.1	63.0	67.7	65.9	74.3		

Sweden	73.8	83.5	72.8	94.4	68.4	87.4	77.9	96.1
West Germany	79.7	78.6	87.1	95.1	70.2	82.2	66.1	85.3
France	73.0	73.3	83.0	89.8	71.2	84.0	72.9	89.3
Japan	53.5	44.5	77.0	66.2	76.4	67.5	73.4	72.4
Canada	86.3	86.5	86.8	89.0	77.3	80.8	71.6	75.2
Netherlands	75.4	81.1	90.3	107.5	83.3	105.4	78.7	103.2
United States	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Sources: Benchmark estimates: China/United States (1987) from Szirmai and Ruoen (1995); India/United States (1975) from van Ark (1991); Indonesia/United States (1987) from Szirmai (1994); Taiwan/United States from Timmer (1996); Hungary/West Germany (1987) from Monnikhof (1996); Poland/West Germany (1989) from Liberda, Monnikhof, and van Ark (1996); East Germany/West Germany (1987) from Beintema and van Ark (1994) with revisions (see van Ark 1995a); Poland/West Germany (1993) are unpublished ICOP/LCRA estimates (January 1996); East Germany/West Germany (1992) are unpublished ICOP/LCRA estimates (January 1996); Czechoslovakia/West Germany from van Ark and Beintema (1993) with revisions (see van Ark 1996); Soviet Union/United States (1987) from Kouwenhoven (1996); Portugal/United Kingdom (1984) from Peres Lopes (1994) linked to United Kingdom/United States (1987) from van Ark (1992); Korea/United States (1987) and Japan/United States (1987) from Pilat (1994); Brazil/United States (1975) and Mexico/United States (1975) from van Ark and Maddison (1994); Spain/United Kingdom (1984) from van Ark (1995b) linked to United Kingdom/United States (1987) from van Ark (1992); Australia/United States (1987) from Pilat, Rao, and Shepherd (1993); United Kingdom/United States (1987) from van Ark (1992); Finland/United States (1987) and Sweden/United States (1987) from Maliranta (1994); West Germany/United States (1987) from van Ark and Pilat (1993); France/United States (1987) from van Ark and Kouwenhoven (1994); Canada/United States (1987) from de Jong (1996); Netherlands/United States from Kouwenhoven (1993). Extrapolations from benchmark years are mostly from (modified) national accounts series on real GDP and employment in manufacturing; see original publications above with extensions according to the ICOP industry database (University of Groningen).

Note: Countries are ranked according to their level of value added per person employed in 1987. All estimates have been converted to the United States as the base country.

[a]1975.

[b]1993.

[c]Extrapolated by series for all industry (including mining, construction, and public utilities).

Table 12.1 shows that, in 1987, the level of manufacturing labor productivity was lowest in China, whereas other CPEs show productivity levels in a range between those of typical low-productivity economies such as India and Indonesia and higher-productivity economies such as Korea, Brazil, and Mexico.[2] Compared to studies of Eastern Europe and the Soviet Union for earlier years, our estimates for the CPEs are relatively low.[3] This is related partly to a genuine decline in comparative productivity performance of the CPEs since the 1970s and partly to differences in methodology between this study and the earlier ones. Our estimates are based on value added rather than gross output, and we use industry purchasing power parities (PPPs), which are a geometric average of PPPs at market economy and CPE weights (see sec. 12.1).

The explanation of productivity differences between countries has been addressed from various angles. In earlier papers, we applied a "level accounting" approach, which accounted for the role of typical supply-side factors, such as differences in physical and human capital intensity, industry composition, and firm size (van Ark and Pilat 1993; van Ark 1993; Pilat 1994). Van Ark (1996) suggests that the emphasis on "extensive growth" strategies, based on rapid accumulation of factor inputs without substantive total factor productivity (TFP) growth, explains much of the relative decline in the productivity performance of the CPEs, in particular during the 1970s and 1980s.

Another plausible explanation for the relatively low productivity levels in CPEs is the misallocation of resources and final output because of a distorted relation between prices and quantities. The CPEs were characterized by a system of administrative prices that do not reflect scarcities in the market but are primarily based on cost plus net indirect taxes and a markup. This explanation for the bad performance of centrally planned economies has been put forward in many studies by key scholars in this field, including Bergson (1961, 1978, 1987) and Kornai (1980, 1992).

In this paper, our aim is not to explain the productivity performance of the CPEs in the first place. In relation to the latter type of explanation, we will investigate to what extent our estimates of price relatives and quantity relatives suggest a greater distortion in CPEs than in other countries. Second, we investigate regularities and irregularities in terms of price and quantity structures for groups of countries given their relative productivity levels.

In section 12.1, we present our estimates of manufacturing output and productivity for four East European countries. Binary comparisons were made for East Germany and Hungary compared to West Germany for 1987 and Czechoslovakia and Poland compared to West Germany for 1989. For two of these countries (i.e., the East German *Länder* and Poland), more recent benchmark comparisons for 1992/1993 were made as well. We also briefly outline the major

2. Taiwan's labor productivity in manufacturing was still somewhat below that of the CPE countries in 1987, but, as table 12.1 shows, it increased very substantially between 1987 and 1993.

3. For details on earlier studies, see n. 13 below.

characteristics of the industry-of-origin approach as compared to the expenditure approach in international comparisons, and we deal extensively with the specific methodological problems that arise from the inclusion of centrally planned economies in those studies.

In the second half of the paper, we focus on the relative price and quantity structures between CPEs and non-CPEs and on the relation between price and quantity relatives. As our comparisons are all of a binary nature, we begin in section 12.2 by analyzing the difference in purchasing power parities (in our terminology, *unit value ratios* [UVRs]) at quantity weights of the "own" country (the Paasche UVR) with those at quantity weights of the "numeraire" (or base) country (the Laspeyres UVR). We find that the Paasche-Laspeyres (PL) ratio, which provides an indication of the "Gerschenkron effect," is much higher for the CPEs than might be expected given their relative level of labor productivity. Subsequently, we analyze the issue from a mathematical perspective, by making use of the "Bortkiewicz formula" (Bortkiewicz 1922, 1924). According to this formula, the PL ratio is decomposed into three components: (1) the variance of price relatives; (2) the variance of quantity relatives; and (3) the correlation between price and quantity relatives. The relation between price and quantity relatives, which can be interpreted as a measure of distortion, is analyzed, and various measures of the (dis)similarity of price and quantity structures between the countries are discussed. Subsequently, each of these three components will be looked at in more detail and will be related to the relative labor productivity level in manufacturing.

12.1 Manufacturing Productivity Levels in Centrally Planned Economies

12.1.1 The Industry-of-Origin Method Compared to the Expenditure Method

International comparisons of GDP and per capita income are mostly made by converting national income into a common currency on the basis of expenditure-based purchasing power parities (PPPs). These PPPs are obtained by expenditure category (private consumption, investment, and government expenditure).[4] There is a long tradition of such comparisons, also for centrally planned economies, including several studies by the UN Economic Commission for Europe (see, e.g., ECE 1988, 1994).[5]

Comparisons of productivity should preferably be based on the industry-of-

4. For early postwar comparisons, see, e.g., Gilbert and Kravis (1954) and Gilbert et al. (1958). Since the late 1960s, surveys were conducted at regular intervals by the International Comparisons Project (ICP); see, e.g., Kravis, Heston, and Summers (1982) and the subsequent Penn World Tables (e.g., Summers and Heston 1988, 1991), which were derived from the ICP estimates.

5. For a review of ICP studies including CPEs, see Marer (1985). For a review of historical comparisons of the Soviet Union and the United States, see Kudrov (1995).

origin approach. It involves comparisons of real output by sector of the economy (agriculture, industry, and services) and branches and industries within these sectors. The earliest industry-of-origin studies were mainly based on direct comparisons of physical quantities produced (tons, liters, units) (see, e.g., Rostas 1948).[6] Later on, industry comparisons switched to using "industry" purchasing power parities to convert the output value by industry, branch, or sector to a common currency.[7]

Since 1983, a substantial research effort has been made at the University of Groningen to develop the industry-of-origin approach as part of the International Comparisons of Output and Productivity (ICOP) project. So far, most ICOP studies dealt with comparisons of manufacturing productivity, which now include almost thirty countries, most of which are reported in table 12.1.[8]

The most solid basis for industry-of-origin studies is provided when, for each country, all information can be derived from a single primary source, which, in the case of manufacturing, is the census of production or industrial survey. It contains considerable detail on the output and input structure by industry and information on the sales values and quantities of most products. The "industry" PPPs are based on ratios of unit values (derived from the sales values and quantities reported) for matched products between two countries. This method is fundamentally different from the pricing technique in the ICP expenditure approach, which makes use of prices for specified products. The industry-of-origin technique provides unit values with a quantity counterpart, as quantities times "prices" equals the value equivalent.

As the production censuses and industry surveys are harmonized across countries only to a limited extent, the most practical approach is to make the industry-of-origin comparisons on a two-country basis. For ICOP comparisons, the United States or West Germany is mostly taken as the "numeraire" (or base) country.[9]

Unit value ratios cannot be obtained for all output produced, mainly because of differences in product mix and product quality across countries, the lack of information for reasons of confidentiality, and the existence of unique products in one of two countries compared. In practice, between 67 (in the case of the China/United States comparison for 1987) and 414 (in the case of the Germany/United States comparison for 1992) unit value ratios are obtained, which cover between 10 and 50 percent of the total value of manufacturing sales (see table 12.5 below). Coverage percentages are usually somewhat below the average for typical investment goods (such as machinery and transport equip-

6. For a Soviet Union/United States comparison of this nature, see Galenson (1955).

7. For an early comparison of this nature for the United Kingdom and the United States in 1950, see, e.g., Paige and Bombach (1959). For comparisons including Austria, Czechoslovakia, France, and Hungary for the 1960s, see Conference of European Statisticians (1971, 1972).

8. For an overall review of ICOP studies, see Maddison and van Ark (1994). For manufacturing, see van Ark (1993).

9. For an application of multilateral indexes to original binary ICOP comparisons at aggregate levels of industries and branches, see Pilat and Prasada Rao (1996).

ment) and above average in nondurable consumer goods (such as food and kindred products). By reweighting UVRs at various stages from the product level up to the industry, branch, and sector level, using either quantities (at the product level) or value added (at higher levels) as weights, it is assured that the UVRs of products in bigger industries affect the UVR for total manufacturing more strongly than those of smaller industries. At the same time, the sensitivity of the aggregate UVR to outlier UVRs is reduced in this way.

Despite their shortcomings (which can be reduced by using more detailed product information or by adjusting existing UVRs for observed quality differences),[10] ICOP UVRs are preferred over ICP PPPs as a conversion factor for sectoral studies. First, expenditure-based PPPs include prices of imports but not of exports. Second, the expenditure prices include trade and transport margins, which may differ between countries. Finally, expenditure PPPs exclude price ratios for intermediate products, which form a substantial part of manufacturing output.[11]

12.1.2 Comparisons of Prices and Productivity for East European Countries[12]

Studies of comparative output and productivity levels for centrally planned economies raise specific problems that are less important for comparisons among market economies.

1. Centrally planned economies have less meaningful prices on the basis of which output is compared to that of market economies. Official price quotations are mostly administered prices, which are determined differently from the price-formation process in a market economy. Comparisons between CPEs and market economies have therefore often been made on the basis of pricing the products at Western prices only, for example, at U.S. dollars or West German marks.[13] Such comparisons usually imply that the output of the country

10. See, e.g., Gersbach and van Ark (1994) for a detailed description of adjustments to ICOP PPPs used in a comparative study of manufacturing productivity between Germany, Japan, and the United States, by the McKinsey Global Institute (1993).

11. For recent applications of expenditure PPPs to industry-of-origin comparisons, see Hooper and Vrankovich (1995) and Pilat (1996).

12. This section concentrates on the main problems of comparisons including former CPEs. For a more detailed account of methods and procedures for each binary comparison and more detailed estimates, see van Ark and Beintema (1993). For the comparison of Czechoslovakia and West Germany, see van Ark (1996). For East Germany vis-à-vis West Germany in 1987, see Beintema and van Ark (1994) and van Ark (1995a). For Poland and West Germany in 1989, see Liberda, Monnikhof, and van Ark (1996). For Hungary vs. West Germany, see Monnikhof (1996). Details of comparisons for East and West Germany in 1992 and Poland and West Germany in 1993 have not yet been published. The Soviet Union/United States and China/United States comparisons are not dealt with in this section. For this, the reader is referred to Kouwenhoven (1996) and Szirmai and Ruoen (1995).

13. Van Ark (1995a) extensively describes earlier comparisons of East and West German output, which include Sturm (1974), Wilkens (1970), and Görzig and Gornig (1991). There has also been one study comparing Czechoslovakia and France in the framework of a four-country comparison (Austria, Czechoslovakia, France, and Hungary) at the end of the 1960s (Conference of European Statisticians 1971, 1972). All these studies make use, to a considerable extent at least, of the

for which the prices are substituted by the prices of the other country gets overstated. This stylized fact, which may be referred to as the *Gerschenkron effect,* will be discussed in more detail in section 12.2.

Although the unit values of the CPEs represent administered prices, these remain the most practical for calculating unit value ratios because of the identity of quantities times prices and values in our data set: the CPE output value that needs to be converted to West German marks is expressed in the same administered prices as the unit values in the unit value ratios.[14] Table 12.2 shows the average unit value ratio for manufacturing for the benchmark years of our comparisons for four East European countries. The table shows that, in all cases, the UVRs are substantially below the commercial exchange rate. The commercial exchange rates reflect the relatively high price of exported goods, when expressed in domestic currencies, compared to the amount of West German marks these goods earn on the world market. The exchange rate deviation index is therefore substantially above one in all cases.

2. There are significant differences between the quality of products produced in CPEs and that of those produced in market economies. Although one can safely assume that, on the whole, average product quality was lower in CPEs than in market economies, it is not clearly documented whether such differences were equally large across the whole range of manufacturing products. Furthermore, given the administrative nature of the pricing system in the CPEs, one cannot be sure to what extent quality differences were or were not reflected in the actual prices.

The present comparisons for Czechoslovakia (1989), East Germany (1987), and Poland (1989) include a rough quality adjustment for passenger cars. This adjustment was derived from a price valuation of a Czech-made car (a Skoda) in West Germany compared to the average price of a car of West German make in 1989. The overall effect of the quality adjustment for cars on the unit value ratio for manufacturing as a whole was 16 percent for the Czechoslovakia/West Germany comparison, 11 percent for the East Germany/West Germany comparison in 1987, and 8 percent for the Poland/West Germany comparison in 1989.[15]

3. A third problem that affects output and productivity comparisons between

method by which quantities were valued at Western prices only. Most comparisons between former CPEs were carried out by the CMEA (Council for Mutual Economic Assistance) Standing Statistical Commission. These estimates were based on detailed repricing of individual commodities mostly with the former Soviet Union as the numeraire country. Until the dissolution of the CMEA, these estimates were not disclosed, although recently estimates for 1988 were published by Comecon (1990). For a detailed description of earlier estimates for these countries, see Drechsler and Kux (1972). Kouwenhoven (1996) and Kudrov (1995) provide a review of former Soviet Union/United States estimates.

14. Here, we ignore the distorting effect that administrative prices may have on the weighting system, which may affect the interpretation of the aggregate results (see, e.g., Marer 1985).

15. For further details, see van Ark (1995a, 1996) and Liberda, Monnikhof, and van Ark (1996). These sources also show the results without the quality adjustment. For the Hungary/West Germany comparison, no adjustment for quality was made as there were no cars produced in Hungary.

Table 12.2 **Unit Value Ratios for Total Manufacturing and Commercial Exchange Rates for (former) CPEs, 1987–93**

	Unit Value Ratio (own currency/DM)			Commercial Exchange Rate (own currency/DM) (4)	Exchange Rate Deviation Index (4)/(3) (5)
	At Own Country Quantity Weights (1)	At West German Quantity Weights (2)	Geometric Average (3)		
Czechoslovakia/West Germany (1989)	3.72	4.03	3.87	8.01	2.07
East Germany/West Germany (1987)	1.81	1.98	1.89	4.52	2.39
Hungary/West Germany (1987)	12.5	15.3	13.8	25.8	1.87
Poland/West Germany (1989)	343.1	342.8	343.0	1,439.2	4.20
East Germany/West Germany (1992)	.77	.73	.75	1.00	1.33
Poland/All Germany (1993)	5,313.4	5,221.9	5,267.5	10,957.0	2.08

Source: See table 12.1 and appendix table 12A.1. Exchange rates from World Bank (1993).

Note: For details on the matching procedure, see appendix table 12A.1.

CPEs and market economies concerns differences in industry classification schemes. For the CPEs, there are difficulties in separating activities in mining and utilities from those in manufacturing. More important is that employment estimates for manufacturing in CPEs often include employees from a wide range of secondary activities, such as repair and maintenance and social services provided by firms on a much wider scale than in market economies. Where possible, adjustments to Western classification schemes were made. Similarly, as far as possible, labor input in social services etc. was excluded from the employment data.

4. Finally, differences in the concept of output between CPEs and market economies have been a matter of major concern in comparative economics. Comparisons across countries can be made either on the basis of gross output or on the basis of value added. The difference between these two output measures is the intermediate inputs. According to the traditional material product system (MPS) accounting system used by the CPEs, output concerns only material production, and intermediate inputs concern only material inputs (raw materials, energy, packaging) and some industrial services (e.g., contract labor). Nonindustrial service inputs were not measured.

As we did not have detailed information on nonindustrial services for the CPE countries, our output comparisons are in terms of gross output and value added, where, in the latter case, we only deducted material cost from gross output (see appendix table 12A.2).[16] Table 12.3 shows the comparative levels of gross output, value added, and gross output and value added per employee that were obtained with the help of the unit value ratios from table 12.2.[17] The estimates show that the output gap between the CPEs and West Germany was smaller in terms of gross output than in terms of value added, which suggests a greater use of intermediate inputs in the CPE countries. This can also be derived from the final column of table 12.3, which shows the ratio of material inputs to gross output in domestic prices. In all cases but one, this ratio was substantially larger in the CPEs (between 60 and 65 percent of gross output) than in West Germany (between 48 and 53 percent).[18]

16. For the 1992/1993 comparisons, we stayed as much as possible with the same concepts as for the late 1980s, partly to retain comparability and partly because, in the case of Poland, the statistics of the early 1990s have not yet been fully adjusted to Western concepts of output and employment.

17. With the exception of Poland (1989), the same unit value ratios were used for the comparisons of value added and gross output, assuming that the price ratios for gross output were also representative for the intermediate inputs. Although this assumption (which can be contrasted with double deflation when intermediate inputs are converted with an independent UVR for intermediate inputs) could not be cross-checked with other evidence, there is no immediate reason to expect a systematic difference between UVRs at the gross output level and UVRs for intermediate inputs. Only in the case of Poland (1989) did we develop separate UVRs for intermediate inputs, which were obtained by backdating the gross output UVRs with six months (assuming that this was the average time during which intermediate inputs were kept in stock), using the producer price index for Poland. (See Liberda, Monnikhof, and van Ark 1996.)

18. The Polish case for 1989 was exceptional. Because of the high inflation during the benchmark year, intermediate inputs were valued at much lower prices than gross output, so the ratio of the value of intermediate inputs to gross output was lower than usual.

Table 12.3 **Gross Value of Output, Value Added, and Labor Productivity in Manufacturing in (former) CPEs as a Percentage of West Germany,[a] 1987–93**

	Gross Value of Output (1)	Value Added (2)	Gross Value of Output per Employee (3)	Value Added per Employee (4)	Material Inputs as a % of Gross Output[b] (5)
Czechoslovakia (1989)	14.7	10.6	44.7	32.3	65.1
East Germany (1987)	19.6	12.9	48.6	32.0	65.8
Hungary (1987)	6.3	5.3	33.4	28.6	59.5
Poland (1989)	16.5	13.5[c]	35.2	29.3[c]	41.9
West Germany (1987–89)	100.0	100.0	100.0	100.0	48.0–51.9
East Germany (1992)	5.9	4.8	56.0	46.9	61.1
Poland (1993)[a]	9.1	7.9	27.0	23.5	59.1
West Germany (1992)	100.0	100.0	100.0	100.0	52.9

Source: Appendix tables 12A.1 and 12A.2.

Note: The conversion to common currency was done at the geometric average of the unit value ratios at own country weights and (West) German weights.

[a]Poland as a percentage of all Germany.

[b]Calculated on the basis of domestic prices.

[c]After adjustment of gross output UVR to a value-added UVR by using a UVR for intermediate inputs that was derived by backdating the gross output UVR by six months using the producer price index. This adjustment was necessary because of an inflation rate of over 700 percent in Poland in 1989.

There are various explanations for the larger share of material inputs in gross output in CPEs compared to market economies. First, there has been a greater wastage of intermediate inputs. Although in recent decades value added rather than gross output was the major performance criterion in CPEs, there was no budget constraint on inputs. This led to an inefficient use of raw materials, energy, and other intermediate inputs. Production prices were raised to allow for greater wastage, and product-oriented subsidies were accorded when prices became too high. Related to this, a second reason for the larger use of intermediate inputs is the misallocation of inputs across industries owing to the distortion of prices. Third, firms tended to hold large stocks of materials and semifinished products, which they used to exchange with other firms in order to compensate for general shortages. Fourth, there may have been a trade-off between the low technology content and high material input content for many products from CPE countries. For example, CPEs often invested in heavy and solid machine tools that performed relatively simple functions with large margins of tolerance. The latter were typical "low-value-added" products, characterized by relatively low ratios of value added to gross output.[19]

In our comparisons, we use value added rather than gross output because, at the aggregate level of total manufacturing, the use of value added prevents double-counting. Moreover, by using value added, we take account of at least part of the quality problem outlined above, namely, as far as it is related to the typical low-value-added content of CPE products. To the extent that the use of excessive intermediate inputs per unit of output was meant to compensate for the low technology content of the products, an implicit correction is made for the low quality content of the products in the CPE country. Admittedly, this method is crude and does not provide an exact adjustment for quality. However, as the latter type of adjustment is very difficult to come by directly, our value-added comparisons are a better proxy for "quality-adjusted" productivity than the gross output comparisons.

Table 12.3 shows that gross output per employee in manufacturing varied from 33 percent of the West German level in Hungary to 49 percent in East Germany during the late 1980s. The value added per person employed as a percentage of West Germany varied from 29 percent in Hungary and Poland to 32 percent in Czechoslovakia and East Germany. The two comparisons for the early 1990s suggest a significant improvement in manufacturing productivity in East Germany relative to West Germany but a worsening of the productivity performance in Poland versus all Germany.

The ICOP papers cited in the source notes to table 12.1 and appendix tables 12A.1 and 12A.2 document the binary comparisons in more detail and provide disaggregated productivity results by industry and branch. Table 12.4 summa-

19. This difference in the nature of products produced in former CPEs compared to high-productivity market economies comes out clearly in a study comparing manufacturing plants in East and West European countries producing similar products (see Hitchens, Wagner, and Birnie 1993, chap. 5).

Table 12.4 **Comparative Levels of Value Added per Employee in Manufacturing, Czechoslovakia, East Germany, Hungary, and Poland as a Percentage of West Germany,[a] 1987–93**

	Czechoslovakia, 1989 (1)	East Germany, 1987 (2)	Hungary, 1987 (3)	Poland, 1989 (4)	East Germany, 1992 (5)	Poland, 1993[a] (6)
Food products, beverages, and tobacco	23.7	46.3	29.3	30.4	44.5	29.6
Textile products, wearing apparel, leather products, and footwear	31.0	41.1	32.9	24.2	43.4	19.2
Chemicals, rubber and plastic products, and oil refining	73.9	44.4	29.6	39.1	33.7	27.5
Basic and fabricated metal products	35.7	40.1	30.0	21.9	63.7	19.7
Electrical and nonelectrical machinery and transport equipment	28.0	22.4	29.8	34.4	48.1	25.9
Other manufacturing[b]	34.2	27.7	26.3	25.6	47.5	17.8
Total manufacturing	32.3	32.0	28.6	29.3	46.9	23.5

Source: See table 12.1. For statistical sources, see appendix tables 12A.1 and 12A.2.

[a]Poland as a percentage of all Germany.

[b]Includes wood products and furniture; paper and paper products and printing; nonmetallic minerals and "other manufacturing."

rizes these results at the level of six major branches in manufacturing. The estimates suggest a varied pattern across the (former) CPEs. In Czechoslovakia and East Germany, the machinery and equipment branch experienced relatively low productivity levels compared to West Germany, whereas chemicals scored relatively well. In East Germany, basic metals and metal products also showed high productivity levels compared to the other CPE countries. In Poland, chemicals and machinery and equipment showed a relatively good productivity performance, whereas basic metals and metal products had by far the lowest productivity level compared to West Germany. Finally, Hungary showed relatively little variation in productivity levels by major branch around the mean for total manufacturing.

12.2 The Gerschenkron Effect and the Role of Distortion

The literature on the comparative performance of (former) centrally planned economies has put much emphasis on distortion of the price formation process in these countries. If prices do not fulfill their role to secure an optimal resource allocation, this may lead to a distorted relation between prices and produced quantities.

A first indication of distortion may be derived from the nonexistence of the Gerschenkron effect. In a two-country framework, the Gerschenkron effect implies that, the more the quantity structures of the two countries differ, the more the use of price weights of one country will lead to an overstatement of the other country's output (Gerschenkron 1951). This effect occurs because goods with a high (low) price in one country relative to the other country are associated with relatively small (large) quantities. Similarly, the more the price structures of the two countries differ, the more the use of quantity weights of one country will lead to an overstatement of the other country's prices. In terms of unit value ratios, this implies that the Laspeyres UVR (using quantity weights of the base country, i.e., the United States or Germany) is higher than the Paasche UVR (using quantity weights of the own country).

Table 12.5 shows that the Paasche-Laspeyres (PL) ratio is below one in twenty-five of the twenty-six cases. We grouped our countries into "high-productivity market economies" (HMEs), "low-productivity market economies" (LMEs), and "(former) centrally planned economies" (CPEs).[20] Within each group, the countries are ordered according to their level of labor productivity relative to the United States. On average, the PL ratio is 0.81 for all countries together, 0.87 for the HMEs, 0.65 for the LMEs, and 0.93 for the CPEs.

From a theoretical point of view, the results in table 12.5 are somewhat un-

20. China was included with the LMEs even though, from a political-economic point of view, it would have been correct to include China with the CPEs. As we will show below, the price and quantity characteristics of Chinese manufacturing are much more like those of LMEs than those of CPEs.

Table 12.5 **Paasche and Laspeyres Unit Value Ratios (at product quantity weights) for 26 Binary Comparisons of Ex-Factory Product Unit Values in Manufacturing**

	Number of Products in Sample (1)	Paasche UVR (own country currency/ numeraire country currency at own country quantity weights) (2)	Laspeyres UVR (own country currency/ numeraire country currency at numeraire country quantity weights) (3)	Paasche-Laspeyres Ratio (2)/(3) (4)
High-productivity market economies (HMEs)				
West Germany/United States (1992)	412	1.95	2.12	.92
Canada/United States (1987)	198	1.36	1.41	.97
Japan/United States (1987)	190	156	225	.69
France/United States (1987)	63[a]	5.04	5.88	.86
West Germany/United States (1987)	273	2.08	2.18	.95
Japan/United States (1975)	163	214	289	.74
Spain/United States (1992)	240	120	156	.77
United Kingdom/United States (1987)	171	.66	.71	.93
Australia/United States (1987)	175	1.28	1.39	.92
United Kingdom/United States (1975)	120	.42	.44	.96
Arithmetic average HMEs	201			.87
(Former) centrally planned economies (CPEs)[b]				
East Germany/West Germany (1992)	263	.75	.74	1.02
Czechoslovakia/West Germany (1989)	70	3.71	4.29	.86
East Germany/West Germany (1987)	335	1.85	1.99	.93
Soviet Union/United States (1987)	132	.48	.51	.93
Poland/West Germany (1989)	236	347	389	.89
Hungary/West Germany (1987)	386	12.4	14.8	.84
Poland/Germany (1993)	216	4,961	4,993	.99
Arithmetic average CPEs	234			.93

(continued)

Table 12.5 (continued)

	Number of Products in Sample (1)	Paasche UVR (own country currency/ numeraire country currency at own country quantity weights) (2)	Laspeyres UVR (own country currency/ numeraire country currency at numeraire country quantity weights) (3)	Paasche-Laspeyres Ratio (2)/(3) (4)
Low-productivity market economies (LMEs)				
Brazil/United States (1975)	129	6.42	8.31	.77
Mexico/United States (1975)	131	11.5	12.9	.89
South Korea/United States (1987)	184	639	951	.67
South Korea/United States (1975)	159	326	607	.54
Taiwan/United States (1976)	104	25.7	48.3	.53
Indonesia/United States (1987)	198	1,093	1,574	.69
South Korea/United States (1967)	114	220	350	.63
India/United States (1975)	111	4.29	8.25	.52
China/United States (1987)	58	1.26	1.98	.64
Arithmetic average LMEs	132			.65
Arithmetic average all countries	186			.81

Sources: See references to benchmark comparisons in table 12.1 and appendix table 12A.1. West Germany/United States (1992) are unpublished estimates from ICOP/LCRA (January 1996); East Germany/West Germany (1992) from ICOP/LCRA (January 1996); Japan/United States (1975) from Pilat (1994); South Korea/United States (1967, 1975) from Pilat (1995); the United Kingdom/United States (1975) from van Ark (1990); Taiwan/United States from Timmer (1996).

Note: The (number of) UVRs reported in this table are slightly different from those used to convert output by manufacturing branch to a common currency (such as, e.g., in sec. 12.2) as the latter have been reweighted by the output share of sample industries. However, in only two cases, we found very big differences: the PL ratio for Korea/United States (1975) was 0.75 after reweighting, and the PL ratio for the Soviet Union/United States was 0.58 after reweighting.

[a]Excluding UVRs for food products that are available only at U.S. quantity weights.

[b]The exchange rates for the CPEs are mostly "commercial" exchange rates. These are expressed as national currencies to the West German mark.

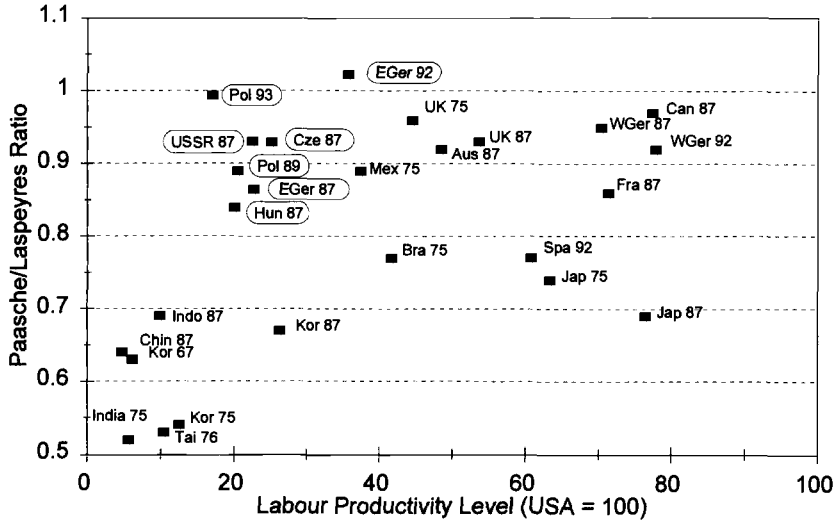

Fig. 12.1 Relation between Paasche-Laspeyres ratios and comparative levels of value added per person employed in manufacturing for 26 binary comparisons
Source: Table 12.5.

expected, as there is a priori less reason to expect the Gerschenkron effect to exist with producer prices than with expenditure prices, which were used in earlier studies (see Kravis, Heston, and Summers 1982; Nuxoll 1994). When prices rise, producers are expected to substitute for more expensive rather than cheaper products.[21] On an ad hoc basis, one may hypothesize that consumer substitution effects are stronger than the producer substitution effects and that therefore the Gerschenkron effect continues to exist even for the ICOP UVRs. This hypothesis is reinforced by the results for the CPEs, for which the PL ratio is even closer to one (and, in one case, exceeds one) than for the HMEs. The nonexistence of a Gerschenkron effect for these countries could perhaps imply that producer effects dominate the PL ratio and that consumer preferences are not reflected in the price setting.[22]

The special position of the CPEs is confirmed in figure 12.1, which relates the Paasche-Laspeyres ratio to the comparative level of labor productivity of each country relative to the United States. Figure 12.1 shows that (former) CPEs have a higher PL ratio than their comparative level of productivity would suggest.

We also analyzed the results statistically by regressing the PL ratios on the

21. For a theoretical exposition of these contrasting effects in neoclassical consumer and producer theories, see, e.g., Usher (1980).

22. We emphasize, however, that this explanation remains unsatisfactory as both producer and consumer theories are essentially static, whereas dynamic theories about substitution are called for. We have therefore not pursued this line of investigation further in this paper.

comparative productivity performance of each country relative to the United States (see regression 1 in appendix table 12A.4). The regression shows a highly significant coefficient for the productivity ratio. When a separate dummy variable is introduced for the CPE countries, the results become even more significant.

To analyze the atypical pattern of the Paasche-Laspeyres ratio for the CPE countries in more detail, we used the Bortkiewicz formula, which decomposes the PL ratio into three independent elements: (1) the weighted coefficient of variation of the price relatives between two countries (σ_p); (2) the weighted coefficient of variation of the quantity relatives between two countries (σ_q); and (3) the weighted coefficient of correlation (r_{pq}) between the price and the quantity relatives.[23] In a formula:

$$(1) \qquad \frac{P^{XU(X)}}{P^{XU(U)}} = \frac{Q^{XU(X)}}{Q^{XU(U)}} = 1 + r_{pq}\frac{\sigma_p}{P^{XU(U)}}\frac{\sigma_q}{Q^{XU(U)}},$$

where $P^{XU(U)}$ and $Q^{XU(U)}$ are the Laspeyres price and quantity indexes between countries X and U of all manufacturing goods, respectively, and $P^{XU(X)}$ and $Q^{XU(X)}$ are the Paasche price and quantity indexes between countries X and U of all manufacturing goods, respectively. The weighted coefficients of variation, σ_p and σ_q, are defined as

$$(2) \quad \sigma_p = \sqrt{\frac{\sum_{i=1}^{m} w_i^U (P_i^{XU} - P^{XU(U)})^2}{\sum_{i=1}^{m} w_i^U}}, \quad \sigma_q = \sqrt{\frac{\sum_{i=1}^{m} w_i^U (Q_i^{XU} - Q^{XU(U)})^2}{\sum_{i=1}^{m} w_i^U}},$$

and the weighted coefficient of correlation (r_{pq}) as

$$(3) \qquad r_{pq} = \frac{\sum_{i=1}^{m} w_i^U (P_i^{XU} - P^{XU(U)})(Q_i^{XU} - Q^{XU(U)})}{\sum_{i=1}^{m} w_i^U},$$

where P_i^{XU} is the ratio of the price of good i in country X and country U, Q_i^{XU} is the ratio of the quantity of good i in country X and country U, and w_i^U is the value of good i in country U.

Table 12.6 shows the values of these three components. In the next section, we will deal with the variation in price and quantity relatives (cols. 1 and 2). Here, we focus on the correlation coefficient (col. 3), which may be used as a proxy of the degree of distortion. When the price relatives between country X and country U do not show a clear negative relation to the quantity relatives, a greater distortion in country X is suggested on the assumption that the numeraire country U (which is either the United States or West Germany) has rela-

23. For an extensive description and derivation, see Allen (1975, 62–65). For an application of the Bortkiewicz formula to a time series of U.S. machinery output from 1899 to 1939, see Jonas and Sardy (1970). See also Dikhanov (1994).

Table 12.6 **Coefficients of Variation of Price and Quantity Relatives and the Correlation between Prices and Quantities for 26 Binary Comparisons in Manufacturing (all at numeraire country weights)**

	Coefficient of Variation		Coefficient of Correlation (between price and quantity relatives) (3)
	Price Ratios (between own country and numeraire country) (1)	Quantity Ratios (between own country and numeraire country) (2)	
High-productivity market economies (HMEs)			
West Germany/United States (1992)	.53	1.69	−.09
Canada/United States (1987)	.29	1.61	−.07
Japan/United States (1987)	.64	2.95	−.17
France/United States (1987)	.41	.77	−.45
West Germany/United States (1987)	.34	1.16	−.12
Japan/United States (1975)	.55	3.01	−.16
Spain/United States (1992)	.49	4.61	−.10
United Kingdom/United States (1987)	.37	.85	−.22
Australia/United States (1987)	.36	1.81	−.12
United Kingdom/United States (1975)	.38	1.11	−.09
Arithmetic average HMEs	.43	1.96	−.16
(Former) centrally planned economies (CPEs)			
East Germany/West Germany (1992)	.36	1.28	.05
Czechoslovakia/West Germany (1989)	.30	1.40	−.33
East Germany/West Germany (1987)	.47	1.36	−.11

(continued)

Table 12.6 (continued)

	Coefficient of Variation		Coefficient of Correlation (between price and quantity relatives) (3)
	Price Ratios (between own country and numeraire country) (1)	Quantity Ratios (between own country and numeraire country) (2)	
Soviet Union/United States (1987)	.80	2.58	−.03
Poland/West Germany (1989)	.49	2.18	−.10
Hungary/West Germany (1987)	.40	2.23	−.18
Poland/Germany (1993)	.52	2.52	−.00
Arithmetic average CPEs	.48	1.94	−.10
Low-productivity market economies (LMEs)			
Brazil/United States (1975)	.47	2.72	−.18
Mexico/United States (1975)	.40	2.42	−.12
South Korea/United States (1987)	.56	7.52	−.08
South Korea/United States (1975)	.72	5.48	−.12
Taiwan/United States (1976)	.63	18.68	−.04
Indonesia/United States (1987)	.55	3.57	−.16
South Korea/United States (1967)	.56	3.34	−.20
India/United States (1975)	.76	4.94	−.13
China/United States (1987)	.59	6.28	−.10
Arithmetic average LMEs	.58	6.08	−.13
Arithmetic average all countries	.50	3.38	−.13

Sources: See tables 12.1 and 12.5 and appendix table 12A.1.

tively little or no distortion. Column 3 of table 12.6 shows that the sign of the correlation coefficient between price and quantity relatives is negative in twenty-five of the twenty-six cases. However, as the (absolute) mean is lower for the CPE countries (−0.10) than for the HMEs (−0.16) and the LMEs (−0.13), this may be interpreted as a sign of greater distortion in CPEs.[24]

The relation between price and quantity relatives can also be analyzed by looking at the unweighted coefficient of correlation instead of a value-weighted one, as in equation (3). For this purpose, we carried out a simple OLS (ordinary least squares) regression over all products in each comparison:[25]

$$\log P_i^{XU} = \alpha + \beta \times \log Q_i^{XU}. \tag{4}$$

Column 1 in table 12.7 shows that a negative relation is found for all countries, and column 2 indicates that this relation is significantly different from zero for all but two binary comparisons.[26] Column 3 shows the sample correlation coefficient, r. A low (absolute) r indicates that, even when a significant relation is found as indicated by the t-statistic, the variability is high; that is, the observations are relatively far from their "predicted" value. A low r can therefore be interpreted as a measure of distortion as it suggests a weak relation between relative quantities and prices. Table 12.7 therefore confirms the conclusion that we drew from table 12.6, namely, that CPEs clearly show a greater distortion of prices ($r = 0.21$) than either HMEs ($r = 0.34$) or LMEs ($r = 0.41$). Again, for all but two countries, r is significantly different from zero. A two-tailed test rejects the hypothesis of equal price distortion of the CPEs vis-à-vis the HMEs and LMEs at the 99 percent significance level (with a t-value of 2.99).

As our ultimate interest is in the relative productivity performance of these countries, we can compare the correlation coefficient, r, to the comparative productivity performance of each country relative to the United States. The results are plotted in figure 12.2, which shows that no relation can be found between the degree of distortion, as measured here, and the manufacturing value added per person employed relative to the United States.

Finally, it is noted alongside that, for all three groups of countries, the sample coefficient of correlation, r, is rather low, which suggests that, apart from the negative effect of quantity relatives on price relatives, other factors determine the value of the UVRs as well.

24. Czechoslovakia is a strong outlier in the opposite direction, which is caused by the relatively small number of matched items in the sample (see table 12.5).

25. Several functional forms were experimented with, of which the present double log form gave the best fit.

26. Lack of significance was found for the Poland/Germany comparison for 1993 and for the Canada/United States comparison for 1987. The latter effect is caused by the fact that the range of values for the UVRs and quality indexes hardly differs from the mean. When using OLS regression, the influence of measurement errors is greatly magnified when the values of the variables are within very small ranges.

Table 12.7 **Results of Unweighted Regression of Log Price Ratios on Log Quantity Ratios for 26 Binary Comparisons in Manufacturing**

	Coefficient of Log of Quantity Relatives (log QI) (1)	*t*-Statistic (2)	Coefficient of Correlation (3)
High-productivity market economies (HMEs)			
West Germany/United States (1992)	−.11	−6.5	−.31
Canada/United States (1987)	−.01	−.7	−.05
Japan/United States (1987)	−.15	−6.9	−.45
France/United States (1987)	−.20	−5.0	−.54
West Germany/United States (1987)	−.07	−4.4	−.26
Japan/United States (1975)	−.16	−7.1	−.49
Spain/United States (1992)	−.15	−7.1	−.42
United Kingdom/United States (1987)	−.13	−4.5	−.33
Australia/United States (1987)	−.14	−5.9	−.41
United Kingdom/United States (1975)	−.08	−2.2	−.20
Arithmetic average HMEs	−.12	−5.0	−.34
(Former) centrally planned economies (CPEs)			
East Germany/West Germany (1992)	−.09	−3.8	−.23
Czechoslovakia/West Germany (1989)	−.09	−2.3	−.26
East Germany/West Germany (1987)	−.09	−3.4	−.18
Soviet Union/United States (1987)	−.16	−1.6	−.38
Poland/West Germany (1989)	−.06	−2.0	−.13
Hungary/West Germany (1987)	−.07	−5.0	−.25
Poland/Germany (1993)	−.01	−.7	−.06
Arithmetic average CPEs	−.08	−3.1	−.21
Low-productivity market economies (LMEs)			
Brazil/United States (1975)	−.16	−5.9	−.46
Mexico/United States (1975)	−.05	−2.2	−.19
South Korea/United States (1987)	−.18	−10.0	−.60
South Korea/United States (1975)	−.14	−6.0	−.43
Taiwan/United States (1976)	−.13	−5.1	−.45
Indonesia/United States (1987)	−.10	−4.4	−.30
South Korea/United States (1967)	−.18	−7.4	−.57
India/United States (1975)	−.11	−3.9	−.35
China/United States (1987)	−.14	−2.5	−.31
Arithmetic average LMEs	−.13	−5.3	−.41
Arithmetic average all countries	−.11	−4.6	−.33

Sources: See tables 12.1 and 12.5 and appendix table 12A.1.

12.3 The Role of Relative Quantity and Price Structures

The existence of a distortion between price and quantity relatives does not tell us anything about differences between countries in terms of their structure of prices and/or their structure of quantities. In the previous section, the Bortkiewicz formula showed that these factors also affect the Paasche-Laspeyres ratio of our price and quantity relatives. For this, we need to look in more detail

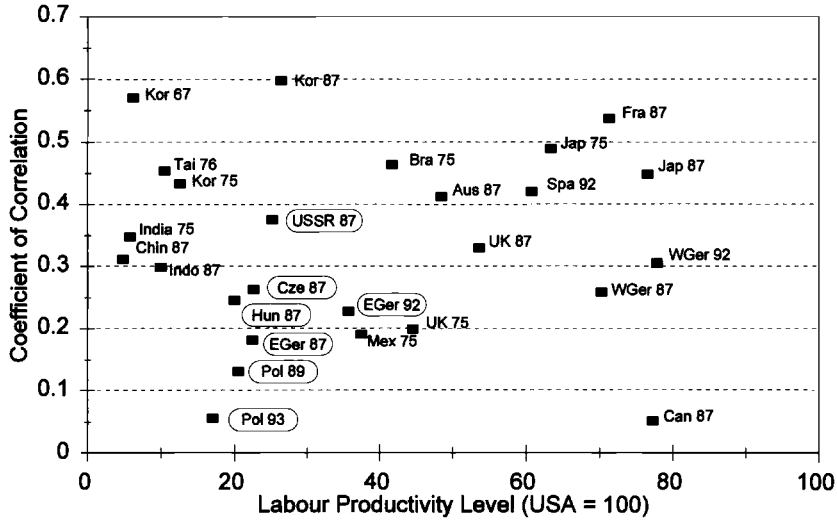

Fig. 12.2 Relation between coefficients of correlation of price and quantity relatives and comparative levels of value added per person employed in manufacturing for 26 binary comparisons
Source: Table 12.7.

at the other two terms on the right-hand side of equation (1), the weighted coefficients of variation of the price and quantity relatives, which are given in equation (2). Column 1 in table 12.6 shows that the coefficient of variation of the price index (σ_p) is 0.50 for all countries together, 0.43 for HMEs, 0.58 for the LMEs, and 0.48 for the CPE countries. The coefficient of variation of the quantity index (σ_q) is 3.38 for all countries, 1.96 for the HMEs, and 6.08 for the LMEs (table 12.6, col. 2).[27] For the CPEs, the average coefficient of variation for the quantity index is virtually equal to that of the HMEs, namely, 1.94.

The results suggest that price structures are more similar across countries than quantity structures. The LMEs have a higher price and quantity dispersion compared to their numeraire country than do the HMEs. The price dispersion of the CPEs fits nicely between that of the HMEs and LMEs. However, the quantity dispersion of CPEs is clearly closer to that of the HMEs than to that of the LMEs.

A second way of measuring the spread of price relatives and of quantity relatives is to calculate the standard deviations of the price indexes, $P_i^{XU(U)}$, and the quantity indexes, $Q_i^{XU(U)}$. This method was also suggested by Allen and Diewert (1981). In contrast to the variables in the Bortkiewicz formula, price and quantity relatives are not weighted by their relative value shares (see eq.

27. Taiwan is a strong outlier, which increases σ_q for the LMEs. This is caused by the fact that the sample is dominated by the product entry for rubber and plastic shoes. However, even after excluding Taiwan, the coefficient of variation for the LMEs is still as high as 4.5.

[2]). In fact, for the purpose of studying dispersion, we see no a priori reason to give a bigger weight to goods with higher value shares than to goods that are less important.[28]

The results on the dispersion of price and quantity relatives in table 12.8 largely correspond with those presented in table 12.6. There is a much lower dispersion of the UVRs (col. 1) than of the quantity relatives (col. 2), and the dispersion of the quantity relatives for the CPEs is very close to that for the HMEs.

Figures 12.3 and 12.4 suggest a significant relation between both price and quantity dispersion and the comparative level of labor productivity, respectively. However, figure 12.4 shows that the CPEs are clear outliers: given their relative productivity level, the CPEs' quantity dispersion is much closer to that of the HMEs than to that of the LMEs. The latter observation is confirmed by the results of regression 2 (appendix table 12A.4), which shows that the coefficient on the CPE dummy is highly significant.

A third way of comparing price and quantity structures is by calculating so-called similarity indexes. The basic idea behind similarity indexes is to construct for each country a price (or quantity) vector constituted of the prices (or quantities) of all m items in the sample. For each country, the prices (or quantities) of all items are related and represented by one single vector. For the case of two countries, A and B, and two goods, 1 and 2, figure 12.5 may be illustrative.

In case of a price comparison, the x- and y-axes show the prices of good 1 and good 2, respectively. The angle α between the two price vectors can be seen as a measure of the similarity between the two vectors. The similarity index, which is defined as the cosine of the angle, varies between zero and one and is lower in case of greater dissimilarity. Using the definition of the cosine of an angle of two vectors in an m-dimensional space, and introducing quantity weights for each observation in the sample in order to make the indexes "unit invariant," the following price similarity indexes can be derived:

$$\text{(5)} \qquad \mathrm{SP}^{\mathrm{XU(U)}} = \frac{\sum_{i=1}^{m}(p_i^{\mathrm{X}}q_i^{\mathrm{U}})(p_i^{\mathrm{U}}q_i^{\mathrm{U}})}{\sqrt{\sum_{i=1}^{m}(p_i^{\mathrm{X}}q_i^{\mathrm{U}})^2\sum_{i=1}^{m}(p_i^{\mathrm{U}}q_i^{\mathrm{U}})^2}},$$

$$\mathrm{SP}^{\mathrm{XU(X)}} = \frac{\sum_{i=1}^{m}(p_i^{\mathrm{X}}q_i^{\mathrm{X}})(p_i^{\mathrm{U}}q_i^{\mathrm{X}})}{\sqrt{\sum_{i=1}^{m}(p_i^{\mathrm{X}}q_i^{\mathrm{X}})^2\sum_{i=1}^{m}(p_i^{\mathrm{U}}q_i^{\mathrm{X}})^2}},$$

28. We use the logarithm of the relatives as only in the log form do ratios smaller than one have a symmetrical influence on the total as ratios bigger than one. This makes the measures more suitable for constructing similarity indexes than the untransformed relatives used in the Bortkiewicz formula. Note that the logs of the price and quantity relatives have been normalized by their unweighted mean.

Table 12.8 **Dispersion of Normalized Log Unit Value Ratios and Log Quantity Ratios for 26 Binary Comparisons in Manufacturing**

	Standard Deviations	
	Log of Unit Value Ratio (log UVR) (1)	Log of Quantity Relative (log QI) (2)
High-productivity market economies (HMEs)		
West Germany/United States (1992)	.25	.64
Canada/United States (1987)	.13	.53
Japan/United States (1987)	.22	.64
France/United States (1987)	.19	.52
West Germany/United States (1987)	.17	.59
Japan/United States (1975)	.20	.61
Spain/United States (1992)	.25	.69
United Kingdom/United States (1987)	.17	.43
Australia/United States (1987)	.18	.53
United Kingdom/United States (1975)	.18	.44
Arithmetic average HMEs	.19	.56
(Former) centrally planned economies (CPEs)		
East Germany/West Germany (1992)	.19	.50
Czechoslovakia/West Germany (1989)	.16	.48
East Germany/West Germany (1987)	.24	.51
Soviet Union/United States (1987)	.29	.70
Poland/West Germany (1989)	.29	.65
Hungary/West Germany (1987)	.24	.79
Poland/Germany (1993)	.28	.72
Arithmetic average CPEs	.24	.62
Low-productivity market economies (LMEs)		
Brazil/United States (1975)	.24	.67
Mexico/United States (1975)	.20	.73
South Korea/United States (1987)	.26	.88
South Korea/United States (1975)	.33	1.02
Taiwan/United States (1976)	.26	.90
Indonesia/United States (1987)	.37	1.14
South Korea/United States (1967)	.29	.92
India/United States (1975)	.28	.87
China/United States (1987)	.44	1.00
Arithmetic average LMEs	.30	.90
Arithmetic average all countries	.24	.70

Sources: See tables 12.1 and 12.5 and appendix table 12A.1.

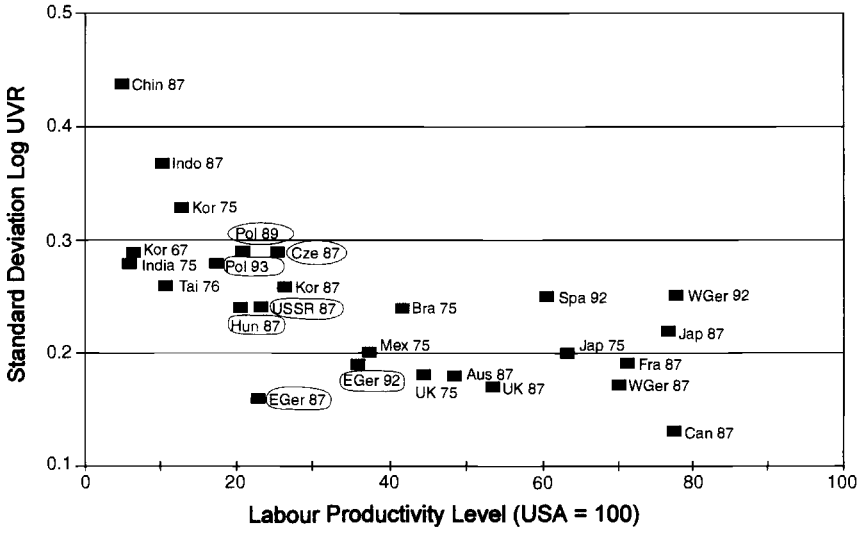

Fig. 12.3 Relation between relative price dispersion and comparative levels of value added per person employed in manufacturing for 26 binary comparisons
Source: Table 12.8.

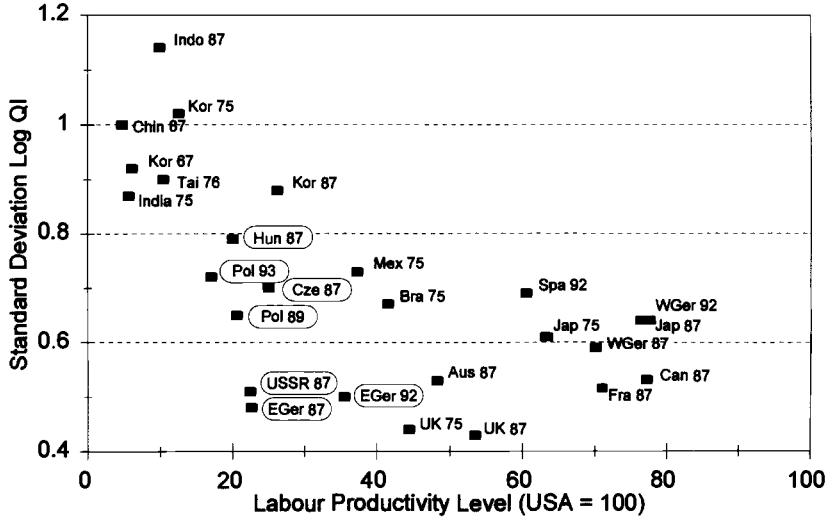

Fig. 12.4 Relation between relative quantity dispersion and comparative levels of value added per person employed in manufacturing for 26 binary comparisons
Source: Table 12.8.

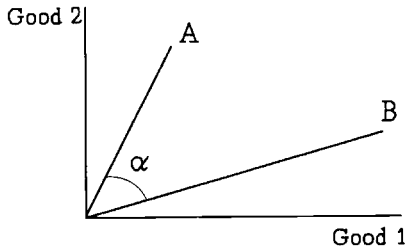

Fig. 12.5 Illustration of a comparison of two price (or quantity) vectors

where $SP^{XU(U)}$ is the price similarity index between countries X and U, using quantities of country U as weights, and $SP^{XU(X)}$ is the price similarity index between countries X and U, using quantities of country X as weights. In the same way, price weights are applied in the quantity similarity indexes:

$$SQ^{XU(U)} = \frac{\sum_{i=1}^{m}(p_i^U q_i^X)(p_i^U q_i^U)}{\sqrt{\sum_{i=1}^{m}(p_i^U q_i^X)^2 \sum_{i=1}^{m}(p_i^U q_i^U)^2}},$$

(6)

$$SQ^{XU(X)} = \frac{\sum_{i=1}^{m}(p_i^X q_i^X)(p_i^X q_i^U)}{\sqrt{\sum_{i=1}^{m}(p_i^X q_i^X)^2 \sum_{i=1}^{m}(p_i^X q_i^U)^2}},$$

where $SQ^{XU(U)}$ is the quantity similarity index between countries X and U, using prices of country U as weights, and $SP^{XU(X)}$ is the quantity similarity index between countries X and U, using prices of country X as weights. These similarity measures are also used in ICP reports—although in a different form—including Kravis, Heston, and Summers (1982) and Heston and Summers (1993). An important feature of our indexes is that these have natural weights attached to them, that is, quantity weights for the price similarity index and price weights for the quantity similarity index.

Table 12.9 shows the Fisher quantity and price similarity indexes for our sample of twenty-six binary comparisons.[29] As was observed above, it is clear that the price similarity indexes are much closer to each other than are the quantity indexes, again suggesting that price structures are more similar across countries than are quantity structures. However, in contrast to the results presented earlier, the HMEs show much greater quantity similarity relative to their base country than the CPEs (col. 2, table 12.9). The quantity structure of the LMEs is most dissimilar from that of the HMEs. This outcome is more in line with the natural dichotomy between low- and high-productivity economies.

29. The Fisher index is the geometric average of the Paasche and Laspeyres indexes presented in eqq. (4) and (5). For the Paasche and Laspeyres similarity indexes, see appendix table 12A.3.

Table 12.9 **Price and Quantity Similarity Indexes for 26 Binary Comparisons in Manufacturing**

	Price Similarity Index (1)	Quantity Similarity Index (2)	Quantity Similarity Index (excluding cars) (3)
High-productivity market economies (HMEs)			
West Germany/United States (1992)	95	59	59
Canada/United States (1987)	99	80	65
Japan/United States (1987)	87	66	59
France/United States (1987)	99	98	73
West Germany/United States (1987)	99	80	63
Japan/United States (1975)	87	68	58
Spain/United States (1992)	88	54	54
United Kingdom/United States (1987)	94	92	83
Australia/United States (1987)	97	82	79
United Kingdom/United States (1975)	92	84	77
Arithmetic average HMEs	94	76	67
(Former) centrally planned economies (CPEs)			
East Germany/West Germany (1992)	96	45	84
Czechoslovakia/West Germany (1989)	98	40	73
East Germany/West Germany (1987)	94	41	71
Soviet Union/United States (1987)	85	62	66
Poland/West Germany (1989)	93	45	65
Hungary/West Germany (1987)	89	64	64
Poland/Germany (1993)	89	73	59
Arithmetic average CPEs	92	53	69
Low-productivity market economies (LMEs)			
Brazil/United States (1975)	91	59	50
Mexico/United States (1975)	96	85	77
South Korea/United States (1987)	88	50	33
South Korea/United States (1975)	74	22	24
Taiwan/United States (1976)	89	38	38
Indonesia/United States (1987)	96	39	51
South Korea/United States (1967)	89	32	35
India/United States (1975)	90	26	26
China/United States (1987)	85	27	39
Arithmetic average LMEs	89	42	41
Arithmetic average all countries	91	58	59

Source: See tables 12.1 and 12.5 and appendix table 12A.1.

Note: The similarity indexes are geometric (Fisher) averages of the indexes at own country weights and numeraire country weights (see appendix table 12A.3). Column 3 is as col. 2, but the product matches for cars have been taken out of the product sample.

Regression 5 in appendix table 12A.4 shows a fairly strong positive relation between the quantity similarity indexes and the comparative productivity ratios but no significant coefficient for the CPE dummy.

One possible explanation for the difference in results between the quantity similarity indexes from table 12.9 and the dispersion of the quantity relatives in table 12.8 might be related to the effect of the product match for cars. In our product sample for the centrally planned economies, cars accounted for more than 15 percent of the product sample, with the exception of Hungary. As discussed in section 12.1, the product match for cars in CPEs is relatively sensitive to the problem of quality differences. It appears that, after deleting cars from the product sample, the average quantity similarity index for the CPEs goes up very substantially and is again very close to that for the HMEs (table 12.9, col. 3).

12.4 Conclusions

Manufacturing productivity levels in (former) centrally planned economies back to 1950 have been substantially lower than in high-productivity market economies and were on average in between labor productivity levels of Asian (except Korea) and Latin American low-productivity economies. After their recent transition to a market economy, most Eastern European countries experienced a collapse in productivity which has been followed by a recovery in which they have attained or even surpassed pretransition levels.

This paper showed that the difference between the Paasche and the Laspeyres measures of industry purchasing power parities was relatively small for the CPEs given their relative level of labor productivity, suggesting the absence of a typical Gerschenkron effect. One possible explanation for this small gap might be that producer substitution effects in CPEs dominated consumer substitution effects. The Gerschenkron effect theoretically exists only in the latter case. Alternatively, the high Paasche-Laspeyres (PL) ratio may be the result of a distortion between relative price and quantity indexes. The pricing system in CPEs was traditionally based on a cost-plus-taxes-plus-markup system, with net indirect taxes being used to reallocate resources according to socially desirable goals.

We decomposed the PL ratio into the effects of dispersion (or dissimilarity) of price and quantity relatives and the effect of the relation between price and quantity relatives. We found that CPEs were characterized by (1) a relatively weak (negative) relation between price and quantity indexes, indicating distortion, and (2) a relatively similar structure of quantities compared to high-productivity market economies. Even though we did not find a relation between our measure of distortion and the comparative level of labor productivity, it is not unlikely that the greater price distortion in CPEs led to a misallocation of resources, which in turn might explain the atypical quantity structure that was observed.

Table 12.10 **Average Shares by Major Branch in Total Employment in High-Productivity Market Economies, Low-Productivity Market Economies and (former) Centrally Planned Economies**

	Share of Employment		
	HMEs[a]	CPEs[b]	LMEs[c]
Food products, beverages, and tobacco	9.8	12.3	22.9
Textile products, wearing apparel, leather products, and footwear	10.4	15.0	19.6
Chemicals, rubber and plastic products, and oil refining	11.7	10.0	12.6
Basic and fabricated metal products	12.1	11.5	10.2
Electrical and nonelectrical machinery and transport equipment	35.7	34.5	15.4
Other manufacturing[d]	20.3	16.8	19.2
Total manufacturing	100.0	100.0	100.0

Sources: See table 12.1.

[a]High-productivity market economies: arithmetic average for France (1987), Germany (1987), Japan (1987), the United Kingdom (1987), and the United States (1987).

[b](Former) centrally planned economies: arithmetic average for Czechoslovakia (1989), East Germany (1987, 1992), Hungary (1987), and Poland (1989, 1993).

[c]Low-productivity market economies: arithmetic average for Brazil (1975), India (1975), Indonesia (1987), and Mexico (1975).

[d]Includes wood products and furniture, paper and paper products and printing, nonmetallic mineral and "other manufacturing."

Given the lower productivity performance of CPEs, how should the quantity similarity between CPEs and high-productivity market economies be interpreted? One possible explanation is that the industrialization strategies of the CPEs were successful insofar as they stimulated the production of capital intensive production of, in particular, investment goods. This led to a convergence of their quantity structures to that of high-productivity market economies. Production plans and pricing policies of CPEs were geared toward boosting the production of capital intensive goods.

A first indication for that explanation can be obtained from table 12.10, which compares the average employment structure of the manufacturing sector between CPEs with that of some low-productivity market economies (Brazil, India, Indonesia, and Mexico) and some high-productivity market economies (France, Germany, Japan, the United Kingdom, and the United States). The table clearly shows that the employment structure (which serves here as a proxy for resource allocation) of the CPEs was much closer to that of the HMEs than to that of the LMEs. It is particularly striking that the share of employment in electrical and nonelectrical machinery and transport equipment was almost as high in CPEs as in HMEs. As was noted above, the comparative levels of productivity in this major branch were relatively low in CPEs, in particular, in Czechoslovakia and East Germany. It suggests that the CPEs failed in transforming their atypical pattern of industrialization into a success-

ful long-term growth strategy. It led to a typical pattern of "extensive" growth in CPEs, which ground to a halt once no more potential resources remained idle (van Ark 1996).

Finally, although the CPEs show a price structure that is not too dissimilar from that of the non-CPEs, CPEs lacked incentives for a systematic improvement of product quality. In fact, pricing policies stimulated price increases of so-called new products without observable improvements in product quality. A more full-scale adjustment of the ICOP estimates for lower product quality in the CPEs might imply lower "real" quantities of, in particular, investment goods and durable consumer goods. This might therefore increase the quantity dissimilarity between (former) centrally planned economies and high-productivity market economies beyond what has been observed in this paper.

Appendix

Table 12A.1 **Number of Unit Value Ratios and Coverage Percentages of Matched Output in Manufacturing**

	Number of Unit Value Ratios	Matched Output as a % of Gross Output	
		Own Country	West Germany
Czechoslovakia/West Germany (1989)	69	32.0	23.2
East Germany/West Germany (1987)	335	41.1	33.7
Hungary/West Germany (1987)	383	33.1	19.3
Poland/West Germany (1989)	236	33.6	19.4
East Germany/West Germany (1992)	255	28.0	20.4
Poland/All Germany (1993)	305	57.8	32.3

Sources: Czechoslovakia/West Germany (1989) from van Ark and Beintema (1993), adjusted in van Ark (1996); data on product detail for Czechoslovakia (1989) derived from Federal Statistical Office, *Monthly Inquiry on Production and Sales of Selected Industrial Products,* and *Annual Survey of Industrial Enterprises.* East Germany/West Germany (1987) from Beintema and van Ark (1994), adjusted in van Ark (1995a); original information on product detail for East Germany (1987) from Staatliche Zentralverwaltung fuer Statistik, *Abrechnung der Erzeugnispositionen der Erzeugnis- und Leistungsnomenklatur: Jahreserhebung 1987* (Berlin). Hungary/West Germany (1987) from Monnikhof (1996); original information on product detail for Hungary from Kozponti Statisztikai Hivatal, *Statisztikai Evkonyv, 1987* (Budapest, 1989), supplemented with unpublished data provided by the Hungarian Central Statistical Office. Poland/West Germany (1989) from Liberia, Monnikhof, and van Ark (1996); original information on product detail for Poland from Glowny Urzad Statystyczny, *Produkcja wyrobow Przemyslowych w 1989 R* (Warsaw, 1991). East Germany/West Germany (1992) are unpublished ICOP/LCRA estimates (January 1996); original information on product detail for both parts of Germany from Statistisches Bundesamt, *Produktion im Produzierenden Gewerbe* (Wiesbaden, 1992). Poland/all Germany (1993) are unpublished ICOP/LCRA estimates (January 1996); original information on product detail for Poland from Glowny Urzad Statystyczny, *Produkcja wyrobow przemyslowych w 1993 R* (Warsaw, 1995). Original information on product detail for West Germany from Statistisches Bundesamt, *Produktion im Produzierenden Gewerbe* (Wiesbaden, 1987, 1989, 1992, and 1993).

Table 12A.2 **Gross Value of Industrial Output, Value Added, Number of Employees: Centrally Planned Economies and Germany, 1987–93**

	Own Country				(West) Germany			
	Gross Value of Output (million national currency)	Value Added (million national currency)	Intermediate Inputs as % of Gross Output	Number of Employees (thousands)	Gross Value of Output (million DM)	Value Added (million DM)	Intermediate Inputs as % of Gross Output	Number of Employees (thousands)
Czechoslovakia/West Germany (1989)	833,285	290,940	65.1	2,326.6	1,469,432	710,484	51.6	7,105.9
East Germany/West Germany (1987)	467,418	160,017	65.8	2,763.6	1,260,359	655,041	48.0	6,855.5
Hungary/West Germany (1987)	1,230,699	498,909	59.5	1,284.4	1,421,796	683,593	51.9	6,772.7
Poland/West Germany (1989)	91,850	53,329	41.9	3,170.1	1,625,474	798,334	50.9	6,856.7
East Germany/West Germany (1992)	82,140	31,930	61.1	741.2	1,870,273	881,006	52.9	7,224.7
Poland/All Germany (1993)[a]	878,168	359,140	59.1	2,340.3	1,841,698	864,740	53.0	7,202.4

Sources: Czechoslovakia/West Germany (1989) from van Ark and Beintema (1993), adjusted in van Ark (1996); data on output and employment for Czechoslovakia derived from Federal Statistical Office, *Annual Survey of Industrial Enterprises for 1989.* East Germany/West Germany (1987) from Beintema and van Ark (1994), adjusted in van Ark (1995a); original information on output and employment for East Germany from Gemeinsames Statistisches Amt, *Ergebnisse der Erfassung der Arbeitsstaeten der Betriebe des Wirtschaftbereiches Industrie* (Berlin, 1990). Ratio of value added to output from Staatliches Zentralverwaltung fuer Statistik, *Verflechungsbilanz des Gesellschaftlichen Gesamtproduktes, 1987* (Berlin, 1988). Hungary/West Germany (1987) from Monnikhof (1996); original information on output and employment for Hungary from Kozponti Statisztikai Hivatal, *Statisztikai Evkonyv, 1987* (Budapest, 1989), and *Iparstatistikai Evkonyv, 1987* (Budapest, 1989). East Germany/West Germany are unpublished ICOP/LCRA estimates (January 1996); original information on output and employment for both parts of Germany from Statistisches Bundesamt, *Kostenstruktur der Unternehmen, 1992* (Wiesbaden, 1994). Poland/all Germany (1993) are unpublished ICOP/LCRA estimates (January 1996); original information on output and employment for Poland from Glowny Urzad Statystyczny, *Rocznik Statystyczny Przemyslu, 1993* (Warsaw, 1995). Original information on output and employment for West Germany from Statistisches Bundesamt, *Kostenstruktur der Unternehmen* (Wiesbaden, 1987, 1989, 1992, and 1993).

[a]Polish values in billion zlotys.

Table 12A.3 **Price and Quantity Similarity Indexes for 26 Binary Comparisons in Manufacturing**

	Price Similarity Index		Quantity Similarity Index	
	At Quantity Weights of Numeraire Country (1)	At Quantity Weights of Own Country (2)	At Price Weights of Numeraire Country (3)	At Price Weights of Own Country (4)
High-productivity market economies (HMEs)				
West Germany/United States (1992)	96	94	60	58
Canada/United States (1987)	99	99	81	79
Japan/United States (1987)	80	95	80	54
France/United States (1987)	99	100	99	97
West Germany/United States (1987)	99	100	81	80
Japan/United States (1975)	83	90	79	58
Spain/United States (1992)	92	83	50	58
United Kingdom/United States (1987)	95	93	93	91
Australia/United States (1987)	98	96	82	82
United Kingdom/United States (1975)	92	91	89	79
Arithmetic average HMEs	93	94	79	74
(Former) centrally planned economies (CPEs)				
East Germany/West Germany (1992)	99	93	46	45
Czechoslovakia/West Germany (1989)	99	97	40	39
East Germany/West Germany (1987)	98	89	40	41
Soviet Union/United States (1987)	88	83	61	63
Poland/West Germany (1989)	96	90	43	47
Hungary/West Germany (1987)	95	84	61	68
Poland/Germany (1993)	88	90	80	66
Arithmetic average CPEs	95	89	53	53
Low-productivity market economies (LMEs)				
Brazil/United States (1975)	89	93	59	58
Mexico/United States (1975)	96	95	84	87
South Korea/United States (1987)	85	92	61	40
South Korea/United States (1975)	83	67	18	27
Taiwan/United States (1976)	89	90	36	41
Indonesia/United States (1987)	96	95	36	43
South Korea/United States (1967)	95	83	26	38
India/United States (1975)	87	94	28	23
China/United States (1987)	93	78	34	21
Arithmetic average LMEs	90	87	43	42
Arithmetic average all countries	93	90	60	57

Source: See tables 12.1 and 12.5 and appendix table 12A.1.

Note: The geometric (Fisher) averages of the similarity indexes at own country weights and numeraire country weights are presented in table 12.9.

Table 12A.4 **Results of OLS Regressions on Level of Value Added per Person Employed with and without Dummy for Centrally Planned Economies**

	Constant	PROD	CPE Dummy	R^2
1. *Paasche-Laspeyres ratio*				
1a	.71	.0028		.21
		2.49		
1b	.59	.0042	.2355	.63
		5.13	5.18	
2. *Standard deviation of QIs*				
2a	.88	−.0049	.40	
		−4.03		
2b	.99	−.0063	−.2193	.64
		−6.06	−3.85	
3. *Standard deviation of UVRs*				
3a	.31	−.0019		.44
		−4.34		
3b	.33	−.0021	−.0404	.50
		−4.81	−1.68	
4. *Price similarity index*				
4a	88.05	.09		.16
		2.18		
4b	86.70	.11	2.73	.21
		2.43	1.11	
5. *Quantity similarity index (all products)*				
5a	34.90	.63		.51
		4.97		
5b	32.38	.66	5.06	.52
		4.86	.68	
6. *Quantity similarity index (excluding cars)*				
6a	46.39	.33		.23
		2.64		
6b	35.05	.47	22.78	.53
		4.45	3.90	

Note: The first line for each regression gives parameter estimates, the second line the corresponding *t*-values. The number of observations for all regressions was 26. PROD = comparative level of value added per person employed (United States = 100). CPE dummy = dummy variable: one if centrally planned economy, zero otherwise.

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Comment

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The gap between a Laspeyres and a Paasche index is something like the Chinese character for *crisis* with its double meaning of "danger" and "opportunity." The original "index number problem" came from the discovery that the choice of weights mattered for the numerical value of a price index, that is, that going from here to there typically results in a different answer than coming from there to here. The positive sign of the difference between the Laspeyres and the Paasche price indexes was soon recognized as an empirical regularity, and it was a Berlin professor of economics and statistics, the great Ladislaus von Bortkiewicz, who provided an elegant proof that the inverse correlation of price and quantity relatives lies at the heart of the matter. Van Ark, Monnikhof, and Timmer attempt to exploit the Paasche-Laspeyres ratio in their paper as an indicator of price distortion in the former centrally planned economies, and to this end they harness Bortkiewicz's formula. Thus, what began as an empirical puzzle appears to have evolved into an opportunity for analysis. With great respect for both the careful and the extensive empirical work that stands behind this paper, I nevertheless sense that a certain danger may still be lurking within the Paasche-Laspeyres ratios calculated by van Ark, Monnikhof, and Timmer for the former centrally planned economies. I use my opportunity to comment in order to add a note of caution to the empirical tale told by the authors.

Their tale is fairly straightforward. An important reason they see for the relatively poor productivity performance of the former centrally planned economies was a distorted relation between prices and quantities. For a summary measure of this distortion, the authors point to the peculiarly high Paasche-Laspeyres ratios that they have calculated for the unit value ratios (UVRs) in binary comparisons of the centrally planned economies with a market economy.[1] Controlling for differences in productivity levels, the centrally planned economies can be seen to differ from market economies, where the benchmark is taken to be the average Paasche-Laspeyres ratio in binary comparisons between market economies. The Bortkiewicz decomposition of such ratios leads the authors to consider the correlation between the price and the quantity relatives along with the relative dispersion of quantity relatives and the relative dispersion of price relatives.[2] The moral of this tale is found in the relatively

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1. For all but one comparison between the Soviet Union and the United States, the binary comparisons of centrally planned economies were exclusively with West Germany.

2. The intuition behind the last two terms is that "the index number problem" goes away (more precisely, the Paasche-Laspeyres ratio is unity) when either all prices or all quantities differ by a single factor of proportionality.

low correlation found between price and quantity relatives in the binary comparisons of centrally planned economies with market economies. Another empirical abnormality reported by van Ark, Monnikhof, and Timmer is that the centrally planned economies had quantity structures that resembled the "high-productivity market economies" rather than the "low-productivity market economies." A pretty good story all told, but can the Paasche-Laspeyres ratios calculated from UVRs in bilateral comparisons involving a centrally planned economy carry this interpretive load safely?

Earlier generations of comparative economists, in particular those who cut their teeth on Abram Bergson's *The Real National Income of Soviet Russia since 1928* (1961), were raised to shun the official valuations coming from the centrally planned economies. It was regarded unwholesome to rely on relative prices that could be presumed to approximate neither the slopes of production possibilities frontiers nor the slopes of private or social indifference curves.[3] Recognizing the problem of using a market economy's prices to value a centrally planned economy's quantities,[4] the solution was sought in estimating weights thought to better approximate relative factor costs rather than in a symmetrical treatment of prices across economic systems. For the goal of comparing outputs and inputs, this was a reasonable strategy.

This is not to say that van Ark, Monnikhof, and Timmer can be accused of simply rushing in where Bergson feared to tread. There is a genuine innovation in the use of the Paasche-Laspeyres ratio to serve as a summary indicator of overall price distortion, quite a different question from that of relative economic performance. But pointing us in this direction does not really get us very far in terms of economic content. What does it ultimately mean if the gap between the Paasche-Laspeyres indexes is half or double what it would be between two market economies? To make matters murkier, we have the problem common to all summary indicators—many other things are confounded in the final number, such as measurement error (e.g., the relative quality issue) and specification error (e.g., the different function of prices under different economic systems). The signal heard by van Ark, Monnikhof, and Timmer may be loud; it is hardly clear.

There is also a fundamental inconsistency with interpreting the Paasche-Laspeyres ratios as an indicator of price distortion and then turning around to use estimates of relative productivity, apparently based at least in part on these problematic UVRs, to analyze the Paasche-Laspeyres (PL) ratios. One can expect that there would be an errors-in-variables bias for any simple regression analysis of the PL ratio using International Comparisons of Output and Produc-

3. The late Evsey Domar compared using published economic statistics of the Soviet Union with ordering from the menu in a restaurant he did not trust. Domar would always order steak rather than goulash, fearing the aggregation that took place in the kitchen. Thus, whenever possible, Domar preferred to work with quantity data from the Soviet Union rather than with expenditure totals.

4. For example, an easy way to make the Soviet military threat look particularly menacing was to use the wages of the U.S. volunteer army to value the Soviet conscript army.

tivity (ICOP) estimates of CPE (centrally planned economy) relative productivity as an explanatory variable (see their appendix table 12A.4).[5] To add to the statistical confusion, the binary comparisons for all the market countries involve the United States, whereas the former centrally planned economies have been compared with the old Federal Republic of Germany.[6] This last problem need not necessarily affect the substantive conclusions of the paper; it is the sort of detail that does not help tighten confidence intervals either.

For comparisons in which we are completely free to determine a sampling strategy, it should make no difference whether we sample price comparisons or quantity comparisons for deflating expenditure totals. However, the ICOP quantity relatives had to be painstakingly culled from side-by-side comparisons of national industrial statistics and hardly constitute a random sample of quantity relatives. I presume that what ICOP got is what we see. One would feel just as uncomfortable were International Comparison Program (ICP) price relatives limited to comparisons of mail-order catalogs across countries. While the problem of nonrandom sampling of quantity relatives is common to all ICOP comparisons, I fear that the results are especially vulnerable for comparisons between the high-productivity market economies and the former centrally planned economies. The sensitivity of the quantity similarity indexes calculated in this paper to the single quality adjustment for automobiles should serve as a clear warning against building too high on such a weak foundation.

My final reservation has to do with the premise of the paper that there was a significant causal link running from the price structure of the former centrally planned economies to economic performance. Given that fundamental decisions in the centrally planned economies involving resource allocation were coordinated through a system of material balances, it is not obvious why price distortion in such economies should have played a very important role for productive efficiency.[7] Could this be an instance where the symmetrical treatment of different economic institutions is worse than leaving an unwanted Gerschenkron effect from valuing CPE quantities at market prices uncorrected?

With these few words of caution now added to the record, the authors surely deserve a final salute for their innovative use of the Laspeyres-Paasche ratio and its Bortkiewicz decomposition. This particular expedition by members of the ICOP team reflects the sort of daring that is sadly missing in so much of empirical economics. The glory of discovery goes only to those who accept the rigors of the voyage of discovery. Anyone who has attempted such an em-

5. The authors explicitly acknowledge that they are ignoring the distorting effect that administrative prices may have on the weighting system, which may affect the interpretation of the aggregate results. The authors then refer to the 1985 Marer World Bank project report on dollar estimates of GNPs in the Soviet Union and Eastern Europe. If anything, Marer and his team of country specialists warned that one should not ignore such distortions. Ignorance may be bliss, but not many of the older hands in the comparative business would have ignored the aggregation distortion.

6. With the single United States/Soviet Union exception noted in n. 1 above.

7. In contrast, in a market system where the information and incentive functions of the price system are critical for the workings of the system, the link is fairly clear and obvious.

pirical voyage will join in wishing van Ark, Monnikhof, and Timmer godspeed in future explorations.

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