Center for Social & Economic Research

Investment in Post-communist Economies

Real Facts and Keynesian Myths

by

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1. Introduction: Demand or Supply driven Depressions?

If official statistics are to be believed, the fall in output in the transition economies of Central and Eastern Europe has probably been the largest anywhere in peacetime in modern history (failed harvests could cause even larger falls in agricultural societies, and such effects were felt on a national level as late as 1854 in Ireland). This fall in output was certainly noticeably larger than that which occurred during the Great Depression of the 1930s (compare Tables 7 and 8-10), although it was smaller than that during World War II in countries which served as battlegrounds (France in 1944, Germany and Japan in 1945). It is therefore important to know what the cause of the post-Communist depressions was. Two main explanations have been put forward, the first posits a sharp reduction in the level of aggregate demand as the cause, the second suggests a dramatic change in the structure of demand, to which supply was unable to respond sufficiently rapidly.

On the demand based view, the anti-inflationary policies pursued by reformist governments resulted in excessive tightening in monetary and fiscal policies, and via high real interest rates and/or reductions in budget deficits caused sharp falls in aggregate demand, which in turn caused output to collapse (e.g. Laski and Bhaduri,1993). The supply-side approach starts from the large increase in the relative prices of energy and other inputs (and the fall in the relative prices of agricultural products), which resulted from price liberalization. This led to many production processes becoming loss making, and having to be discontinued. Due to various rigidities many resources became permanently useless, while others had to remain idle until until they were redeployed or improved. Since the required micro-adjustments were large, the post-Communist depressions were inevitable. If, in the transition, aggregate demand was not reduced to correspond to the level of the (much reduced) sustainable aggregate supply, then countries suffered very high inflation as well as great depression, as in Russia or Ukraine (Gomulka, 1993).

If the demand based explanations are correct, we would expect the fall in investment during the transition to be far greater than the fall in GDP, with a resulting fall in the investment/GDP ratio. This follows both from theory and empirical observation.

In a simple accelerator model, the optimal capital stock is proportional to the expected output level:

(1) $$K^* = \upsilon Y_2$$

If today's capital stock is optimal, investment will be undertaken to offset depreciation and to match any expected increase in output:

(2) $$I_1 = K^* - K_1 + \delta K_1 = \upsilon(Y_2 - Y_1) + \delta K_1$$

Thus, a change in national income causes a matching change in the capital stock. Since the capital output ratio is usually between 2 and 3, and investment is between 15% and 30% annual of GDP, a 10% increase in expected (permanent) GDP would lead to a 100-200% increase in investment, if the whole of the increase in the capital stock had to take place in one period. Equally, a fall of permanent GDP by 10% would lead to the complete elimination of investment. In fact, since the adjustment of the capital stock does not need to take place in one year, and since not every increase or fall in output is believed by businesses to be a change in permanent output, there is no need for the changes in investment to be quite as violent as suggested by such a very simple model. Nevertheless, in western market economies changes in investment are usually several times larger than the changes in output which they accompany. This is documented in Section 2 for some major OECD countries in the post-War period (both at the aggregate and sectoral levels) and in Section 3 for the major capitalist countries during the Great Depression of the 1930s. In Section 4 the experience of the post-Communist economies is compared with that in the West during the Great Depression. It is found that although (according to official statistics) the output collapse was in general larger during the transition crisis, investment fell by far less (Figures 1 and 2 and Tables 7-9).

The behaviour of investment and of its components during the transition in Poland is examined in Section 5. It can be seen to be incompatible with both the predictions of the aggregate demand based explanation of the post-Communist depression in that country, and with the experience of market economies, both in the post-War period and during the Great Depression. Instead of observing a massive fall in the investment/GDP ratio, as we would expect as a result of the excess capacity which should accompany an aggregate demand driven depression, investment/GDP actually increased during the transition in Poland

(Figure 1). What is more, this ratio increased very sharply in those sectors in which one would expect there to be a particular need for fixed assets to be restructured - namely, in industry and commerce. Also significant is the fact that investment in machinery and equipment rose even more than total investment relative to output, both in the economy as whole and in industry and commerce in particular. On the other hand agriculture, where there was less possibility of restructuring, and which suffered a massive terms of trade shock, experienced a fall in the investment/output ratio similar to that of the US economy during the Great Depression.

Even in the post-Communist countries in which investment falls relative to GDP, this fall is far smaller than the experience of the western market economies would lead us to expect (see Figure 2 for a comparison of Russia during 1989-93 with the United States 1929-33). This suggests that, even in these countries (the Czech Republic, Hungary, Romania, Russia, Ukraine), reductions in aggregate demand can not provide a full explanation of the transition depression(1), and that supply side effects are an important part of what happened (Sections 6 and 7).

2. The Behaviour of Components of National Income and of Gross Fixed Capital Formation during the Business Cycle in Selected OECD Countries.

Recently a number of studies have shown that in the post-war period fluctuations in investment have been highly positively correlated with fluctuations in national income, but that the amplitude of the investment fluctuations is far greater than that of the national income fluctuations (some 2.5 to 4.8 times greater). Kydland and Prescott (1990) have shown that in the United States quarterly fluctuations in total investment, fixed investment, non-residential fixed investment and non-residential fixed investment in equipment were all strongly correlated with quarterly fluctuations in real GNP(2) (Table 1). Not only was the correlation very high (between 0.80 and 0.91) but also the variability of investment was far greater than that of GNP. Thus, whereas the standard deviation of real GNP was 1.71%, that of fixed investment was 5.38%, that of investment in equipment 6.21% and that of total

investment 8.30%. Thus, if the growth rate of GNP fell by 1 percent there was a very high probability that the growth rates of various categories of investment would also fall, but by several times that amount. Blackburn and Ravn (1992) obtained similar results for the UK for the period 1956-90 (Table 2)[3].

Burda and Wyplosz (1993) confirm the greater variability of investment than of GDP for Australia, Canada and Japan during 1970-91 (also on the basis of quarterly data). In Tables 3 to 6 we report analogous annual data for gross domestic product and gross fixed capital formation for 1971-92 for Germany, Italy, France and the UK[4]. In order to make the data more comparable to that of the post-communist economies, annual rather than quarterly data were used. More importantly, a number of categories of investment which are more relevant to the comparison with post-communist economies were included:

1. gross fixed capital formation of machinery and equipment in the economy as a whole;
2. gross fixed capital formation in manufacturing;
3. gross fixed capital formation in construction;
4. gross fixed capital formation in agriculture;
5. gross fixed capital formation of equipment in manufacturing (UK only).

In all four countries fluctuations in total gross fixed capital formation (GFCF) and in gross fixed capital formation of machinery and equipment (GFCF-E) are positively correlated with contemporaneous annual fluctuations in real GDP. The correlations range from 0.78 for GFCF and 0.78 for GFCF-E in the UK to 0.51 and 0.36 respectively in Germany. Again the amplitude of the fluctuations was far larger for both GFCF and GFCF-E than for GDP, with the standard deviations ranging from 2.3 times as large for GFCF as for GDP in the UK, to 4.3 times as large for GFCF-E (compared to the standard deviation of GDP) in Germany.

When we look at the picture within the major productive sectors of the economy, the correlation of GFCF in manufacturing (GFCF-M) to gross value added in manufacturing (GVA-M) was quite high in the UK and Italy (0.64 and 0.63), much lower in France (0.30)

and almost zero in Germany (0.08). Again, the standard deviation of GFCF-M was far higher than that of GVA-M: being 3.6 times in the UK, 3.5 times in Germany, 2.8 times in France and 2.2 times in Italy. Fluctuations in gross fixed capital formation of machinery and equipment in manufacturing (GFCF-E-M) was quite strongly correlated with GVA-M in the UK, the only country for which it was available, at 0.61, and it had a standard deviation which was 2.4 times as great as that of GVA-M.

Gross fixed capital formation in construction (GFCF-C) was positively correlated with contemporaneous GVA in construction in all four countries, most strongly in Germany (0.65) and least strongly in the UK (0.25). Gross fixed capital formation in agriculture (GFCF-A) was hardly correlated at all with contemporaneous GVA in agriculture (except in the UK where the correlation was 0.47). In both the UK and Italy, however, GFCF-A was more strongly correlated with GVA-A in the subsequent year, showing that it is a lagging indicator, even with annual data. Again, however, the standard deviation of GFCF-A was considerably larger than that of GVA-A.

There are three possible interpretations of these relationships:

1) Tightening of macroeconomic policy leads to a fall in the growth rate of national income, causing the appearance of excess capacity, which in turn causes a larger fall in the rate of GFCF.

2) Increases in interest rates cause a fall in the rate of GFCF, which causes a smaller fall in the growth rate of national income (investment demand is only a fraction of aggregate demand)[(5)].

3) Investment opportunities decline as a result of a fall in the rate of technical innovation, leading to a fall in GFCF, which in turn leads to a smaller fall in the rate of growth of national income because investment is only a fraction of national output (a real business cycle hypothesis).

As we shall see, as far as comparison with, and analysis of, the behaviour of investment in some post-communist countries is concerned, it does not matter which of these explanations is correct for developed market economies.

3. The Behaviour of Investment During the Great Depression of 1929-33.

Table 7 shows the behaviour of real GDP, real investment and (in some cases) real GFCF and real GFCF in machinery and equipment (GFCF-E) between 1929 and 1933 in Australia, Canada, Germany, Italy, Sweden, the United States and the United Kingdom (data was not available for other countries[6]). The countries fall into two groups. The first, consisting of the USA, Canada and Germany, suffered falls in national income which are comparable to those in the transition economies (see Table 8). On the other hand, the second group (the UK, Australia, Italy and Sweden) suffered much smaller declines. In both groups, however, real investment, real GFCF and real GFCF-E fell by several times more than real national income. In the first group real gross investment fell some 2.7 to 2.8 times as much as the fall in national income, whereas in those countries in which the depression was less severe the fall in gross investment relative to the fall in national income was much larger (between 2.8 and 6.5 times). For those countries for which we have real GFCF (Australia, the UK and the USA), it fell by slightly less than real gross investment, but still by several times more than real GDP (by 6 times, 2.8 times and 2.5 times respectively). We have real GFCF-E only for the UK and the USA, and again the decline was much larger than the decline in real GDP - 4.6 times for the UK and 2.3 times for the USA.

In the United States gross national product fell a cumulative 29.8% in real terms, while gross investment fell 84.5%. Real GFCF fell 74% and real GFCF-E fell slightly less, by 69.9%. Thus by 1933 investment expenditure per unit of national income had fallen to 22% of its 1929 level, GFCF to 40.3% of that level, and GFCF-E to 43%. In Canada the results of the great depression on real GDP and real gross investment were almost identical to those in the US[7]. In Germany real GDP fell by 23.5% between 1929 and 1932 (the trough of the depression in terms of national income). During that time investment expenditures fell 63.5%, so that investment per unit of national income fell to 48% of its 1929 level[8].

In the UK real GDP fell 5% between 1929 and 1932 (the trough year) while gross investment fell 17.6%[9]. In Australia real GDP fell 7.9% and gross investment fell 51.5%

between 1929 and 1931 [(10)]. In Italy national income fell only in 1930. In that year real GDP fell 7% while investment fell 28%. In Sweden real GDP only fell between the years 1930 and 1932. In that time real GDP fell 11.9%, while real investment fell 33.2%.

There are two commonly presented interpretations of these facts:

1) the Monetarist: the unintended tightening of the monetary stance in 1929 lead to a sharp fall in national income, causing the appearance of a large amount of excess capacity, which in turn caused an even larger fall in investment and GFCF.

2) the Keynesian: an initial fall in investment demand and GFCF was the trigger. It caused a (smaller) fall in national income, which in turn caused a further fall in investment and GFCF, since firms with excess capacity had little reason to invest.

4. The Behaviour of Investment During the Transition Crisis of 1989-93.

Data was obtained on gross investment and national income for eight post-Communist economies. Tables 8-10 show that all the countries suffered declines in GDP which were similar in size to those experienced by the three economies in our sample which were severely affected by the great depression of the 1930s (Canada, Germany and the United States). The smallest loss of GDP (from the beginning of the transition to the trough) was suffered by Poland at 17.8%, while the largest was suffered by Bulgaria at 41.3%. The post-Communist countries fall into two groups: one in which gross investment fell by less than GDP, and another in which it fell by more. Bulgaria, Poland and Slovakia belong to the first group, while the Czech Republic, Hungary, Romania, Russia and Ukraine belong to the second.

It is clearly impossible to account for the fall in economic activity in the countries of the first group by a shortage of aggregate demand, as many writers have done [e.g. Kolodko, 1992, Laski and Bhaduri, 1993]. Such a fall in aggregate demand should have led to the appearance of excess capacity and therefore to a decline of gross investment steeper than that of output. But this did not happen in these three transition countries.

Particularly striking is the fact that in the post-Communist countries there is no inverse relationship between the size of the fall in GDP and the ratio of the fall in investment to the fall in GDP, as there is in our sample of countries from the Great Depression (Table 7). What we observe in the Great Depression is that when we look across countries, the greater the percentage fall in GDP the greater the percentage fall in investment, but with a declining percentage increment. The explanation of this phenomenon is probably quite straightforward. The investment aggregate used is gross investment or gross fixed capital formation. The greater the percentage fall in GDP and in investment, the smaller the remaining investment is relative to the economy's existing capital stock, and therefore the larger the proportion of any investment which goes to offsetting the depreciation of the existing capital stock. Since offsetting depreciation is likely to involve less risk than creating new capital, one would expect such investment to be more resistant to reduction (even as a result of falls in aggregate demand) than is investment in new capital. The absence of such a phenomenon in the transition economies suggests that investing in offsetting the depreciation of the existing capital stock is no less risky than investing in new capital. This in turn indicates the importance of relative rather than aggregate demand shifts.

5. The Boom within the Slump: the Behaviour of Components of National Income and of Investment during the Transition to a Market Economy in Poland.

In Poland during 1989 to 1993 we get a quite different history of the behaviour of investment and national income and their components than one would expect on the basis of Western experience (Table 9). Whereas GDP fell by 18.3% between 1989 and 1991, gross fixed investment (GFI) fell by only 13.8%, so that GFI expenditures per unit of national income actually rose by 4%, rather than falling dramatically.

Even more striking are the results for the relationship between investment and national income by main branches of output. When we look at the main sectors of output we see a divergence between those sectors in which investment fell more than GDP produced in

that sector (construction and transport) or where investment fell sharply even though GDP produced increased (agriculture), and those where it either fell far less than GDP produced (industry) or where it increased by more than GDP produced (commerce). *Thus, whereas GDP produced in industry fell 35.4% between 1989 and 1991, GFI in industry fell only 14%, so that GFI per unit of GDP increased by 33%!* This contrasts with the much larger standard deviation of GFCF in manufacturing than of GVA in manufacturing(11) which we find in the post-War period in all of the Western European countries described in Section 2, and the quite strong positive correlation between the two variables which we find in three of the four countries described. (Unfortunately, we did not find data for GFI in industry during the Great Depression for any of the countries.)

How can these facts be explained? For those who hold to a Keynesian explanation according to which both national income and investment declined in Poland as a result of a decline in aggregate demand, the facts regarding GFI in industry become if anything even more difficult to explain when one notes that although GFI in construction and transport did indeed decline more than the GDP produced in those sectors, it did so by only very slightly more.

On the other hand, these facts *are* explicable by the hypothesis that the comprehensive liberalization and imposition of hard budget constraints, which lay at the core of the Balcerowicz Plan in Poland in 1990, constituted a massive real shock to enterprises - equivalent to a block of technical innovations - which affected the various productive sectors of the Polish economy in different ways. Such an approach makes it possible to understand why investment in Polish industry per unit of GDP produced in that sector increased sharply instead of falling, as would have been suggested by the aggregate demand based approach. Industrial firms realized that they were not suffering from excess capacity - as would indeed have been the case if the problem had been a *shortage* of aggregate demand. Instead it is our belief that they were suffering from a shortage of the right kind of productive capacity, and therefore they needed to invest in order to increase such capacity. The ability of the firms to invest was, however, limited by the fall in revenue which they faced due to the restrictive macroeconomic policy which was a key part of the Balcerowicz Plan, and which was necessary in order to impose hard budget constraints on the firms in the first place. Together with the fact that Poland had reneged on its

international debt payments already in 1981 - so that Polish firms did not have access to international capital markets - this may explain why GFI in industry fell in absolute terms instead of perhaps increasing in the face of the fall in capacity.

Such a "real shocks" approach to the behaviour of GDP and GFI in the Polish transition is also supported by the behaviour of GFI in machinery and equipment (GFI-E) in industry. This fell by only 7.8%, even less than total investment in industry between 1989 and 1991, so that GFI-E in industry rose relative to GDP produced in industry by 42.6% between 1989 and 1991! While incomprehensible in the light of a standard Keynesian or accelerator model, this fact can be readily understood if we accept that Polish producers realized that they needed to fundamentally restructure their technical base.

The same "real shocks" approach can explain what happened in agriculture, where GFI fell by 62% even though real GDP increased by 6.5% between 1989 and 1991. GFI-E in agriculture fell even more - by 76.6%. Producer prices had been kept artificially high in the 1980s in agriculture, and farmers were therefore subject to a massive terms of trade shock when industrial prices were freed and utility tariffs raised [Bell and Rostowski 1995]. Farmers clearly decided that there was not going to be a great future in expanding agricultural production under the new market determined conditions. On the other hand in commerce - which had been severely repressed under communism and where liberalization of prices and entry caused sectoral GDP to grow very fast - investment grew even faster. As a result GFI/GDP in this sector increased by 53% between 1989 and 1993 and GFI-E/GDP increased by *three times* during the same period.

Finally, it is worth noting that the hypothesis that the depression in Poland in 1990 was due to a "credit crunch" (Calvo and Coricelli, 1992) is also hard to reconcile with the behaviour of investment in that year. Table 7 shows that for the whole economy GFI/GDP rose by 1.7%, GFI/GDP in industry rose 18.8%, and GFI-E/GDP in industry rose by 31.8% (in industry there was an almost 30% fall in gross output in that year, and yet GFI-E actually increased by 2.8% in absolute real terms in this context). Since, on the credit crunch hypothesis industrial firms reduced output because they did not have the financial resources to buy inputs (particularly material inputs), and indeed were supposedly obliged in this situation to "borrow from their employees" by reducing real wages sharply, it is hard to

explain why these same firms should have actually increased the volume of investment in machinery and equipment.

6. Investment and Output in Hungary.

Hungary is the other country for which fairly detailed investment and sectoral output statistics were obtained (Table 10). The story here has some similarity to that in Poland, but with a clear delay in the "investment recovery" as compared to Poland, so that the ratio of GFI/GDP remains several points below its 1989 level from 1990 to 1993 (between 93.5% and 97.8% of 1989), and only exceeds that level in 1994 (106.8%). However this is in spite of an 18.3% fall in GDP between 1989 and the trough of the depression in 1993, which given western experience would have led us to expect a far larger fall in investment. When we look at GFI-E/GDP we again have a pattern which is similar to that in Poland, with however the ratios for the economy as a whole exceeding 100% by a significant amount only from 1992 (before that date the ratios were slightly above 100% in Poland and slightly below 100% in Hungary). This is an extraordinary contrast with the behaviour of gross fixed capital formation in machinery and equipment during the Great Depression. We have data only for the UK and the USA. However, in the UK where GDP fell by only some 5%, GFCF-E had fallen by 33% by 1933, whereas in the USA, where GDP fell by 30%, GFCF-E fell by 70% (Table 7). Once more this is a puzzle which a demand based explanation of the transition depression cannot explain.

As in Poland there are wide sectoral differences in the behaviour of GFI and GFI-E, and in that of the GFI/GDP and GFI-E/GDP ratios, which suggest that the high level of investment was linked to the restructuring of the economy during the transition. The "investment recovery" (relative to the 1989 level) only really starts in industry and transport in 1992, while in commerce and construction investment is higher than its 1989 level in absolute terms throughout the period (in the former case this is similar to Poland, in the latter it is not). Most significantly in agriculture, again as in Poland, GFI and GFI-E exhibit a continuous and very sharp downward trend, reaching 16% and 15% of their 1989 levels.

7. Transition countries in which Investment fell by more than GDP.

These are: the Czech Republic, Hungary, Romania, Russia and Ukraine. Even in these countries, however, the fall in gross investment relative to the fall in national income was far smaller than that in any of the countries in our sample from the Great Depression. The largest relative fall in investment took place in Russia during 1991-3. During this period GDP fell by 29.9%, slightly more than in the USA and Canada in 1929-33, while gross investment fell by 53.2% in Russia as against almost 85% in the USA and Canada (See Figure 2). This means that the fall in gross investment was only 1.8 times that of the fall in national income (compared to a factor of 2.8 times in the USA and Canada). To take another comparison: during 1929-32 GDP in Germany fell 23.5% and gross investment fell 63.5%; during 1990-3 in the Czech Republic, GDP fell 20.6% while gross investment fell only 28.2% (both examples run from the peak to the trough of the depression in terms of GDP). This gives a ratio of 1.4 for the Czech Republic, only slightly more than half of the lowest figure for the sample from the Great Depression.

These figures suggest that even in this second group of countries, in which real investment did fall by more than real GDP, there may be reason to suppose that the fall in output (or part of the fall in output) was due to something other than merely a reduction in aggregate demand. Two possibilities present themselves. First, producers invested as much as they could, but were prevented from increasing the share of investment in GDP (in constant prices), by the rigour of macroeconomic policies, which simply denied them the finance which would have made such investment possible. Alternatively, insufficient hardening of budget constraints and insufficient price, trade and other liberalization, made it impossible for producers to know what kinds of new capacity they needed (i.e. the prices and the macro-economic context were not yet right). Aggregate data cannot tell us which process was at work in which country, although outside information we have about the depth of reform suggests that the first process may have operated in the Czech Republic and Hungary, and the second in Romania, Russia and Ukraine.

8. Conclusions and Implications.

The behaviour of investment in the post-Communist economies seems to be incompatible with the view that the transition depressions were caused exclusively by a shortage of aggregate demand. In the case of Poland the behaviour of investment suggests that none of the output fall can be attributed to insufficiency of demand. Further research needs to be done, particularly on Slovakia and Bulgaria, to see whether the sectoral patterns and of investment observed in Poland and Hungary, and the behaviour of investment in machinery and equipment in the two countries -- all of which are consistent with the view that the resilience of investment was due to restructuring of the economy -- are repeated.

It is also important to know: which are the firms which were undertaking this investment? Were they state enterprises or new private businesses? As they stand, our results cast some doubt on the hypothesis of Grosfeld and Roland (1995) that in the early transition enterprises in Central Europe engaged only in "defensive" restructuring and failed to undertake "strategic" restructuring. The resilience of investment shows that enterprises did more than merely sack workers and sell unneeded plant, which is what defensive restructuring amounts to. However, it is not impossible that all the investment was undertaken by new private firms, and that Grosfeld and Roland are right as regards the behaviour of state enterprises.

The investment facts we have described (particularly in the case of Poland) are unfriendly to a number of other hypotheses about the transition. We have already mentioned that the high level of investment in Poland in 1990 seems incompatible with the "credit crunch" hypothesis of Calvo and Coricelli. It is also incompatible with the implications of the work of Borensztein and Ostrey (1992) and Borenstein, Demekas and Ostrey (1993), which implies that there was very little structural adjustment in the transition economies during 1990 and 1991 at the level of the ten major sectors of industry. It has been pointed out (e.g. Rostowski 1993) that these results suffer from the level of aggregation of the data chosen, whereas the changes in output mix happened either at a higher level of aggregation (the shift from industry to commerce and other services) or at a lower level (within particular enterprises). The resilience of investment in all transition countries (as compared with what one would expect on the basis of experience in western market economies), and

the remarkable resilience of investment in machinery and equipment in Poland and Hungary in particular, shows that considerable restructuring was taking place - otherwise, why invest when output has fallen so sharply?

Appendix:

A back of the envelope calculation of the amount of machinery and equipment which had to be written down in Poland after 1989 in the industrial sector can be attempted through a calibration of a very simple extension to the accelerator model presented in eq.(2).

In order to calculate the equilibrium value of the net capital stock in the form of machinery and equipment in 1990 the following procedure was adopted. First it was necessary to find the historical value of the net capital stock in M&E in industry in 1989, so as to compare this to the level of GDP produced in industry in that year, and thus arrive at a guess for the equilibrium ratio of M&E net capital/Y in industry.

This was done in the following way. The real gross capital stock in industry (at 1984 prices) was obtained (Rocznik Statystyczny - hereafter R.S. - 1991 p. 252). The real gross capital stock in industry in the form of machinery and equipment was then estimated by applying the ratio of the value of machinery and equipment in industry to total capital in industry in 1989 at replacement cost (R.S. 1991 p. 256). This ratio was 0.45. The real net capital stock of machinery and equipment in industry was then estimated by applying the ratio of fully depreciated capital to total capital (stopa zużycia środków trwałych) of machinery and equipment in industry (R.S. 1991 p.258) to the estimate of the real gross capital stock in the form of machinery and equipment in industry already obtained. This ratio was 0.28.

The figure obtained in this way was 1,896 bn zł for the net stock of machinery and equipment in industry at 1984 prices, and the level of GDP (in 1984 prices) was 3,773 bn zł for 1989. The net K/Y ratio for machinery and equipment in industry in 1989 is thus 0.5. We assume that this is the equilibrium value of υ. If we then assume, as is usual, that the depreciation rate for machinery and equipment is 10%, and substitute into equation (2), to find I* (equilibrium investment), we get (in billions of 1984 złotys):

$$(2') \qquad I^* = 0.5(2850 - 3773) + 0.1(1896) = -270$$

as the figure for GDP produced in industry in 1990 at 1984 prices was 2,850 bn zł.

This indicates that with such parameters, investment in machinery and equipment in industry should have been zero in 1990, whereas in fact it was 327 bn zł in 1984 prices. In fact, investment in M&E in industry in 1990 should have been zero even if we assume a depreciation rate of 0.24 (24% per annum) which is extraordinarily high even for M&E, and the level of investment which was actually experienced in 1990 can only be obtained if one assumes a depreciation rate of 42% per annum.

We can also use the simple accelerator approach to get a very rough idea of the amount of M&E capital which had to be written down in industry as a result of the initiation of the economic transformation in Poland. GDP generated in industry, which was 2,850 bnzł in 1990, exceeded 2,800 bn zł (in 1984 prices) only in 1994, so it seems reasonable to assume that in 1990 industrial output expected for the foreseeable future was about this amount. This gives us an equilibrium capital stock of M&E of about 1,400 bn zł. The equilibrium level of investment can also be thought of as given by:

$$(3) \qquad I = \lambda(K^* - K') + \delta K'$$

where λ is the proportion of the difference between K* and K' which is eliminated each year, K' is the true value of the capital stock and K* is the equilibrium capital stock given by

$$(4) \qquad K^* = \upsilon Y^*$$

where Y* is the equilibrium (expected) level of output.

By rearranging (3) we get:

$$(3') \qquad I = \lambda K^* + (\delta - \lambda)K'$$

and

$$(3'') \qquad K' = (I - \lambda K^*)/(\delta - \lambda)$$

We then get the following values for K', given the historical I (327 bn zł) and K* estimated at 1,400 bn zł:

	$\delta = 0.1$	$\delta = 0.2$
$\lambda = 0.33$	574	1015
$\lambda = 0.25$	133	400

Given that the historical amount of capital (in M&E in industry at 1984 prices) in 1989 was 1896 bn zł, the amount of this capital which needed to be written down in 1990 can be calculated to have been as follows:

	$\delta = 0.1$	$\delta = 0.2$
$\lambda = 0.33$	70%	48%
$\lambda = 0.25$	93%	79%

If $\lambda = 0.33$, then there is no write down of M&E capital in industry only if $\delta = 0.26$; and if $\lambda = 0.25$ then the same result occurs if $\delta = 0.24$. However, since it seems very improbable that δ should be any larger than 0.20, or even less that λ should be any larger than 0.33, we can suppose that the amount of machinery and equipment which needed to be written down in 1990 is unlikely to have been much less than about half.

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Notes:

1. There are other more obvious reasons to reject the idea of insufficient aggregate demand in Romania, Russia and Ukraine. In all three macroeconomic policy was very lax for most of the first two years of the transition, during which output fell very sharply.

2. For the period 1954-89, quarterly data. Non-residential structures and residential investment (overwhelmingly structures) were also correlated with GNP, but not quite so strongly.

3. Also quarterly. Unless otherwise stated all data is in real terms.

4. Continuous comparable data was not available for investment in Eurostat.

5. Investment demand could also fall as a result of a decline in the "animal spirits" of entrepreneurs.

6. Data from 1930 was available for Japan, but that country experienced no fall in national income.

7. Data on real GFCF and GFCF in M&E are not available.

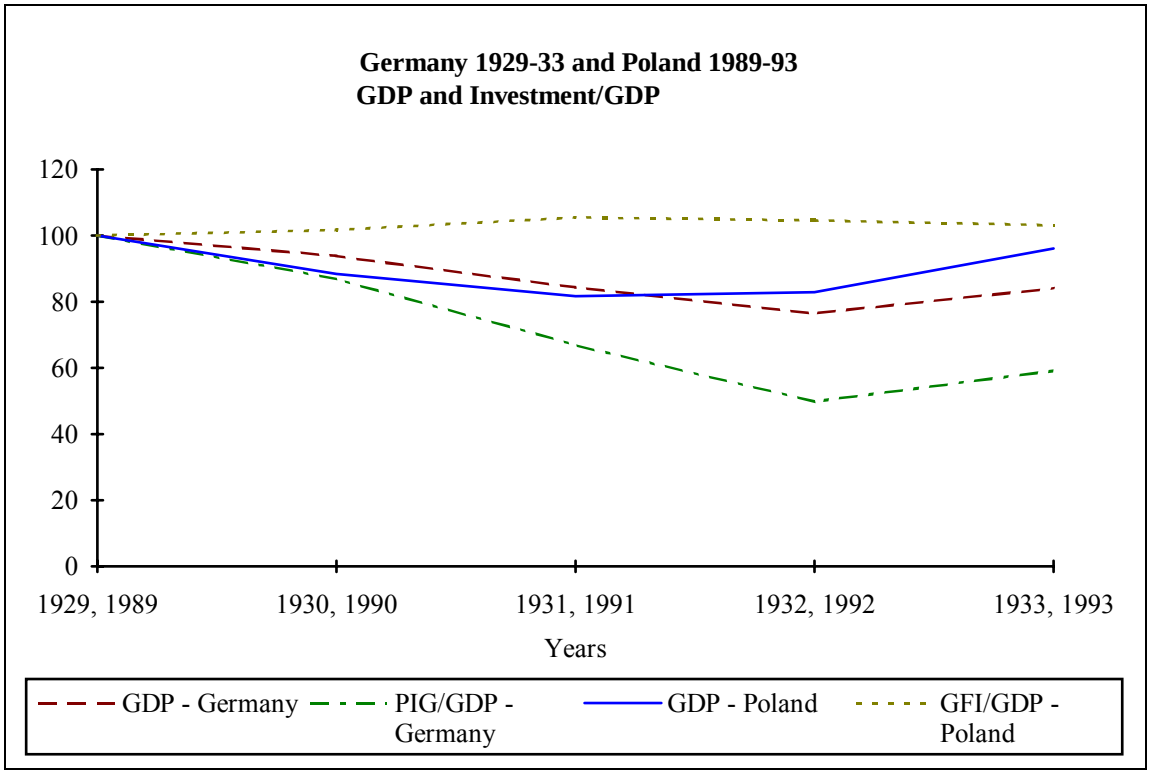
8. GFCF is unavailable for Germany.

9. GFCF fell 14% and gross fixed capital formation of machinery and equipment fell even more: by 22.8%.

10. While GFCF fell 47.5%.

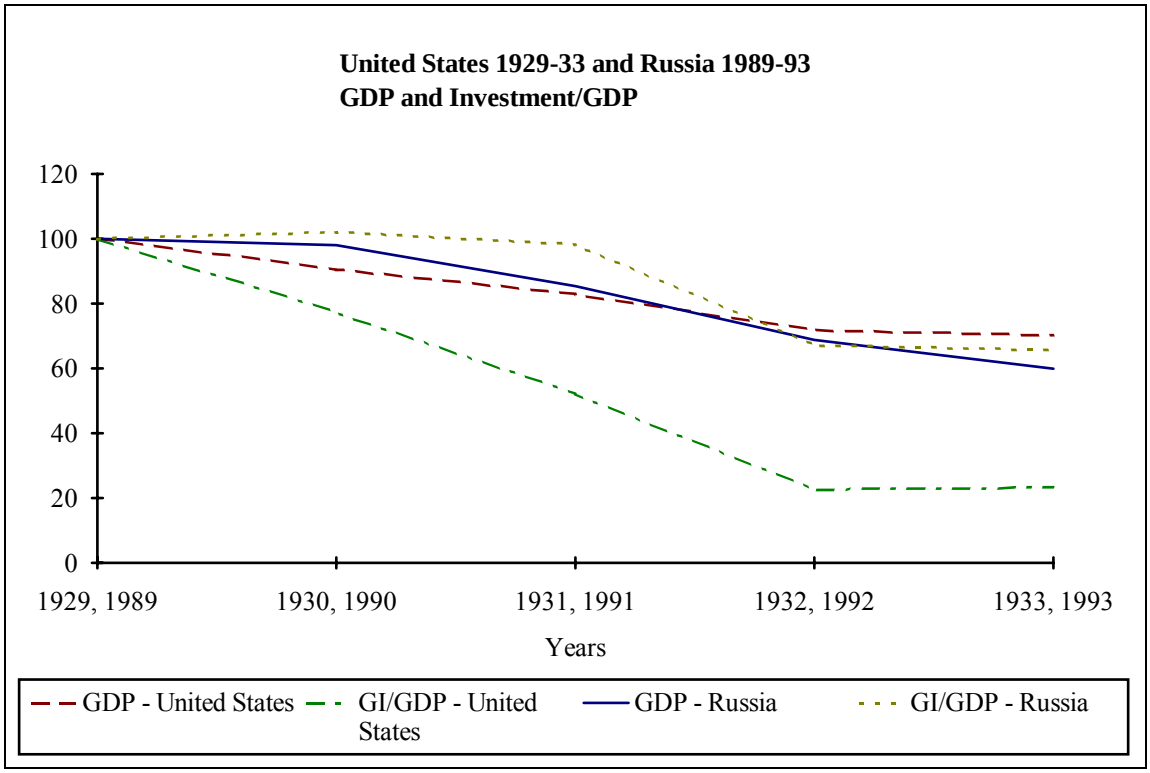
11. "Industry" in Poland consists of the usual manufacturing two digit sectors plus extractive industry, which accounts for less than 5% of the whole.

Figure 1



Source: Tables 7 and 9

Figure 2



Source: Tables 7 and 8

Table 1: United States; Correlations of real GDP and gross value added with gross fixed capital formation (Quarterly Data)

	Volatility (% st dev)	t-1	t	t+1
GDP	1.71	0.85	1.00	0.85
Investment Expenditure	8.30	0.79	0.91	0.75
Fixed Investment	5.38	0.83	0.90	0.81
Equipment	6.21	0.65	0.85	0.90

Source: Kydland, F. & Prescott, E.: Business Cycles: Real Facts and Monetary Myth, Federal Reserve Bank of Minneapolis

Table 2: United Kingdom: Correlations of real GDP and gross value added with gross fixed capital formation (Quarterly Data)

	Volatility (% st dev)	t-1	t	t+1
Output	1.49	-	-	-
Total Investment	6.69	0.51	0.74	0.58
Fixed Investment	3.48	0.36	0.64	0.55
Inventory Investment	0.82	0.47	0.59	0.43

Source: Blackburn, K. & Ravn, M. O.: Business Cycles in the United Kingdom: Facts and Fictions, Economica, 59, 383-401.

Table 3: France: Correlations of real GDP and gross value added with gross fixed capital formation (Yearly Data)

	Volatility (% st dev)	t-1	t	t+1
Gross Domestic Product	1.59	0.38	1.00	0.38
- Gross Fixed Capital Formation	4.43	0.39	0.76	0.34
- Gross Fixed Capital Formation in Machinery & Equipment	6.12	0.31	0.69	0.23
- Gross Value Added -Manufacturing	3.00	0.37	0.92	0.36
Gross Value Added - Manufacturing	3.00	0.41	1.00	0.41
- Gross Fixed Capital Formation - Manufacturing	8.25	-0.23	0.30	-0.03
Gross Value Added - Construction	3.07	0.16	1.00	0.16
- Gross Fixed Capital Formation - Construction	7.37	0.05	0.45	0.05
Gross Value Added - Agriculture	5.67	-0.30	1.00	-0.30
- Gross Fixed Capital Formation - Agriculture	9.44	-0.21	0.05	-0.12

Source: Eurostat

Table 4: Germany: Correlations of real GDP and gross value added with gross fixed capital formation (Yearly Data)

	Volatility (% st dev)	t-1	t	t+1
Gross Domestic Product	2.02	0.28	1.00	0.28
- Gross Fixed Capital Formation	6.09	0.31	0.51	0.13
- Gross Fixed Capital Formation in Machinery & Equipment	8.59	0.34	0.36	-0.06
- Gross Value Added - Manufacturing	2.76	-0.04	0.86	0.19
Gross Value Added - Manufacturing	2.76	-0.10	1.00	-0.10
- Gross Fixed Capital Formation - Manufacturing	9.79	-0.09	0.08	0.12
Gross Value Added - Construction	4.20	0.38	1.00	0.38
- Gross Fixed Capital Formation - Construction	16.32	0.67	0.65	0.10
Gross Value Added - Agriculture	6.94	-0.06	1.00	-0.60
- Gross Fixed Capital Formation - Agriculture	9.40	-0.07	0.08	0.12

Source: Eurostat

Table 5: Italy*:* Correlations of real GDP and gross value added with gross fixed capital formation (Yearly Data)

	Volatility (% st dev)	t-1	t	t+1
Gross Domestic Product	2.3	0.08	1.00	0.08
- Grossed Fixed Capital Formation	4.8	-0.04	0.68	0.31
- Gross Fixed Capital Formation in Machinery & Equipment	8.6	0.12	0.70	0.13
- Gross Value Added in Manufacturing	4.6	-0.04	0.94	-0.23
Gross Value Added in Manufacturing	4.6	-0.23	1.00	-0.23
- Gross Fixed Capital Formation in Manufacturing	10.1	-0.20	0.63	0.22
Gross Value Added - Construction	2.9	0.21	1.00	0.21
- Gross Fixed Capital Formation - Construction	6.0	0.02	0.43	0.25
Gross Value Added - Agriculture	4.0	-0.30	1.00	-0.30
- Gross Fixed Capital Formation - Agriculture	6.4	-0.41	-0.02	0.20

Source: Eurostat

Table 6: United Kingdom: Correlations of real GDP and gross value added with gross fixed capital formation (Yearly Data)

	Volatility (% st dev)	t-1	t	t+1
Gross Domestic Product	2.5	0.33	1.00	0.33
- Grossed Fixed Capital Formation	5.8	0.27	0.78	0.44
- Gross Fixed Capital Formation in Machinery & Equipment	7.3	0.37	0.78	0.35
- Gross Value Added in Manufacturing	4.3	0.19	0.86	0.42
Gross Value Added in Manufacturing	4.3	0.40	1.00	0.40
- Gross Fixed Capital Formation in Manufacturing	15.3	0.18	0.64	0.50
- Gross Fixed Capital Formation in Equipment - Manufacturing	10.4	-0.14	0.61	0.65
Gross Value Added - Construction	6.1	0.32	1.00	0.32
- Gross Fixed Capital Formation - Construction	5.9	-0.06	0.25	0.25
Gross Value Added - Agriculture	6.9	-0.40	1.00	-0.40
- Gross Fixed Capital Formation - Agriculture	16.3	0.19	0.08	-0.37

Source: Eurostat

Table 7: Volume Indices (part I)

Years	1929	1930	1931	1932	1933
Australia					
GDP	100,00	90,59	92,12	97,61	101,26
Gross investment	100,00	71,89	55,33	56,21	80,47
Gross capital formation	100,00	72,38	52,49	50,28	70,17
GI/GDP	100,00	79,36	60,06	57,59	79,47
GFCF/GDP	100,00	100,67	94,87	89,44	87,19
Germany					
GDP	100,00	93,79	84,36	76,47	84,13
Production of investment goods*	100,00	81,50	56,48	38,08	49,75
PIG/GDP	100,00	86,90	66,95	49,80	59,14
Italy					
GDP	100,00	92,96	94,37	97,89	97,89
Gross investment	100,00	72,01	63,06	72,76	66,04
GI/GDP	100,00	77,47	66,83	74,33	67,47
Canada					
GDP	100,00	95,73	83,57	74,89	69,91
Gross investment	100,00	71,61	50,35	22,47	15,55
Gross capital formation	100,00	87,51	64,99	36,01	25,75
GI/GDP	100,00	74,81	60,25	30,00	22,24
GFCF/GDP	100,00	91,42	77,77	48,08	36,84
Sweden					
GDP	100,00	103,40	93,53	91,12	92,28
Gross investment	100,00	115,58	99,43	77,24	79,69
GI/GDP	100,00	111,78	106,31	84,78	86,36
UK					
GDP	100,00	99,90	94,85	95,04	96,18
Gross investment	100,00	87,20	94,08	82,48	76,80
Gross capital formation	100,00	100,83	98,33	85,83	89,17
GFCF in machinery & equipment	100,00	92,90	95,85	77,19	67,24
GI/GDP	100,00	87,28	99,19	86,79	79,85
GFCF/GDP	100,00	100,93	103,68	90,31	92,71
GFCF in M&E/GDP	100,00	92,99	101,05	81,22	69,91

Notes: see next page.

Table 7: Volume Indices (part II)

Years	1929	1930	1931	1932	1933
US					
GDP	100,00	90,59	82,88	71,76	70,25
Gross investment	100,00	70,04	43,25	16,24	16,38
Gross capital formation	100,00	76,64	52,41	30,37	26,09
Gross capital formation in M&E	100,00	80,00	51,43	29,61	30,13
GI/GDP	100,00	77,32	52,18	22,63	23,32
GFCF/GDP	100,00	84,60	63,24	42,33	37,14
GFCF in M&E/GDP	100,00	88,31	62,05	41,26	42,89

Source: Liesner, T.; "One Hundred Years of Economic Statistics", The Economist, 1984, London.

*I. Svermilson, "Growth and Stagnation in the European Economy", UNECE, 1954, Geneva.

Table 8: Other Central and East European Countries - Volume Indices (1989=100)

	1989	1990	1991	1992	1993
Gross Domestic Product					
Czech Republic	100.0	98.8	84.8	78.8	78.4
Slovakia	100.0	97.5	86.6	80.5	76.7
Bulgaria	100.0	88.2	68.0	62.4	58.7
Romania	100.0	91.6	79.7	67.7	68.3
Russia	100.0	98.0	85.4	68.8	59.9
Ukraine	100.0	97.4	86.5	73.5	61.8
Gross Investment					
Czech Republic	100.0	93.5	68.4	75.0	67.1
Slovakia	100.0	105.3	89.6	109.1	106.5
Bulgaria	100.0	81.5	65.3	64.3	59.2
Romania	100.0	61.7	45.8	45.3	44.9
Russia	100.0	100.1	83.9	46.2	39.3
Ukraine	100.0	101.9	96.5	57.9	44.6
GI/GDP					
Czech Republic	100.0	94.6	80.7	95.2	85.6
Slovakia	100.0	108.0	103.5	135.5	138.9
Bulgaria	100.0	92.4	96.0	103.0	100.9
Romania	100.0	67.4	57.5	66.9	65.7
Russia	100.0	102.1	98.2	67.2	65.6
Ukraine	100.0	104.6	111.6	78.8	72.2

Source: Poland: International Economic Report 1993/4, World Economy Research Institute, Warsaw School of Economics, 1994.

Table 9: Poland - Volume Indices (1989=100)

	1987	1988	1989	1990	1991	1992	1993
Gross Domestic Product	95.9	99.8	100.0	88.4	81.7	82.9	86.1
- industry	97.7	102.1	100.0	78.0	64.6	66.3	70.3
- construction	94.6	100.3	100.0	85.5	91.3	94.7	96.6
- agriculture	97.6	99.0	100.0	99.7	106.5	93.4	98.0
- transport	95.4	99.0	100.0	85.2	68.2	68.9	67.3
- commerce	89.3	95.5	100.0	100.7	108.7	108.5	121.5
Gross Fixed Investment	97.2	102.4	100.0	89.9	86.2	86.8	88.7
- industry	87.8	91.7	100.0	92.7	86.0	81.9	83.8
- construction	115.6	129.0	100.0	72.8	98.0	155.3	109.0
- agriculture	106.0	109.5	100.0	67.0	38.2	34.1	38.6
- transport	131.8	145.6	100.0	100.5	93.1	78.4	71.3
- commerce	82.2	85.2	100.0	97.7	111.5	151.5	185.9
GFI/GDP	101.4	102.6	100.0	101.7	105.5	104.6	103.1
- industry	89.9	89.8	100.0	118.8	133.1	123.5	119.1
- construction	122.2	128.7	100.0	85.2	107.4	163.9	112.9
- agriculture	108.7	110.6	100.0	67.2	35.8	36.6	39.4
- transport	138.1	147.1	100.0	118.0	136.5	113.8	106.0
- commerce	92.0	89.2	100.0	97.0	102.6	139.7	153.0
Gross fixed investment in machinery & equipment							
- total	99.1	105.5	100.0	90.2	82.3	94.3	110.1
- industry	83.3	89.5	100.0	102.8	92.2	96.4	101.5
- construction	125.5	139.1	100.0	66.4	67.9	133.8	109.0
- agriculture	107.6	113.2	100.0	61.2	23.4	15.7	18.4
- transport	147.3	155.1	100.0	64.1	67.3	54.8	60.8
- commerce	102.4	102.4	100.0	106.6	156.3	271.8	368.9
Gross fixed investment in machinery & equipment / GDP							
- total	103.4	105.7	100.0	102.0	100.7	113.6	127.9
- industry	85.3	87.6	100.0	131.8	142.6	145.4	144.4
- construction	132.6	138.8	100.0	77.6	74.4	141.2	112.9
- agriculture	110.3	114.4	100.0	61.4	21.9	16.8	18.8
- transport	154.3	156.7	100.0	75.2	98.7	79.5	90.4
- commerce	114.6	107.1	100.0	105.8	143.8	250.5	303.6
Gross fixed investment in buildings in industry	92.7	94.6	100.0	87.1	84.4	72.5	66.5
Gross fixed investment in buildings in industry/GDP in industry	94.9	92.6	100.0	111.7	130.6	109.3	94.6

Source: Rocznik Statystyczny. Główny Urząd Statystyczny, various issues.

Table 10: Hungary - Volume Indices (1989=100)

	1987	1988	1989	1990	1991	1992	1993	1994
Gross Domestic Product	99.39	99.31	100.00	96.46	84.98	82.40	81.70	83.34
- industry	103.59	102.01	100.00	92.32	75.81	70.75	73.86	
- construction	97.67	92.35	100.00	78.10	66.39	67.64	63.28	
- agriculture	93.79	101.21	100.00	95.32	87.49	72.98	68.06	
- transport	92.35	93.57	100.00	92.67	82.08	78.51	74.49	
- commerce	116.46	101.35	100.00	111.77	102.44	85.89	81.44	
Gross Fixed Investment	100.54	92.83	100.00	90.37	79.44	78.11	79.92	88.98
- industry	98.57	91.34	100.00	92.15	79.47	109.24	100.97	
- construction	79.17	81.53	100.00	103.14	122.50	109.53	113.36	
- agriculture	137.17	107.13	100.00	83.42	47.77	17.16	15.92	
- transport	105.67	104.64	100.00	91.27	96.02	133.59	158.49	
- commerce	76.69	72.02	100.00	106.69	110.44	135.21	115.02	
GFI / GDP	101.16	93.48	100.00	93.68	93.48	94.80	97.82	106.76
- industry	95.15	89.54	100.00	99.82	104.82	154.40	136.71	
- construction	81.05	88.29	100.00	132.05	184.53	161.94	179.14	
- agriculture	146.26	105.85	100.00	87.51	54.60	23.51	23.39	
- transport	114.41	111.83	100.00	98.48	116.99	170.15	212.78	
- commerce	65.85	71.05	100.00	95.46	107.82	157.41	141.24	
Gross fixed investment in machinery & equipment								
- total	102.34	93.98	100.00	93.20	79.97	101.75	102.97	121.90
- industry		88.26	100.00	94.58	78.23	144.19		
- construction		90.49	100.00	80.70	59.09	75.88		
- agriculture		105.15	100.00	87.55	52.53	14.98		
- transport		110.46	100.00	83.04	84.45	122.41		
- commerce		85.23	100.00	138.68	131.23	174.89		
Gross fixed investment in machinery & equipment / GDP								
- total	102.96	94.64	100.00	96.62	94.11	123.49	126.04	146.27
- industry		86.52	100.00	102.45	103.19	203.79		
- construction		97.99	100.00	103.32	89.01	112.19		
- agriculture		103.89	100.00	91.85	60.04	20.53		
- transport		118.05	100.00	89.60	102.89	155.92		
- commerce		84.09	100.00	124.07	128.11	203.60		

Sources:

1. Yearbook of Economic Statistics 1989-91, KSH Budapest;
2. National Accounts Hungary 1990-93, KSH Budapest;
3. Statistical Yearbook 1987, 1988, 1989, 1990, 1991, 1992, 1993, KSH Budapest;
4. National Bank of Hungary, Annual Report, 1990, 1991, 1992, 1993.