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Why Did Socialism Fail?
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ABSTRACT

We present revised growth accounts for three socialist economies between 1950 and 1989. Government statistics reported distorted measures for both the rate and trajectory of productivity growth in Czechoslovakia, Hungary, and Poland. Researchers have benefited from revised output data, but continued to use official statistics on capital input, or estimated capital stock from official investment data. Investment levels and rates of capital accumulations were, in fact, much lower than officially claimed and over-reporting worsened over time. Sluggish factor accumulation, specifically declining equipment investment and labor input, contributed much more to the socialist growth failure of the 1980s than previously thought.

Keywords: growth accounting, capital accumulation, Socialism, Eastern Europe

JEL classification: N14, N64, O47, P27

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Why have some countries forged ahead while others stayed poor or fell behind? The role of institutions has featured prominently in comparative studies of economic development. Eastern Europe after 1945 is a textbook case, where relative decline in income per head and productivity has been linked to institutional failure. The inefficiency of central planning compared to the market economy is well established both theoretically and empirically.[1] A core argument in the literature is that the socialist system was relatively successful in mobilizing resources but stifled innovation and creative entrepreneurship. Consequently, planned economies achieved 'a satisfactory productivity performance in the era of mass production, but could not adapt to the requirements of flexible production technology' (Broadberry and Klein 2011, p. 37). Effective in the phase of extensive growth, socialist economies slowed down abruptly as factor accumulation reached diminishing returns, culminating in their eventual collapse in the 1980s. While Eastern European countries, it was argued, maintained high rates of labor participation and very high levels of investment in physical capital, they became increasingly inefficient compared to western market economies in their use of production factors and intermediate inputs (Bergson 1987; Van Ark 1997).

This paper does not challenge the view that the planned economy was inefficient, but the above characterization of the socialist growth experience is out of date. The majority of previous studies found that the last decades of communism witnessed sharply diminishing (during the 1980s often even negative) rates of productivity growth. The inefficiency of the socialist system was manifested in a productivity failure. However, these results were biased by the inconsistent use of data on output and factor inputs. Researchers have benefited from substantially downward-revised estimates on the rate of economic growth, but they continued to use official data on capital formation, or estimated capital stock from official investment data. Under central planning, investment statistics are just as difficult to trust as output indicators. Recent revisions of national and cross-country data both indicate that socialist economies invested considerably less in physical capital than previously claimed. Likewise, official employment figures overstate labor expansion because they disregard the decline in average work hours. New evidence suggest a much larger role for factor inputs and a much smaller one for productivity in the relative decline of Eastern Europe than what traditional interpretations advocated and reveal fundamental differences in the experience of the Soviet Union and that of smaller socialist countries in this regard.

We construct new investment series for the aggregate economy in Czechoslovakia, Hungary, and Poland from 1950 to 1989 independent from official investment data and derive rates of capital accumulation from these revised estimates. We adjust employment totals for changes in average work hours as well as educational attainment in order to provide better measures for the growth of labor input. We then use our revised data on factor inputs to establish new growth accounts. With disaggregate data on value added and employment, we decompose aggregate labor-productivity growth into industry contributions and the effect of structural change.

[1] For summaries see Eichengreen (2007), Ch. 5 and 10, and Berend (1997).

Our main findings can be summed as follows. Weighted input growth in all three countries began to slow down in the 1960s and in Hungary and Poland turned negative after 1980. Labor-productivity growth remained respectable until the fall of communism. Structural change enhanced productivity during the 1950s and 1960s, most notably in Czechoslovakia. By contrast, during the 1980s, it made a negative contribution to aggregate labor-productivity growth. As in many other European economies, average rates of Total Factor Productivity (TFP) growth dropped considerably after the end of the Golden Age. Their continued decline, if any, in the 1980s was less dramatic and is largely explained by adverse structural shifts in employment. Productivity growth in East Central Europe was comparatively slow, but this was true for any sub-period of the socialist era, not only the 1980s. Centrally planned economies ran out of steam not so much because of diminishing rates of productivity growth but mainly because of inadequate factor accumulation.

Technological inefficiencies are partly to blame for the growth retardation of the 1980s, but focusing only on them provides an incomplete picture, since insufficient aggregate demand played a very important role, too. This was, in turn, the outcome of austerity policies that ignited public discontent and gradually undermined the economic legitimacy of communism. Two major exogenous shocks hit most Eastern European countries simultaneously. Firstly, rising raw-material prices made their industries less competitive because they applied energy-intensive technologies, while fuel imports suddenly became much more expensive. Secondly, refinancing their external debt, which had grown substantially during the 1970s, was more costly as western creditor nations raised interest rates to combat inflation at home. Within the prevailing geo-political constraints, the only feasible policy response to the looming balance-of-payments crises was to limit imports and drastically cut back on international borrowing. Consequently, even when GDP continued to grow, domestically disposable income stagnated or declined. As governments tried to allocate scarce resources to consumption and social overhead capital to satisfy popular demands, investment in equipment became the main victim of austerity. Low levels of machinery investment, in turn, constrained both technological modernization and employment creation. Labor input declined further as a result of shorter official workweeks and popular welfare measures that reduced female labor participation.

Our revised growth accounts bring the experience of East Central Europe after the post-war Golden Age closer to what the literature has described for Latin America and other developing regions in the period following their flirtation with import-substituting industrialization. By contrast, it differs fundamentally from the experience of the Soviet economy that was hampered by the wasteful allocation of the glut of investment mobilized by the boom in hydrocarbons. The crisis of East Central Europe in the 1980s was not an idiosyncratic phenomenon and did not result from the inefficiencies commonly attributed to the socialist economic system. This does not mean that either technological or allocative inefficiencies can be refuted; indeed there is plentiful evidence for their existence. But, they are not the sole reason for the loss of momentum in socialist economic growth after 1980; insufficient factor accumulation was equally important, if not more.

The paper is structured as follows. The following section reviews the existing literature and explains the motivation of our research. In the third section, we discuss the available data on output and factor inputs and describe the methodology that we use to estimate investment and capital stock. The fourth section reports our new estimates (see also Appendix 1). In the fifth section, we reconstruct the aggregate growth accounts of the three countries and discuss the role of structural change. The sixth section presents our view on the crisis of the 1980s, before we conclude. Robustness checks are reported in Appendix 2.

LITERATURE REVIEW

The theory of extensive growth reaches back to the Marxian model of extended reproduction. Grigory Feldman formalized this concept and argued that the rate of economic growth was limited by the capacities to produce capital goods, and thus growth could be accelerated by reinvesting industrial output in expanding these capacities (Feldman 1928, p. 312). Evgenii Preobrazhensky extended this argument by stressing the vital role of the state in accumulating the necessary resources for investment-led growth in a backward country with inadequate domestic savings and underdeveloped capital markets (Preobrazhensky 1926, p. 235). The concept of primary socialist accumulation was often used to justify state intervention in late-developing nations. In the words of Alexander Gerschenkron (1962), it 'provided for lacking prerequisites'.

Robert Allen (1988 and 2003) reinterpreted Soviet industrialization in the 1930s as 'Feldman and Preobrazhensky in action'. Centralized resource allocation in favor of heavy industry was achieved with the simultaneous application of output planning and soft budget constraints. Allen could draw inspiration from Ragnar Nurkse (1953), who developed an extended version of the Feldman model, according to which capital accumulation in less developed countries generated rapid growth through the reallocation of inefficiently employed farm labor into industry. High rates of investment yielded high rates of growth as long as this labor surplus was not absorbed. Common to these interpretations is that they did not define the role of technological progress and did not specifically acknowledge the limits of extensive growth. Economic theory has made good on both shortcomings. Branko Horvat (1964) was the first to introduce diminishing returns to the theory of socialist economic development by arguing that the capacity of each economy to absorb new capital was limited by the stock of complementary factors of production, especially labor.[2]

The falling behind of socialist economies from the late 1970s has often been blamed on the neglect of technological progress and inefficient investment (see Kalecki 1993). These factors were complemented by the relatively high and growing material intensity of production. State enterprises operating with soft budget constraints had the incentive to maximize their use of investment funds and intermediate inputs regardless of the potential returns on them. This evolved into a shortage economy, in which profit maximization was replaced by resource hunger that undermined

[2] The contemporary socialist literature saw capital accumulation and capital intensity as the main drivers of development, as in the Harrod-Domar model, and focused on the capital-output ratio rather than joint factor productivity (see Berend 1985).

productivity growth and innovation (Kornai 1992, pp. 140-45). Shortages emerging from inefficient allocation are also believed to have become more disruptive as planned economies modernized, meaning that they operated further and further below their production possibility frontier. Consequently, grey markets emerged to satisfy increasingly complex consumer demands and to reallocate intermediate inputs between firms (Banerjee and Spagat 1991). Comparative analyses of input-output data confirmed that, on average, the material intensity of production was higher in socialist countries than in western market economies and that this gap widened after the mid-1970s (Gomulka and Rostowski 1988).

Paul Krugman (1994) articulated perhaps most illustratively the predominant view on authoritarian growth. He proposed that growth under developmental dictatorships was unsustainable in the long run. Early success came from 'perspiration' (factor accumulation), followed by an inevitable slowdown because of the lack of 'inspiration' (innovation and the creativity of free enterprise). Krugman's characterization of the East Asian growth miracles as the product of neoclassical transition dynamics received support from quantitative research (see Mankiw 1995 and Young 1995, among others), but has since been convincingly refuted. Official statistics exaggerated the rate of capital accumulation; TFP actually made a very substantial contribution to aggregate growth in newly industrialized nations between 1960 and 1990 (Hsieh 2002).

By contrast, the notion of extensive growth continued to dominate our view on socialist economic development. Most research conducted on both the USSR and Central Europe reported high productivity growth for the 1950s and, in some cases, the 1960s, followed by considerable slowdown (Balassa and Bertrand 1970; Bergson 1987; Easterly and Fischer 1995; Ofer 1987; Ritschl 1996; Sleifer 2006; Van Ark 1997). For the Soviet economy, most studies found negative TFP growth during the late 1970s and 1980s. Josef Brada (1984) applied a frontier production function to examine Eastern European industrial performance between 1960 and 1985 and confirmed the declining rate of TFP growth, especially after 1980. He associated this trend with the deteriorating efficiency of factor utilization rather than regress in technical know-how.

However, this conventional story of productivity failure may be, at least in part, the product of statistical illusion. Official production and input figures indicated no such failure; instead constant or increasing rates of TFP growth, at least until the early 1980s.[3] Signs of a productivity meltdown emerged from subsequent research that benefited from downward-revised output data but that continued to use official statistics on factor accumulation or estimated capital stock from official investment data. Recent revisions suggest that investment levels in government statistics were inflated, which implies that official figures overstated the rate of capital accumulation, too, not only the rate of income growth. The last version of the *Penn World Tables* (PWT) to include all socialist countries reported investment ratios of close to or even above 30 percent across Eastern Europe in the 1970s and 1980s (Heston et al. 1995). Recent updates of the PWT data report dramatically lower investment rates. It now appears that East Central European countries invested much less than

[3] On the East German economy, see Ritschl (1996) p. 500, Table 16.1, Column 2. On Czechoslovak and Polish industry, see Rusek (1989) and Kemme (1987) respectively.

the faster growing Southern European periphery from the 1960s onward (see Feenstra et al. 2015). Soviet investment levels remained on a higher plateau but, according to the latest CIA (1990) estimates, surpassed the 30-percent mark only during the period of high oil prices in the 1980s.

These revisions suggest a considerable role for factor inputs in addition to productivity in the falling behind of socialist economies. Rather than recording modest growth rates despite very high levels of investment, countries in East Central Europe underperformed in comparison to faster growing western nations during the 1980s, at least partly, because they invested relatively smaller proportions of their national income in productive capital. This argument differs fundamentally from what we know about the relative decline of the Soviet economy in the same period.

DATA AND METHODOLOGY

Socialist data on national income must be treated with more than a modicum of suspicion. Official statistics on physical output indicators are considered comparatively trustworthy, but aggregates in value terms were distorted by unrealistic producer prices, incorrect weighting inasmuch as industry was assigned higher than actual shares in net material product, and inappropriate index-number methods.[4] Independent western research established alternative estimates based on standard national accounting and using official data only on physical output indicators in the construction of time series. The Research Project on National Income in East Central Europe under the leadership of Thad P Alton at Columbia University carried out the most substantial work. The Research Project reported GNP for several countries including Czechoslovakia, Hungary, and Poland that were later incorporated into the Maddison data.[5] The sources report GNP by sector of origin of product (Alton 1970; Alton et al. 1979a; Alton et al. 1991b; Czriják 1973; Holesovsky 1969; Lazarcik 1968).[6]

On factor inputs, our main contribution is to construct new series of investment and capital stock that can be considered more reliable than official statistics or existing scholarly estimates built on them. Socialist investment data are unreliable. Under fixed prices and allocations, capital-goods suppliers had an incentive to increase value added by degrading quality, either by changing product specifications or by shifting to less valuable inputs. Prices for new types of machinery were inflated by unsubstantiated claims of significant product innovation. The presence of concealed inflation in the investment statistics was extensively discussed in the Soviet context (see Nove 1981, Wiles 1982, Bergson 1987, and Kontorovich 1989, among others). Gross investment was also magnified by additional items, such as the training of personnel, R&D, and inventories, which were fabricated in order for the main components of national accounts to match. Inflated investment figures, in turn, yielded excessively high rates of capital accumulation.

[4] Net Material Product was the national accounting concept used by COMECON countries. It is conceptually similar to GDP, but excludes services deemed unproductive, especially housing and the government.
[5] For details on data sources see Maddison (2006), pp. 469-71.
[6] The disaggregated series are continuous for Czechoslovakia and Hungary. For Poland prior to 1965, data is only available for benchmark years with five-year intervals.

We determine capital stock using the perpetual-inventory method.[7] In principle, this approach builds up stocks of capital from flows of investment after discounting depreciation. In practice, since historical data on depreciation are scarce, capital stock is typically estimated with a shortcut method of time-series projections from independently established benchmarks. This usually means backward extrapolation from a modern benchmark for which reliable statistics are available.

$$K_t = K_{t+1} - I_t + R_t \quad [1]$$

The stock of fixed capital (K) in period *t* is derived from the capital stock of period *t+1* after subtracting investment (I) and adding capital retirement (R) made during period *t*. The same method can be applied to estimate recent levels from earlier benchmarks with forward projection. Capital retirement only accounts for assets entirely withdrawn from production. This method determines gross capital stock, meaning that the depreciation of asset value is not accounted for: all assets enter at their purchase value in the benchmark year. Since there are normally no specific data on capital retirement, it is estimated as a product of the capital stock in period *t* and the retirement rate *r*.

$$K_t = K_{t+1} - I_t + rK_t \quad [2]$$

We can rewrite the right-hand side of equation (2) in terms that have already been computed.

$$K_t = \frac{K_{t+1} - I_t}{1 - r} \quad [3]$$

We assume constant retirement rates of 2 percent for buildings and 4 percent for equipment, which imply average asset lifespans of 50 and 25 years respectively.[8] The German Institute of Economic Research (DIW) used these rates to determine the capital stock of both West and East German industry during the interwar and early postwar periods (Krengel 1958; Melzer 1980). According to DIW estimates, they correspond to the rates characteristic of the West German economy as a whole in the early 1950s, but are considerably lower than the rates that prevailed during the 1960s (see Kirner 1968, Table 24, p. 97). Since retirement rates rise with technological progress, constant rates can increasingly underestimate actual capital retirement and thereby overestimate the actual rate of capital accumulation. At the same time, there is ample evidence for the use of outdated machinery in socialist countries, suggesting that they had significantly lower retirement rates than what advanced market economies recorded in the early post-war era. The robustness checks in Table A2.1 in Appendix 2 show that the rates of capital accumulation are not very sensitive to alternative rates of capital retirement.

[7] Recent advances in estimating capital input used the concept of capitals services (Jorgenson 1989, 1990), which has been applied in historical research (e.g. Prados de la Escosura and Roses 2009, 2010). This requires data on the rental price of capital. For socialist economies, we cannot follow this approach. In addition, we do not believe that it would generate results radically diffrent from our computations. Capital-service flows allocate greater weight to the assets with rapidly falling prices or high rates of depriciation, typical features of IT and communication equipment which are prime examples of capital assets socialist countries adopted slowly and only in insignificant quantities.

[8] In reality, *r* is a non-linear function of the age of any specific type of asset, but to apply non-linear functions to the data requires investment series long enough to cover the lifespan of fixed assets in different industries. In the absence of such data, a constant retirement rate is assumed, which is the reciprocal of the average lifespan across all industries.

To apply the perpetual inventory approach, we need data on the benchmark values of capital stock and time series for machinery and construction investment expressed in the prices of the benchmark year. The former cannot be independently established. Thus, we must be cautious in selecting the most trustable official sources. These date from the years when Central European governments introduced major reforms of the economic system: 1967 in Czechoslovakia, 1968 in Hungary, and 1971 in Poland. A core task of these reforms was to systematically revise official prices. The comprehensive re-evaluation of all fixed assets in the socialist sector aimed at making producer prices better reflect factor costs, since enterprises were subsequently required to pay interest on the value of their assets and were allowed to write off depreciation.[9] These statistics contain the most reliable estimates for the stock of fixed capital during the entire socialist period and the relative prices of these benchmark years approximate most closely real factor costs.

We follow two strategies to construct the investment series. For the period from 1950 to 1965, the Research Project published independent estimates for investment in both equipment and structures that reflect the availability of investment goods and construction services (Bandor et al. 1970; Czirják 1968; Holesovsky 1969; Korbonski et al. 1973; Staller 1965a, 1965b). They measure investment in all buildings in the economy by gross output in construction that, in turn, is estimated by the volume of available construction materials. Equipment investment is approximated by the production of investment goods, both machinery and metal products, adjusted for net imports and disregarding year-to-year fluctuations in inventories. These estimates of actual investment levels are increasing upper-bound because the share of consumer durables in total engineering output increased over time. The literature argued that waste in construction materials also increased, due both to the growing complexity of input requirements and the long duration of building projects (Banerjee and Spagat 1991; Kalecki 1993).

Until the mid-1960s, the estimates can be deemed accurate, as the share of consumer durables in engineering output remained very small. This was true even for Austria, a more developed and more consumer-oriented economy relative to socialist countries.[10] For the period after 1967, the Research Project did not publish similar estimates, since they would have no longer measured the level and structure of investment accurately. Instead, it reported an index for domestically disposable income, decomposed into three major items of final use: personal consumption, government consumption (public administration and justice, education, health care, and social services), and a residual dominated by gross investment (Alton et al. 1991a; Alton et al. 1979b).[11] This residual still includes several sub-components of public spending, most notably national defense and R&D outside higher education and health care, and all statistical errors made in the aggregation of final-use components into gross product consumed domestically.

[9] For overviews of the reform process and the working of the New Economic Mechanism, see Staller (1968), Balassa (1970), Kýn (1970), Portes (1970), Hare and Wanless (1981), and Kornai (1987).
[10] Until the 1960s, very few private households owned modern appliances. See Seidel (2005), p. 57, Table 1.13.
[11] Gross product for domestic use is GDP adjusted for net imports and net foreign payments.

For the period after 1965, we derive index numbers for investment in fixed capital by further decomposing this residual.[12] Specifically, we construct index-number series for defense and R&D spending, and then subtract these from the index reported by the Research Project, weighting each sub-component by its share in total GDP.[13] Disaggregate data on research outlays are taken from official sources. Since these items never accounted for more than 1.5 percent of GDP, the accuracy of the data does not affect our capital-stock estimates significantly. The yearbooks of the Stockholm International Peace Research Institute (SIPRI) report total military expenditure, both in constant-price values and as percentages of GDP (SPRI, diff. vols.) In light of the controversy about Soviet budgetary figures on national defense, one could question the reliability of this evidence (see Epstein 1990, Davis 2002, and Harrison 2008 among others). However, previous research has shown official data on military spending in East Central Europe to be very accurate. Estimates constructed using wage and living-cost data for personnel expenses and input-output as well as trade statistics to determine material costs came close to budgetary figures (Crane 1988).[14] The lack of transparency in government accounts on defense expenditure was much more serious in the Soviet Union than in the smaller Warsaw Pact countries (Clements 1985; Wiles 1987).

Finally, we construct index numbers for equipment investment by subtracting the construction index (Alton et al. 1979a; Alton et al. 1991b), weighted by the share of total construction in GDP, from the index of fixed-capital investment that we have established. In the aggregate economy, the gross value of construction service must equal total investment in buildings even in the post-1965 period, notwithstanding material waste. The index-number series that we constructed for the period after 1965 are then linked to the level estimates of the Research Project for the period 1950-1967.[15]

Employment data are obtained from official publications.[16] In the absence of comprehensive government statistics on labour hours outside industry, we follow a shortcut method to adjust total employment for changes in average hours worked. If the number of extra hours employees were required to work did not change dramatically over time, then, for the economy as a whole, the official workweek is a good indication of actual labour hours. We have exact figures on total hours worked in Hungary after 1980, which confirm the accuracy of our approach.[17] Legislation on the official workweek and its implementation are well documented. In addition, for Czechoslovakia and Poland, we assume that in 1989 at least 5 percent of official labour hours were lost due to the extensive strikes. To adjust labour input for returns to educations, we use the most recent Barro-Lee data on the average years of schooling by the adult working-age population.[18]

[12] To follow this approach, we have to assume that aggregation errors were random and that the relative size of inventories did not change over time, since we cannot establish these items independently.
[13] We adjust for the difference between GDP and gross product available for domestic use based on detailed benchmark statistics from Alton et al. (1979b) for 1975 and 1976, upon which the index for final-use components was constructed.
[14] These estimates are similar to the data collected in Alton et al. (1985).
[15] Estimates for a few missing years in the late 1960s were constructed by interpolation from adjacent years. Investment levels are converted into benchmark-year prices using official price series for machinery and construction investment.
[16] Employment statistics are generaly considered uncontroversial. See Adam (1985), among others.
[17] See *The Conference Board Total Economy Database* (http://www.conference-board.org/data/economydatabase/).
[18] See Barro and Lee (2013) and the data available at http://barrolee.com/.

INVESTMENT AND CAPITAL ACCUMULATION

We report annual estimates for equipment and construction investment as well as the stock of fixed capital, both machinery and buildings, in Appendix 1. In this section, we describe the general trends. In both Czechoslovakia and Hungary, investment levels recovered rapidly after World War II and, following a temporary setback in the early to mid-1950s, continued to increase steadily until 1967. Thereafter, the two countries began to diverge. The share of equipment investment in gross capital formation increased further in Czechoslovakia until the late 1970s. In Hungary, investment in new machinery declined from 1968 and during the 1980s fell below the levels that were achieved already during the 1950s. Construction also began to decline after 1979 but remained at a much higher level relative to earlier periods than equipment investment. In Czechoslovakia, building activity stabilized after 1978, while machinery investment first plummeted in the early 1980s and then recovered somewhat after 1986. Over the last two decades of communism, investment in fixed capital focused much more strongly on machinery in Czechoslovakia than in Hungary, but during the 1980s the share of equipment investment fell considerably in both countries.

In aggregate terms, the rate of capital accumulation was remarkably similar in the two economies until the late 1970s. Between 1950 and 1980, the stock of fixed capital nearly tripled. Thereafter, the composition of the Hungarian capital stock shifted towards structures. By contrast, in Czechoslovakia, the share of machinery continued to increase. This is not surprising given the difference between the two countries in structural development that we will discuss in the following section. The contribution of the most equipment-intensive sectors of the economy, industry in particular, to GDP was proportionally much larger in Czechoslovakia and continued to increase moderately even in the 1970s and 1980s, when it was already declining in Hungary.

Poland was a markedly different case. In the immediate post-war years, investment was very low, so that the stock of fixed capital actually declined until 1951. Investment growth resumed thereafter, but remained modest until the mid-1960s. Slow capital accumulation in this period reflected the unique factor proportions the Polish economy was endowed with after World War II. Due to the colossal wartime casualties and the expulsion of ethnic Germans from the former eastern provinces of Prussia, the population of the country declined by 20 percent between 1939 and 1947. It was not before 1963 that Poland recovered from this demographic shock. Consequently, the Polish economy faced labor shortage in the 1950s and thus could grow into existing production capacities that were temporarily underutilized. In late 1960s and early 1970s, investment growth became explosive, first in construction and later in machinery, but this acceleration proved short lived. Compared to the two other countries, the rate of capital accumulation in Poland was very high during the 1970s, but relatively modest after 1980.

Figure 1 plots our new estimates for investment in equipment and structures for Czechoslovakia. Total investment is compared with official figures. For the period until the mid-1960s, government statistics seem to have underestimated investment in the Czechoslovak economy, but the two alternative series do not differ significantly in the rate of investment growth. By contrast, official data massively overstate the growth of investment during the late 1970s and

thus also investment levels in the 1980s. Investment at best stagnated, and most likely declined from the mid-1970s. The diagram also confirms that both the initial fall and the ensuing recovery in investment levels during the 1980s were entirely driven by machinery investment.

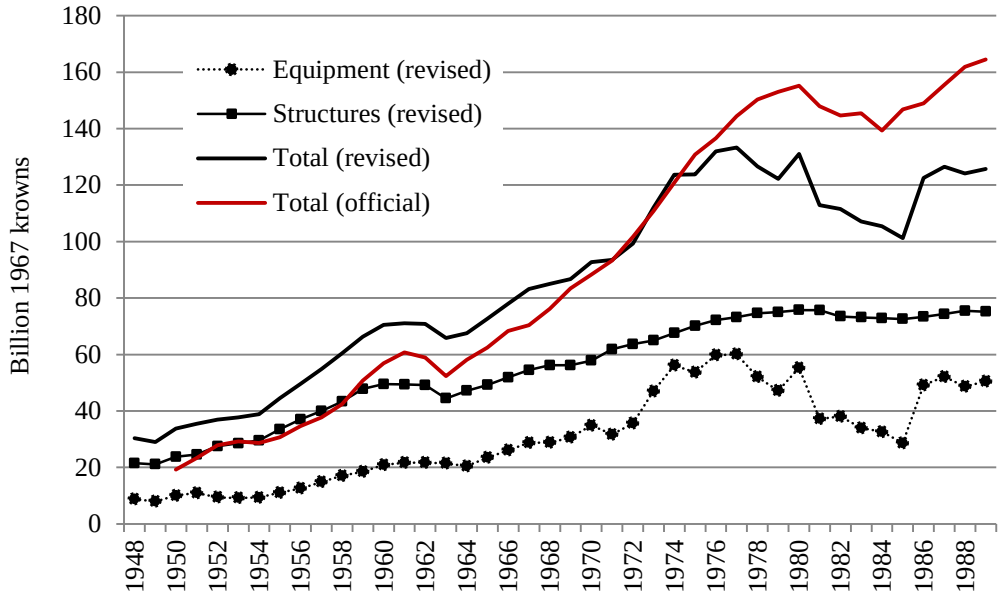

FIGURE 1
ALTERNATIVE ESTIMATES FOR INVESTMENT IN CZECHOSLOVAKIA, 1948-1989

Note: Official statistics on gross investment in fixed capital do not distinguish between types of investment.
Sources: Revised estimates are from Table A1.1 in the appendix. Official statistics are from *Historická statistická ročenka ČSSR*, Tables 8-1 and 8-2, p. 169, *Statistická ročenka Československé socialistické republiky 1986*, Table 8-1, p. 205, and *Statistická ročenka České a Slovenské federatívni republiky 1990*, Table 8-1, p. 220.

For Hungary, government sources allow us to compare official and revised estimates not only for total investment but also for construction and equipment investment separately. Notwithstanding year-to-year fluctuations, our revisions are very close to the official figures until the early 1960s. For the period after 1965, government statistics grossly overstate both construction and machinery investment. As in Czechoslovakia, the main distortion comes from the overestimation of investment growth during the 1970s. However, Hungarian statisticians over-reported investment to a far greater extent than their counterparts in Prague, levels of equipment investment being the most dramatically inflated. According to official data, investment in machinery and buildings grew at similar rates until the late 1970s and their rate of decline was also comparable after 1980. In reality, equipment investment began to fall in the late 1960s, while construction continued to grow for another decade. Investment growth over the last two decades of communism was much less remarkable than officially claimed and was entirely driven by increasing outlays for building projects.

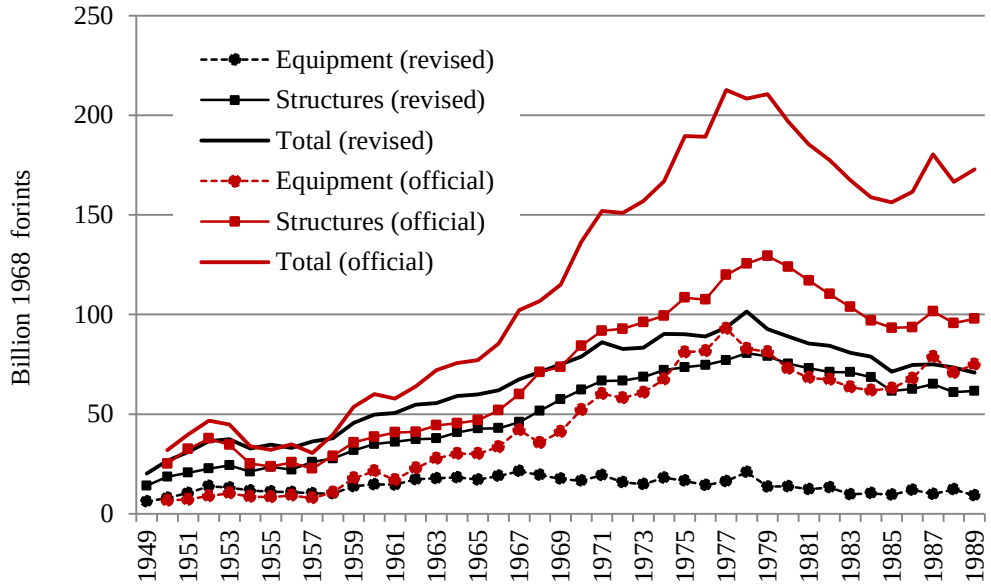

FIGURE 2
ALTERNATIVE ESTIMATES FOR INVESTMENT IN HUNGARY, 1949-1989

Sources: Revised estimates are from Table A1.2 in the appendix. Official data, incl. investment prices, are from KSH, *Beruházási adattár 1950-1977*, p. 32 and KSH, *Beruházási évkönyv 1989*, pp. 13-14.

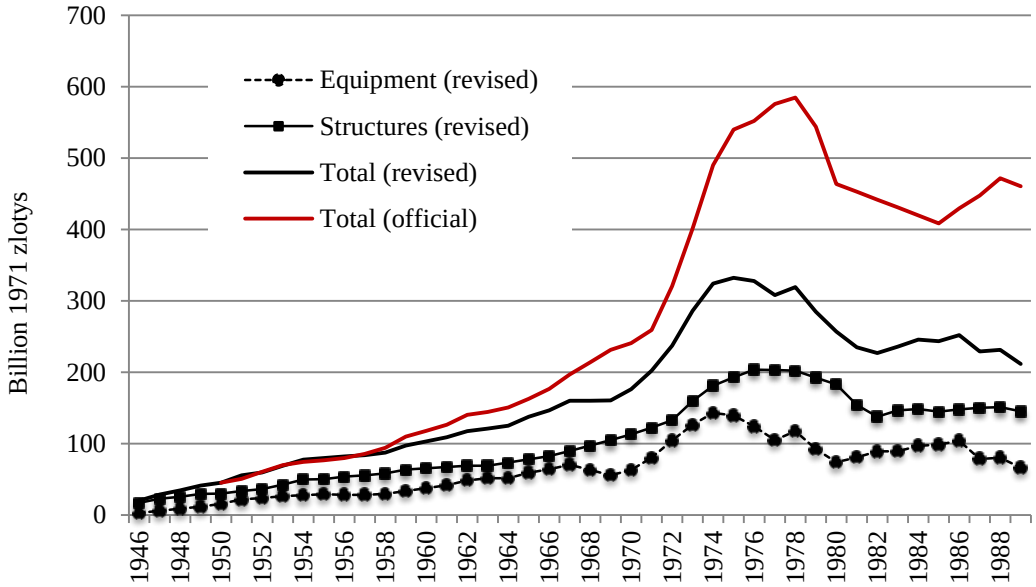

FIGURE 3
ALTERNATIVE ESTIMATES FOR INVESTMENT IN IN POLAND, 1946-1989

Note: Official statistics on gross investment in fixed capital do not distinguish between types of investment.
Sources: Revised estimates from Table A1.3 in the appendix. The official index is calculated from *Rocznik Statystyczny 1995*, Table I, p. 68, and converted into 1971 prices using data from *Rocznik Statystyczny 1968*, Table I, p. 98.

As shown in Figure 3 above, the difference between the official data and our new estimates is as large for Poland as for Hungary. In aggregate terms, we show steady increase in investment levels until 1967, a strong surge thereafter until 1975, and sharp reduction in the early 1980s. The period of the oil shocks saw capital formation in the Polish economy decline by a third. Until the

early 1970s, investment in machinery and buildings grew in tandem. Thereafter, while equipment investment started to fall in 1975, construction only began to decline in 1979. The final collapse of investment levels after 1985 was entirely driven by equipment investment. Official figures report faster investment growth already in the 1960s, but, as in the other two countries, growth rates were overstated the most for the 1970s. The apparent recovery of investment levels after 1985 is pure statistical fabrication.

Two core findings stand out from the investment record of all three economies. First, investment levels during the 1980s were much lower than what official data had suggested and what researchers using these data believed. Second, capital accumulation slowed down in the last decade of communism mainly, or exclusively, because of the sharp decline in machinery investment.

REVISED GROWTH ACCOUNTS

Table 1 reports average growth rates of national income and factor inputs according to alternative sources and specifications. Aforementioned previous research has already established substantially downward-revised estimates for output growth. Official sources reported rapid growth until the late 1970s, followed by a sudden and sharp slowdown. In fact, socialist economies ran out of steam more gradually from the late 1960s onward. They were falling behind successful modernizers in both Southern Europe and East Asia throughout the socialist period, not only or especially after 1980. In other words, the extent to which government statistics overstated the rate of economic growth was drastically reduced during the 1980s. We observe the opposite pattern in the capital-stock data. Our estimates show that official sources overstated the rate of capital accumulation throughout the entire period, but the margin of error was much larger for the 1980s (in Hungary also the 1970s) than for the 1950s and 1960s. This finding already suggests that previous research on the relative decline of socialist economies may have been seriously mislead by faulty statistics.

Polish official data were inaccurate even in comparison with the accounts of other socialist governments. Economic growth was much slower than the authorities had claimed, but the rate of capital accumulation was overstated even more. Price distortions are mainly to blame for the vast margin of error in the 1980s, the period of hyperinflation. Polish statistics on capital stock do not allow us to construct growth rates for the 1950s, meaning that our new estimates not only improve on the existing evidence but also extend it. The common feature in the data for all three countries is that capital accumulation, according to our estimates, accelerated at least until the mid-1970s, but the economic slowdown after 1980 correlated with sharply reduced rates of net capital formation.

This is not the end of the story! The growth of labor input is not measured precisely by total employment. Especially in the 1970s and 1980s, when most legislation on the reduction of weekly work hours was passed, the actual number of hours worked grew far slower than employment. In Czechoslovakia, the official workweek was already shortened in the late 1950s and again a decade later. In addition, by the end of the 1980s, extensive strikes reduced actual labor input considerably in both Czechoslovakia and Poland. We made the rather conservative assumption that this effect cost only 5 percent of total hours in both countries in 1989. The adjusted growth rates show only

modest labor expansion in Czechoslovakia between 1950 and 1970 and practically none after 1980. In both Hungary and Poland, we can observe sharp reduction in labor input during the 1980s. This contraction did not only result from declining hours; total employment fell, too, mainly because of decreasing female participation following the introduction of popular welfare measures, including generous maternity benefit schemes.

TABLE 1
ANNUAL AVERAGE GROWTH RATES OF NATIONAL INCOME AND FACTOR INPUTS (LOG %)

	1950s	1960s	1970s	1980s
		Czechoslovakia		
Net Material Product	7.3	5.5	4.5	1.9
Gross Domestic Product	4.6	3.1	2.5	1.3
Fixed capital (official)	3.4	3.8	4.2	4.3
Fixed capital (revised)	2.8	3.7	3.9	2.2
Total employment	0.9	1.2	0.7	0.7
Total hours worked	0.5	0.5	0.4	0.2
		Hungary		
Net Material Product	5.7	5.3	4.4	1.1
Gross Domestic Product	4.5	4.1	2.4	0.9
Fixed capital (official)	3.5	4.2	5.5	3.9
Fixed capital (revised)	2.6	3.8	3.8	1.9
Total employment	1.4	0.5	0.2	-0.5
Total hours worked	1.4	0.1	-0.2	-1.6
		Poland		
Net Material Product	7.3	7.3	5.3	1.0
Gross Domestic Product	4.5	4.2	3.5	0.6
Fixed capital (official)		4.1	6.1	6.4
Fixed capital (revised)	0.7	2.2	4.2	1.7
Total employment	1.9	2.1	1.3	-0.3
Total hours worked	1.9	2.1	0.9	-1.6

Sources: GDP from Maddison (2006); NMP, capital stock (official) and employment from statistical yearbooks; capital stock (revised) from Tables A1.1-A1.3 in the appendix. Total hours worked is employment adjusted for changes in official weekly work hours.

We apply the standard growth accounting framework developed by Robert Solow (1957), which assumes a Cobb-Douglas production function with constant returns to scale and constant elasticity of substitution (CES) equal to one between capital and labor.

$$Y_t = A_t(K_t)^{\alpha}(L_t)^{1-\alpha} \qquad [5]$$

Value added *Y* in period *t* is the function of the available capital stock (K), the size of the labor input (L) and Total Factor Productivity (A). The coefficients α and $1\text{-}\alpha$ denote the elasticity of

output with respect to capital and labor. In a dynamic framework, output growth can arise either from the expansion of factor inputs or from TFP growth.

$$\Delta lnY = \alpha \Delta lnK + (1 - \alpha)\Delta lnL + \Delta lnA \quad [6]$$

The terms α and *1-*α stand for the respective shares of capital and labor in gross value added. Equation (6) can be rewritten to express TFP growth as the proportion of labor-productivity growth unexplained by capital deepening (the increase of the capital-labor ratio). This formula is more appropriate to assessing the roles of extensive versus intensive growth under central planning.

$$\Delta lnA = \Delta ln(Y/L) - \alpha[\Delta ln(K/L)] \quad [7]$$

Growth accounts most commonly use the value of 1/3 for α, a reasonable approximation of the share of capital in national income in advance market economies. However, it has been argued that a higher capital share is more realistic for socialist command economies (Easterly and Fischer 1995).[19] Following this literature, we assume a constant α of 0.4 in our analysis. In theory, since production factors are paid their marginal products, factor shares can be computed from data on factor prices, but true factor costs are difficult to determine for centrally planned economies. For this reason we report robustness checks using both upper- and lower-bound plausible factor shares in Appendix 2, Table A2.2.

Martin Weitzman (1970) proposed that socialist economies were better represented by a production function with CES below one. William Easterly and Stanley Fischer (1995) argued the same for the Soviet Union, and Antonin Rusek (1989) for Czechoslovakia. However, we agree with Allen's (2003) rebuttal, supported by Crafts (2009), that the technological possibilities available to planned and market economies did not differ profoundly enough to validate the assumption of radically different underlying production functions. To the extent that Weitzman was correct, the approach we prefer underestimates the contribution of TFP to economic growth, especially towards the end of the socialist period. Since unit CES does not fully account for diminishing returns to capital, it may overstate the contribution of capital deepening to labor-productivity growth. This confirms further that our estimates for the rate of TFP growth are, if anything, lower bound.

In our revised growth accounts, we adjust labor quality for returns to education. The extended Solow model that includes education as a labor-augmenting factor was first developed by Edward Denison (1962), but we follow the specification proposed by Robert Hall and Charles Jones (1999).

$$Y_t = A_t(K_t)^{\alpha}(H_t)^{1-\alpha} \quad [8]$$

Human capital-augmented labor (H) is defined as the product of labor input and the efficiency of labor with *E* years of schooling relative to the efficiency with no schooling. The derivative $\phi'(E)$ is the actual return to education and is estimated in a Mincerian wage regression.

[19] Higher capital shares were also used for developing countries as in Benhabib and Spiegel (1994).

$$H_t = e^{\phi(E_t)} L_t \qquad [9]$$

Hall and Jones (1999) take the rate of return to be piecewise linear, 13.4 percent for each of the first four years of education, 10.1 percent for each of the next four years, and 6.8 percent per year after the eighth year of schooling (the underlying estimates come from Psacharopoulos 1994). Previous research using the wage grid of socialist economies computed substantially lower returns to education, but these findings are biased by strong wage compression applied by central planners (Münich et al. 2005; Jolliffe and Campos 2005). Low rates, thus, reflect not so much the poor efficiency derived from education, but the low rewards that socialist governments offered for these efficiency gains. To the extent that the true returns to education in socialist economies were smaller than the global average rates, our refined estimates of TFP growth can also be considered lower bound. Letting *h* denote human capital per worker (H/L), TFP growth is computed as the residual of labor-productivity growth after subtracting the contributions of capital deepening and education.

$$\Delta lnA = \Delta ln(Y/L) - \alpha[\Delta ln(K/L)] - (1-\alpha)\Delta lnh \qquad [10]$$

We present the growth accounts constructed with official data on factor inputs in Table 2. Government statistics reported remarkably high labor-productivity growth until the 1970s and a sharp slowdown after 1980. Capital intensity seems to have increased not only rapidly but also at increasing rates, at least until the late 1970s. Thus, capital deepening is believed to have contributed strongly to labor-productivity growth throughout the socialist period. TFP growth rates calculated from official data appear to have been high, albeit gradually decreasing, until the 1970s. By contrast, all three economies seem to have experienced sharply worsening productivity after 1980. The revised GDP estimates did not change this characterization of the Central European growth record profoundly. It made socialist economic development look even more capital intensive. Productivity growth ran out of steam after 1970; TFP first stagnated, and then declined. Based on existing data, Poland represents the most extreme case of productivity failure. According to official statistics, capital intensity increased rapidly in both the 1970s and the 1980s. The annual rate of labor-productivity growth fell like a rock after 1980. TFP growth slowed down alarmingly fast, and productivity declined by almost 2 percent per year during the 1980s. Although the other two countries seem to have performed better, productive efficiency also appears to have worsened in Czechoslovakia and Hungary.

Our revised growth accounts paint a different picture (see Table 3). Previous studies that used official data on factor inputs and made no adjustments for work hours thus underestimated labor-productivity growth from the 1960s onward, and overestimated capital deepening. As in many other regions of Europe, the growth of labor productivity and TFP slowed down after the post-war golden age in both Czechoslovakia and Hungary. However, we obtain higher rates of TFP growth for both economies than what the previously available data suggested. The upward revision of productivity growth is most notable after 1970, especially for the 1980s. TFP growth during the 1980s even improved in Hungary and Poland, although the growth rates were significantly lower than before.

Indeed, Hungary maintained respectable rates of labor productivity growth until the fall of communism, and while TFP growth slowed down after the golden age, it did not decline further between the 1970s and the 1980s. Czechoslovakia appears to have performed more poorly in terms of productivity growth after 1980, which might reflect more efficient labor use in Hungary, where employment and work hours fell more sharply. These results do not imply that the socialist economies performed better in comparison with their western neighbors, as we will demonstrate shortly. However, they have important implications for our understanding of the slowdown of socialist economies during the 1980s and of the economic causes behind the failure of socialism.

TABLE 2
GROWTH ACCOUNTS USING OFFICIAL DATA ON FACTOR INPUTS (LOG %)

	1950s	1960s	1970s	1980s
		Czechoslovakia		
NMP per worker	6.4	4.3	3.8	1.2
GDP per worker	3.7	1.9	1.9	0.6
Capital intensity	2.5	2.7	3.5	3.6
Capital deepening	1.0	1.1	1.4	1.5
TFP (NMP)	5.4	3.2	2.4	-0.3
TFP (GDP)	2.7	0.8	0.5	-0.9
		Hungary		
NMP per worker	4.3	4.8	4.2	1.6
GDP per worker	3.1	3.6	2.1	1.4
Capital intensity	2.1	3.7	5.3	4.4
Capital deepening	0.8	1.5	2.1	1.8
TFP (NMP)	3.5	3.3	2.1	-0.2
TFP (GDP)	2.3	2.1	0.0	-0.4
		Poland		
NMP per worker	5.4	5.3	4.0	1.3
GDP per worker	2.6	2.1	2.2	0.9
Capital intensity		2.0	4.8	6.7
Capital deepening		0.8	1.9	2.7
TFP (NMP)		4.5	2.1	-1.4
TFP (GDP)		1.3	0.3	-1.8

Note: Capital intensity is the stock of fixed capital per employee. Capital deepening is the weighted contribution of the growth of capital intensity to labor-productivity growth. NMP refers to the official data, GDP to the estimates provided by the Research Project.
Source: Table 1.

The development of the Polish economy represents a unique case. In total contradiction with the standard models of socialist industrialization, its growth in the early postwar period was driven entirely by labor expansion, not capital deepening. In fact, capital intensity was markedly reduced during the 1950s and then stagnated until the late 1960s. This is *prima facie* evidence for increasing

capacity utilization and for the existence of a vast capital surplus in the early days of communism. After the end of the war and the expulsion of ethnic Germans from the country, the most pressing challenge for Polish governments was not how to accelerate capital accumulation, but how to make use of the existing production capacities. Thus, there was little need for additional investment, which explains why the capital stock expanded so little before the late 1960s. With less investment in new equipment, labor-productivity growth was modest relative to other socialist countries. Thanks to the investment boom of the early 1970s and the sharp contraction of labor input during the 1980s, labor-productivity growth became more and more investment-driven. Still, TFP growth remained positive, and slowed down gradually from the 1960s, not abruptly after 1980.

TABLE 3
GROWTH ACCOUNTS USING REVISED DATA ON FACTOR INPUTS (LOG %)

	1950s	1960s	1970s	1980s
		Czechoslovakia		
GDP per work hour	4.1	2.6	2.1	1.1
Capital intensity	2.3	3.1	3.5	2.1
Capital deepening	0.9	1.3	1.4	0.8
TFP I	3.2	1.3	0.7	0.3
Education	0.3	0.3	0.3	0.3
TFP II	2.9	1.0	0.4	0.0
		Hungary		
GDP per work hour	3.1	4.0	2.6	2.5
Capital intensity	1.2	3.7	4.0	3.5
Capital deepening	0.5	1.5	1.6	1.4
TFP I	2.6	2.5	1.0	1.1
Education	0.2	0.4	0.4	0.0
TFP II	2.4	2.1	0.6	1.1
		Poland		
GDP per work hour	2.6	2.1	2.6	2.2
Capital intensity	-1.2	0.2	3.3	3.3
Capital deepening	-0.5	0.1	1.3	1.3
TFP I	3.1	2.0	1.3	0.9
Education	0.5	0.8	0.4	0.4
TFP II	2.6	1.2	0.9	0.5

Notes: TFP (I) and TFP (II) are the residuals of growth accounts not accounting and accounting for educational attainment respectively. Human capital deepening is the weighted contribution of average improvement in educational attainment to aggregate labor-productivity growth.
Sources: Table 1; average educational attainment from http://barrolee.com/.

Growth into existing capacities also has a role in explaining fast TFP growth in the Czechoslovak economy during the 1950s. Due mainly to the expulsion of ethnic Germans, the steep population decline after 1945 left Czech industry with surplus capital. Subsequent investment was

used to adopt more capital-intensive production technology (which had its beginnings in the interwar years) and to substitute capital for labor in agriculture, which released a quarter of its workforce in the late 1950s. The reallocation of farm workers into industry, in turn, erased surplus capacity in manufacturing. The failure of the Polish economy to replicate this process was most likely the consequence of an initially weaker industrial base and the failed attempts at collectivizing the farming sector.

Our main quantitative findings hold, at large, when we adjust for returns to schooling. Improvements in education and vocational training are among the least doubted achievements of socialism. Although the neglect of teaching quality has often been stressed in the literature, educational standards clearly increased, especially in primary schooling and technical education. However, since the growth of educational attainment was rather smooth over the socialist period in all three countries, accounting for labor quality does not alter the trajectory of productivity growth; except for Poland in the 1960s and Hungary in the 1980s. As Poland was recovering from the demographic shock of the 1940s, the best educated young cohorts born after 1945 and entering the labor force in the late 1960s made up a relatively large share of the total working age population. Demographics were also responsible for the slow growth of labor qualifications in Hungary after 1980. As population growth began to slow considerably in the late 1960s, the youngest cohorts of the labor force in the 1980s carried less weight in average attainment levels than the oldest workers, whose schooling had been disrupted during the war and the immediate post-war years.

TABLE 4
COMPARATIVE ANNUAL RATES OF PRODUCTIVITY GROWTH IN CENTRAL EUROPE (LOG %)

	1950s	1960s	1970s	1980s
			Labor productivity	
West Germany	6.6	5.2	3.7	2.6
Austria	4.4	4.9	2.9	2.3
Czechoslovakia	4.1	2.6	2.1	1.1
Hungary	3.1	4.0	2.6	2.5
Poland	2.6	2.1	2.6	2.2
			TFP	
West Germany	5.5	3.0	2.4	1.6
Austria	3.6	3.1	1.6	1.0
Czechoslovakia	3.2	1.3	0.7	0.3
Hungary	2.6	2.5	1.0	1.1
Poland	3.1	2.0	1.3	0.9

Notes: Labor productivity is GDP per work hour. TFP is the growth accounting residual unadjusted for educational attainment. Capital shares are 0.3 for western market economies and 0.4 for socialist countries.
Sources: Table 1. For West Germany and Austria, GDP data are from TED (https://www.conference-board.org/data), data on capital and labor input from DIW and WIFO (diff. publications).

Two important conclusions emerge from the comparison of our growth accounts with existing data for western market economies. First, as shown in Table 4, East Central Europe was falling behind its western neighbors, Austria and West Germany, in both labor productivity and TFP throughout the socialist period, not only and not even most visibly in the late 1970s and the 1980s. If anything, the countries East of the Iron Curtain, especially Poland, recorded comparatively faster productivity growth after the golden age. The productivity performance of socialist countries was already mediocre in the phase of extensive growth that dominated the early post-war decades. Second, while productivity growth in Czechoslovakia, Hungary, and Poland was comparatively modest, it never came to a standstill, and thus it cannot explain on its own the sudden collapse of socialism in Central Europe in the late 1980s. Especially because the country that performed best in terms of aggregate growth after 1980, Czechoslovakia, recorded the lowest rates of productivity growth among the three economies.

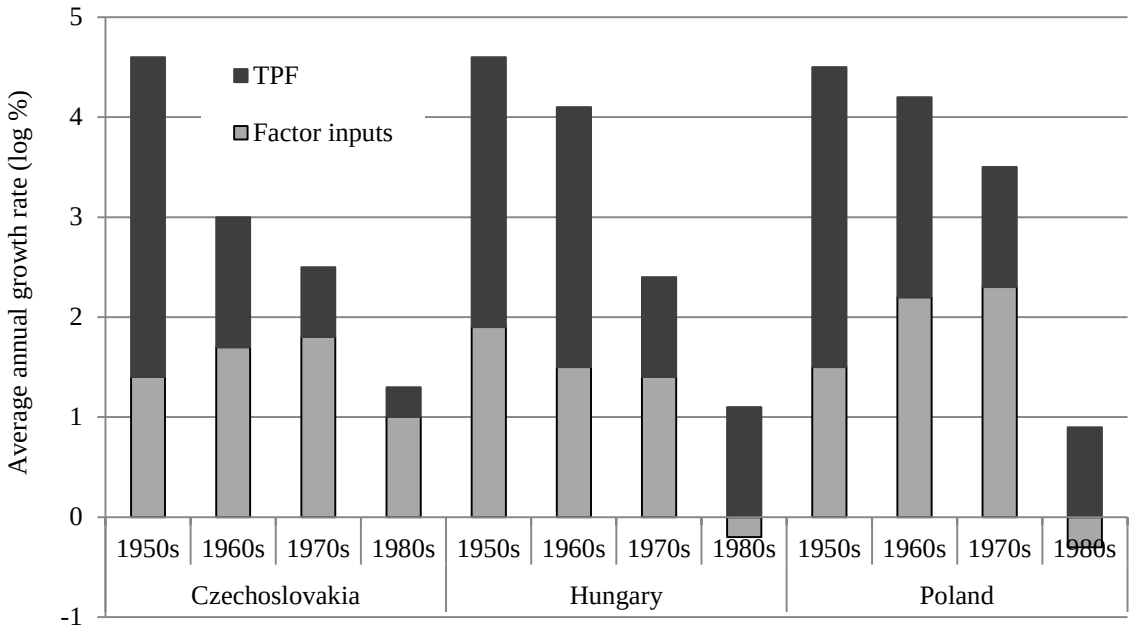

FIGURE 4
THE PROXIMATE SOURCES OF GROWTH IN EAST CENTRAL EUROPE, 1950-1989

Sources and methods: Rates of factor accumulation and GDP growth from Table 1. $\Delta lnTFP = \Delta lnGDP - \Delta lnTFI$ (total weighted factor input). Factor shares are 0.4 for capital and 0.6 for labor (see TFP I in Table 3).

Figure 4 summarizes the core results. As in many other regions of post-war Europe, the gradual slowdown of economic expansion in the postwar period reflected declining rates of productivity growth.[20] However, the socialist growth failure of the 1980s was mainly or exclusively input driven. This conclusion becomes even stronger, if we account for the structural components of aggregate labor-productivity growth. Given the emphasis that the literature on planned economies placed on labor reallocation between agriculture and industry, our study of the socialist growth record cannot be complete without the assessment of structural development.

[20] For comparisons, see Crafts and Toniolo (1996, 2010), Maddison (1997), and Toniolo (1998) among others.

Table 5 reports the share of six major sectors of the economy in gross value added in constant prices. The share of industry in GDP ceased to increase in the 1970s, but deindustrialization after the oil shocks was not as dramatic as in western market economies. Structural modernization dominated the 1950s and 1960s, but not the next two decades. In Hungary, the relative decline of agriculture came to a halt already in the 1970s, and after 1980 the importance of the farming sector increased in all three countries. The argument that central planning was not flexible enough to make a successful transition from an industrial to a more service-based economy also needs to be more nuanced. Modern services actually made a great leap forward during the 1970s, but contracted more than any other sector in the 1980s, most drastically in Poland. By contrast, the relative decline of government services was reversed after 1980. As we will explain, this reversal in the structural development of socialist economies was a response to exogenous aggregate demand shocks.

TABLE 5
GDP BY SECTOR OF ORIGIN OF PRODUCT (% SHARE)

	1950	1960	1970	1980	1989
			Czechoslovakia		
Agriculture	32.4	23.6	17.7	16.3	17.0
Industry	24.5	32.2	37.5	39.8	40.0
Construction	6.6	9.4	8.7	8.6	7.6
Transport and communications	4.0	7.2	7.7	8.2	8.3
Trade	5.5	6.3	7.9	8.5	8.7
Non-material services	27.0	21.3	20.5	18.4	18.4
			Hungary		
Agriculture	36.6	30.0	23.2	23.4	24.3
Industry	20.5	28.1	33.4	32.7	32.4
Construction	4.5	5.8	7.5	7.0	5.3
Transport and communications	5.1	7.8	8.3	9.0	8.2
Trade	3.4	4.3	6.1	7.0	7.0
Non-material services	29.8	23.9	21.7	20.9	22.8
			Poland		
Agriculture	50.5	42.4	32.3	24.1	28.9
Industry	14.5	23.1	30.7	33.7	29.1
Construction	2.5	4.5	5.5	6.6	5.0
Transport and communications	3.2	4.3	5.7	9.2	8.3
Trade	3.7	4.3	5.2	6.5	6.5
Non-material services	25.5	21.3	20.6	19.9	22.3

Notes: Agriculture includes farming, fishing and forestry. Industry includes mining, manufacturing and electrical power. Trade includes both wholesale and retail. Non-material services include water and gas utilities, government services, catering, and personal services. All shares are expressed in 1976/77 prices.
Sources: Own calculations from Alton (1970), Alton et al (1991b), Alton et al. (1979a), Czirják (1973), Holesovsky (1968), and Lazarcik (1969).

Disaggregated growth accounts make frequent use of decomposition techniques to exploit the richness of data in order to better understand the aggregate growth processes. The specification we follow has been proposed by Marcel Timmer and associates.[21] The growth of aggregate value added (Y) over period *t* is defined as the Törnqvist-weighted growth of industry-specific value added (Z) in all industries *j*. The industry weights represent the period-average shares of each industry in aggregate value added.

$$\Delta lnY_t = \sum_j \bar{v}^Y_{Z,jt} \Delta lnZ_{jt} \qquad [11]$$

Labor-productivity growth in industry *j* is computed as the growth of value-added divided by the growth of labor input (L) over period *t*.

$$\Delta lnz_t = \Delta lnZ_{jt} - \Delta lnL_{jt} \qquad [12]$$

Using this formula, aggregate labor-productivity growth can be decomposed into the sum of industry contributions and a residual that measures the effect of labor reallocation across industries.

$$\Delta ln\, Y_t/L_t = \sum_j \Delta lnz_{jt} \bar{v}^Y_{Z,jt} + \left(\sum_j \Delta lnL_{jt}\, \bar{v}^Y_{Z,jt} - \Delta lnL \right) = \sum_j \Delta lnz_{jt} \bar{v}^Y_{Z,jt} + R_t \qquad [13]$$

The term R_t is positive whenever industries with above-average levels of labor productivity increase their weight in total labor input, or when the relative size of industries that are relatively unproductive declines.[22] Since we have no data on actual work hours for sectors outside industry, we need to measure labor input by employment in our decomposition analysis. Therefore, the results reported in Table 6 are not fully consistent with the aggregate growth accounts in Table 3. But, they provide additional information that help to explain the trajectories of productivity growth that we described earlier.

During the 1950s and 1960s, labor reallocation between sectors contributed strongly to aggregate labor-productivity growth. The transition of workers from agriculture to industry was the fastest after farms had been collectivized (which did not happen in Poland). Since collectivization in Hungary suffered severe setbacks and was only completed in 1961, the most progressive period of structural modernization came later than in Czechoslovakia. After 1980, the process of structural change had a negative impact on aggregate productivity growth in all three countries. In the 1970s labor reallocation only made a substantial contribution to productivity growth in Poland. The late surge in investment discussed above maintained the rate of industrialization, and thereby the steep decline in the share of farm employment, longer than in the other two economies.

[21] Timmer et al. (2010), pp. 153-54. The authors applied the model to decompose GDP growth.

[22] In traditional shift-share analysis, this term corresponds best to the static shift affect, except for the fact that industry contributions are weighted by value-added, not employment, shares. The approach of Timmer et al. (2010) essentially concurs with the 'modified shift-share' analysis in Broadberry (1998).

TABLE 6
DECOMPOSING AGGREGATE LABOR-PRODUCTIVITY GROWTH (LOG %)

	1950s	1960s	1970s	1980s
		Czechoslovakia		
Aggregate growth	3.7	1.9	1.8	0.6
Industry contributions	2.3	1.3	1.8	0.9
Labor relocation	1.4	0.6	0.0	-0.3
		Hungary		
Aggregate growth	3.1	3.6	2.2	1.4
Industry contributions	3.0	3.0	2.3	1.5
Labor relocation	0.1	0.6	-0.1	-0.1
		Poland		
Aggregate growth	2.6	2.1	2.2	0.9
Industry contributions	1.2	1.2	1.5	1.0
Labor relocation	1.4	0.9	0.7	-0.1

Sources: Rates of labor-productivity growth from Table 2; GNP by sector of origin as in Table 5; employment by sector from Czirják (1973), Lazarcik (1969), and statistical yearbooks; value-added weights from Table 5.

Labor reallocation explains half of the gap in the rate of labor-productivity growth between the 1950s and 1960s in Czechoslovakia and practically all the difference between the respective rates recorded in Hungary and Poland. More crucially, the percentage-point change in the size of the reallocation effect between the 1970s and 1980s corresponds with the changes in the rate of TFP growth reported in Table 3. The apparent differences in the trajectories of productivity growth between the three countries after 1980 are, in large part, the result of compositional effects. At the industry level, average rates of labor-productivity growth seem to have fallen after 1980, but this is mostly the effect of declining work hours, which the decomposition results do not account for.

THE CRISIS OF THE 1980S

If the growth failure that undermined socialism in East Central Europe during the 1980s was input driven, then what caused sluggish factor accumulation, especially the sharp fall in investment and the diminishing rate of capital accumulation? Answers to this question need not be invented. We can draw inspiration from the literature on developing regions and from contemporary observers in the three countries that we study. Parallels with the experience of Latin America are particularly strong. The ‘lost decade’ of Latin American growth has often been linked to poor investment in physical and human capital, which in turn was explained by the debt overhang and the payments crises of the 1980s (see Ocampo 2004, Astorga 2010, and Astorga et al. 2011, among others). However, these factors were largely overlooked in most theoretical and empirical studies that sought to interpret the failure of planned economies as the consequence of technological and allocative inefficiencies above all else (Snell 1970; Brada and Montias 1984).

'Worst things come in pairs', says the old adage, and they certainly did in Eastern Europe at the turn of the 1970s and 1980s. Firstly, the oil shocks were more detrimental than elsewhere. Until 1975, COMECON countries imported crude oil, natural gas, and petroleum products from the Soviet Union at prices fixed well below the world market price. The existence of this practice prompted some scholars to argue that the USSR effectively subsidized economic development in her satellite states (see Marrese and Vanous 1983). As the first oil shock radically improved the Soviet terms of trade *vis-à-vis* western nations and Soviet industry was in grave need to import western machinery, the fixed-price regime was replaced by the so-called 'Bucharest Principle'. COMECON prices for raw materials were thereafter determined as five-year moving averages of the world-market price. Thus the ensuing increase of import bills in East Central Europe was initially smoother and somewhat delayed, but lasted longer, than elsewhere, until the mid-1980s (Beckmann and Fidrmuc 2012, p. 36).

Rising fuel prices made socialist industries less competitive because they applied relatively material-intensive technologies. This was not the outcome of technical backwardness but of rational choice. Due to the vast fossil-fuel deposits of the COMECON, energy prices were not just nominally but also relatively lower than in the West until the late 1970s. Thus, it paid to employ relatively fuel-inefficient technologies. Indicators derived from input-output matrices indicate remarkably similar manufacturing technologies in terms of natural-resource use between Eastern Europe and OECD countries. Only their consistently higher energy intensity made the input-output ratios of socialist economies notably higher (Drábek 1988; Gomulka and Rostowski 1988). After the oil shocks, this meant loss of competitiveness, sharply worsening terms of trade, and the need for massive investments to replace the existing stock of fuel-inefficient equipment.

Secondly, the 1970s witnessed the expansion of public debt in Eastern Europe, facilitated by cheap credit and urged by popular demands for investment in public infrastructure. In the early 1980s, refinancing their external debt became more costly for socialist countries as western creditor nations raised interest rates in an attempt to combat inflation at home. Within the prevailing geo-political constraints, especially the worsening of East-West relations, autarky was the logical, albeit self-destructive, policy response. Both the Soviet politburo and the COMECON council called upon socialist countries to limit their imports and to drastically cut back on international borrowing.[23]

This had negative consequences for economic growth and productivity. In aggregate terms, even though GDP continued to increase, domestically disposable income effectively stagnated from the mid-1970s. As governments struggled to satisfy public demands to expand government services, increase the availability of consumer goods, and improve housing provisions, investment in machinery became the prime victim of austerity (Alton et al. 1991a; Bálek 2007). The shrinking share of national income available for investment was shifted from equipment towards construction. Paradoxically, as communist regimes were nearing their collapse in the late 1980s, they disbursed record sums for building projects. Social housing programs are partly to blame, but equally hurting

[23] See Berend (1997), from p. 195 for further details.

was the construction of nuclear power plants in Czechoslovakia and Hungary precisely with the aim of reducing the dependence of both countries on imported hydrocarbons.

Both external demand shocks and the policy response they invoked limited the expansion and modernization of production capacities. The need to improve their balance of trade also forced socialist countries to promote exports at all cost. To achieve this, they channeled resources into low-productivity sectors with relatively strong export potential in hard-currency markets. Thus, austerity adversely affected the structure of production, too. The contribution of labor reallocation to aggregate labor-productivity growth turned negative after 1980. Deflationary policies (most notably in Czechoslovakia) seeking to dampen the impact of rising energy prices and to improve trade balances also hampered investment and productivity growth (Brada 1989). The need to curtail imports from hard-currency areas may have also contributed to slower productivity growth by limiting the import and implementation of advanced western technologies (Whitesell 1985).

Low levels of equipment investment implied slow growth in productive capacity and sluggish technological modernization as well as employment creation. Thus, austerity affected both input growth and productivity negatively. This argument is supported by previous research on the importance of machinery investment, in particular, for productivity growth (De Long 1992; De Long and Summers 1991). It also corresponds with recent evidence pointing to the conditionality of technological gains on sufficiently high levels of capital intensity, and thus investment (Kumar and Russel 2002; Allen 2012). Labor input declined further because of the shortening of the official workweek and popular welfare measures that diminished female labor participation after it had increased robustly for decades.[24] The most influential among these measures were the generous maternity benefits that allowed young mothers to stay at home for several years after childbirth and increased pensions for the elderly with a low retirement age for women.

Although the slowdown of economic growth after 1980 demonstrated these common features in most socialist economies, the extent of the crisis was very different across countries precisely because the severity of the external shocks that hit them was not uniform either. In Poland, GDP per capita actually fell between 1980 and 1989. After lavish borrowing in the 1970s, the Polish government was the first to declare insolvency in the wake of the second oil shock, before the avalanche of Latin American defaults began. Extreme austerity and the return to a repressive style of government under General Jaruzelski spurred popular dissent from the Solidarity movement. The recurrent strikes diminished manufacturing output, which further curbed resources for investment (for details see Berend 1997). Czechoslovakia, by contrast, recorded the highest growth rates among socialist economies after the Soviet Union during the 1980.[25] Because of limited borrowing in the 1970s, leaders in Prague did not need to tighten the belts as much as their counterparts in other countries and, consequently, could maintain relatively high levels of investment. Machinery

[24] See Adam (1987) for a discussion of employment policies in Eastern Europe.

[25] As a main exporter of hydrocarbons, the USSR could investment levels after 1980 and, thanks to that, achieved the highest growth rates in Easter Europe in both GDP and GDP per capita (Maddison 2006). Within the union, Russia, which benefited more from the new export opportunities than most other republics, recorded considerably faster growth than the Soviet economy as a whole, as long as oil prices remained high (compare with Ponomarenko 2002).

investment declined less drastically than in Hungary and Poland. Hungary represents a somewhat special case within the socialist camp. It managed to ease the pressure of austerity to some extent by maintaining access to western credit after it joined the IMF and the World Bank in 1982 in a secret operation conducted behind the backs of unsuspecting Soviet leaders.

CONCLUSIONS

Why did socialist economies fail? The falling behind of Eastern Europe in income per head and productivity in the period of the Cold War has been subject to a myriad of studies. Most blamed it on the intrinsic inefficiencies of centrally planning. The extensive nature of the investment-driven socialist development model is well established both in the theoretical and empirical literature. Most existing growth accounts for Eastern Europe confirm this view. The inefficiencies of the socialist system were manifested in the productivity failure that brought economic growth to a standstill by the 1980s and undermined the viability of socialism. Planned economies, it has been claimed, failed because they were bound to. By construction, they were incapable of a successful transition from an extensive growth model to one driven by innovation and rising productivity.

While we accept that socialism was relatively inefficient, we argue that existing accounts of the socialist growth experience require revision. Official statistics did not only overstate the growth of national income but also the rate of capital accumulation. Socialist economic development was not as strongly capital intensive as previous research has advocated. Productivity growth, albeit relatively modest, never came to a standstill and certainly did not turn into reverse. The growth retardation of the 1980s in Eastern Europe did not result from the failure to sustain productivity growth but from the failure to sustain factor accumulation. As in many other late-developing regions, this was the outcome of powerful exogenous demand shocks rather than an inefficient supply side. Unlike in the Soviet Union, the oil shocks and the payments crises that emerged in their aftermath invoked austerity in the other socialist countries, and investment in new machinery became the prime victim thereof. The outcomes were growing technological backwardness, structural sclerosis, and employment contraction with worsening capacity utilization in the capital goods industries. The draconian policy response to the crisis undermined the legitimacy of the socialist system and brought it to collapse.

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APPENDIX 1: NEW ESTIMATES FOR INVESTMENT AND CAPITAL STOCK

TABLE A1.1
GROSS INVESTMENT AND GROSS CAPITAL STOCK IN CZECHOSLOVAKIA, 1948-1989
(BILLION 1967 KROWNS)

	Investment		Capital Stock			
	Equipment	Structures	Equipment	Structures	Total	Index
1948	8.8	21.5	151.6	600.5	752.2	97.0
1949	8.0	21.1	154.4	610.1	764.4	98.6
1950	10.1	23.7	156.2	618.9	775.1	100.0
1951	11.0	24.6	160.0	630.3	790.3	102.0
1952	9.4	27.5	164.5	642.2	806.8	104.1
1953	9.2	28.5	167.4	656.9	824.3	106.3
1954	9.4	29.6	169.9	672.3	842.1	108.7
1955	11.0	33.5	172.4	688.4	860.8	111.1
1956	12.6	37.0	176.6	708.1	884.7	114.1
1957	14.8	40.0	182.1	731.0	913.1	117.8
1958	17.1	43.3	189.7	756.3	946.0	122.1
1959	18.5	47.8	199.2	784.5	983.7	126.9
1960	20.9	49.5	209.7	816.6	1,026.3	132.4
1961	21.7	49.4	222.2	849.8	1,072.0	138.3
1962	21.7	49.2	235.0	882.2	1,117.2	144.1
1963	21.4	44.5	247.3	913.7	1,161.0	149.8
1964	20.5	47.2	258.8	939.9	1,198.7	154.7
1965	23.5	49.2	268.9	968.3	1,237.2	159.6
1966	26.1	51.9	281.6	998.1	1,279.8	165.1
1967	28.7	54.5	296.5	1,030.0	1,326.5	171.1
1968	28.8	56.2	313.3	1,063.9	1,377.3	177.7
1969	30.6	56.2	329.6	1,098.8	1,428.4	184.3
1970	34.9	57.9	347.0	1,133.0	1,480.0	191.0
1971	31.7	61.9	368.0	1,168.2	1,536.2	198.2
1972	35.6	63.7	385.0	1,206.7	1,591.7	205.4
1973	47.0	65.0	405.2	1,246.3	1,651.5	213.1
1974	56.1	67.6	436.0	1,286.3	1,722.3	222.2
1975	53.7	70.1	474.7	1,328.2	1,802.9	232.6
1976	59.8	72.2	509.4	1,371.8	1,881.1	242.7
1977	60.1	73.2	548.8	1,416.5	1,965.3	253.6
1978	52.1	74.6	586.9	1,461.4	2,048.3	264.3
1979	47.2	75.0	615.5	1,506.8	2,122.3	273.8
1980	55.3	75.7	638.1	1,551.7	2,189.7	282.5
1981	37.2	75.7	667.8	1,596.4	2,264.2	292.1
1982	38.0	73.5	678.3	1,640.1	2,318.4	299.1
1983	34.0	73.1	689.2	1,680.8	2,370.0	305.8
1984	32.6	72.9	695.6	1,720.3	2,415.9	311.7
1985	28.6	72.6	700.4	1,758.8	2,459.2	317.3
1986	49.2	73.4	701.0	1,796.2	2,497.2	322.2
1987	52.1	74.3	722.2	1,833.6	2,555.7	329.7
1988	48.7	75.5	745.4	1,871.3	2,616.6	337.6
1989	50.5	75.2	764.3	1,909.3	2,673.5	344.9

Sources and methods: See text and footnotes in the section 'Data and Methodology'.

TABLE A1.2
GROSS INVESTMENT AND GROSS CAPITAL STOCK IN HUNGARY, 1949-1989
(BILLION 1968 FORINTS)

	Investment		Capital Stock			
	Equipment	Structures	Equipment	Structures	Equipment	Structures
1949	6.1	14.1	77.1	548.4	625.5	99.0
1950	8.0	18.6	80.2	551.5	631.7	100.0
1951	10.4	20.6	85.0	559.1	644.1	102.0
1952	13.8	22.7	92.0	568.5	660.5	104.6
1953	13.1	24.3	102.2	579.8	682.0	108.0
1954	11.7	21.2	111.2	592.6	703.7	111.4
1955	11.2	23.6	118.4	601.9	720.3	114.0
1956	10.9	22.1	124.9	613.4	738.3	116.9
1957	10.2	26.0	130.8	623.3	754.1	119.4
1958	10.2	27.8	135.8	636.8	772.6	122.3
1959	13.8	31.8	140.5	651.9	792.4	125.4
1960	14.8	35.0	148.7	670.7	819.4	129.7
1961	14.6	36.1	157.5	692.2	849.8	134.5
1962	17.4	37.4	165.8	714.5	880.3	139.4
1963	17.8	37.8	176.5	737.6	914.2	144.7
1964	18.3	40.9	187.3	760.7	948.0	150.1
1965	17.1	42.7	198.1	786.4	984.4	155.8
1966	19.0	43.0	207.3	813.4	1,020.7	161.6
1967	21.4	46.0	218.0	840.1	1,058.1	167.5
1968	19.5	51.7	230.7	869.3	1,100.0	174.1
1969	17.6	57.4	241.0	903.6	1,144.6	181.2
1970	16.6	62.2	248.9	942.9	1,191.9	188.7
1971	19.4	66.7	255.6	986.3	1,241.9	196.6
1972	15.9	66.8	264.8	1,033.2	1,298.1	205.5
1973	14.8	68.6	270.1	1,079.4	1,349.5	213.6
1974	18.2	72.1	274.1	1,126.4	1,400.6	221.7
1975	16.6	73.5	281.3	1,176.0	1,457.3	230.7
1976	14.4	74.6	286.7	1,226.0	1,512.6	239.5
1977	16.4	77.1	289.6	1,276.1	1,565.7	247.9
1978	20.9	80.6	294.4	1,327.6	1,622.0	256.8
1979	13.6	79.0	303.6	1,381.7	1,685.2	266.8
1980	13.8	75.3	305.1	1,433.1	1,738.2	275.2
1981	12.3	73.1	306.6	1,479.7	1,786.4	282.8
1982	13.2	71.1	306.7	1,523.2	1,829.9	289.7
1983	9.8	71.0	307.7	1,563.9	1,871.6	296.3
1984	10.3	68.5	305.1	1,603.6	1,908.8	302.2
1985	9.6	61.7	303.3	1,640.1	1,943.4	307.6
1986	12.0	62.7	300.7	1,669.0	1,969.7	311.8
1987	9.9	65.1	300.7	1,698.3	1,999.0	316.5
1988	12.3	61.0	298.6	1,729.4	2,028.0	321.0
1989	9.2	61.7	299.0	1,755.8	2,054.8	325.3

Sources and methods: See text and footnotes in the section 'Data and Methodology'.

TABLE A1.3
GROSS INVESTMENT AND GROSS CAPITAL STOCK IN POLAND, 1946-1989
(BILLION 1971 ZŁOTYS)

	Investment		Capital Stock			
	Equipment	Structures	Equipment	Structures	Total	Index
1946	3.0	17.0	373.5	2,148.6	2,522.1	103.8
1947	5.9	22.9	364.0	2,122.7	2,486.7	102.4
1948	8.8	25.6	357.8	2,103.1	2,460.9	101.3
1949	11.8	29.4	354.6	2,086.7	2,441.3	100.5
1950	15.5	29.9	354.6	2,074.4	2,429.0	100.0
1951	21.8	33.7	358.3	2,062.7	2,421.0	99.7
1952	23.6	36.2	368.1	2,055.2	2,423.3	99.8
1953	26.3	42.5	379.4	2,050.3	2,429.7	100.0
1954	27.7	49.9	393.1	2,051.8	2,444.9	100.7
1955	29.3	50.3	407.7	2,060.7	2,468.4	101.6
1956	28.4	53.7	423.4	2,069.8	2,493.2	102.6
1957	28.4	55.5	437.7	2,082.1	2,519.8	103.7
1958	29.4	58.2	451.4	2,096.0	2,547.4	104.9
1959	33.6	63.6	465.8	2,112.2	2,578.0	106.1
1960	37.8	65.5	483.9	2,133.6	2,617.5	107.8
1961	41.7	67.1	502.3	2,156.4	2,658.8	109.5
1962	48.6	69.1	524.0	2,180.4	2,704.4	111.3
1963	51.7	69.3	551.6	2,205.9	2,757.5	113.5
1964	51.7	73.5	581.2	2,231.1	2,812.3	115.8
1965	59.3	78.1	609.7	2,259.9	2,869.6	118.1
1966	64.3	82.5	644.6	2,292.9	2,937.4	120.9
1967	70.4	89.5	683.1	2,329.5	3,012.6	124.0
1968	63.0	97.2	726.2	2,372.4	3,098.6	127.6
1969	55.6	104.8	760.2	2,422.2	3,182.3	131.0
1970	63.0	113.1	785.4	2,478.5	3,263.9	134.4
1971	80.1	122.2	817.0	2,542.0	3,359.0	138.3
1972	104.4	132.9	856.3	2,613.4	3,469.6	142.8
1973	126.3	159.8	917.9	2,694.0	3,611.9	148.7
1974	142.8	181.3	998.3	2,799.9	3,798.1	156.4
1975	139.4	193.0	1,091.2	2,925.2	4,016.4	165.4
1976	124.2	203.8	1,176.1	3,059.6	4,235.7	174.4
1977	104.8	203.0	1,241.4	3,202.2	4,443.6	182.9
1978	117.3	202.0	1,284.2	3,341.1	4,625.3	190.4
1979	92.4	192.6	1,337.3	3,476.3	4,813.6	198.2
1980	73.9	183.1	1,362.8	3,599.4	4,962.1	204.3
1981	80.8	154.4	1,368.5	3,710.5	5,079.0	209.1
1982	89.1	137.8	1,380.9	3,790.6	5,171.5	212.9
1983	89.4	146.5	1,401.0	3,852.6	5,253.6	216.3
1984	97.0	148.6	1,420.3	3,922.0	5,342.3	219.9
1985	98.6	144.7	1,446.3	3,992.1	5,438.4	223.9
1986	104.2	147.8	1,472.6	4,057.0	5,529.6	227.7
1987	78.6	150.3	1,503.1	4,123.6	5,626.8	231.7
1988	80.3	151.1	1,506.6	4,191.5	5,698.1	234.6
1989	66.4	145.1	1,511.5	4,258.7	5,770.3	237.6

Sources and methods: See text and footnotes in the section 'Data and Methodology'.

APPENDIX 2: ROBUSTNESS CHECKS

TABLE A2.1
ANNUAL RATES OF CAPITAL ACCUMULATION USING ALTERNATIVE RATES OF CAPITAL RETIREMENT (LOG %)

	1950s	1960s	1970s	1980s
		Czechoslovakia		
Constant rates (baseline)	2.8	3.7	3.9	2.2
Constant rates (lower-bound)	2.0	3.2	3.7	2.0
Constant rates (upper-bound)	3.4	4.0	4.1	2.4
Increasing rates	3.2	3.7	3.8	2.0
		Hungary		
Constant rates (baseline)	2.6	3.8	3.8	1.9
Constant rates (lower-bound)	1.8	3.3	3.6	1.7
Constant rates (upper-bound)	3.2	4.1	4.0	2.0
Increasing rates	2.9	3.8	3.7	1.7
		Poland		
Constant rates (baseline)	0.8	2.2	4.2	1.7
Constant rates (lower-bound)	-0.1	1.7	4.0	1.6
Constant rates (upper-bound)	1.2	2.6	4.6	2.0
Increasing rates	0.8	2.3	4.2	1.6

Baseline: from Table 1, working life = 25 years (for Poland declining) for machines and 50 years for buildings
Lower bound (L): working life = 20 years for machines and 45 years for buildings
Upper bound (U): working life = 30 years for machines and 55 years for buildings
Increasing rates: linear decline of working life from 30 to 20 years for machines and from 55 to 45 years for buildings

TABLE A2.1
ANNUAL RATES OF TFP GROWTH USING ALTERNATIVE FACTOR SHARES (LOG %)

	1950s	1960s	1970s	1980s
		Czechoslovakia		
$\alpha = 0.3$	3.4	1.6	1.1	0.5
$\alpha = 0.5$	2.9	1.0	0.4	0.1
		Hungary		
$\alpha = 0.3$	2.8	2.9	1.4	1.4
$\alpha = 0.5$	2.5	2.2	0.6	0.7
		Poland		
$\alpha = 0.3$	2.9	2.0	1.6	1.3
$\alpha = 0.5$	3.2	2.1	1.0	0.6

Note: α is the elasticity of output with respect to capital, or the share of capital in national income.