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Origins of Catch-up Failure: Comparative Productivity Growth in the Hapsburg Empire, 1870-1910

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Origins of Catch-Up Failure: Comparative Productivity Growth in the Habsburg Empire, 1870-1910*

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Abstract

This paper examines patterns of structural change and labour productivity growth in the late nineteenth-century Habsburg Empire. Using shift-share analysis and a set of basic measures to account for the contribution of physical and human capital growth, it seeks to address three questions: First, what was the role of labour productivity growth in per capita income growth? Second, to what extent can structural change account for the comparatively slow growth of the Habsburg economy in general, and Austria's in particular? Third, how important were physical and human capital stock growth in aggregate labour productivity growth in Austria-Hungary as compared to Germany? The paper argues that, in contrast to the Hungarian experience, the size and performance of the agricultural sector imposed a severe burden on Austrian aggregate growth. Further, the evidence points to a significantly smaller contribution of TFP growth to aggregate and industrial labour productivity growth in Austria and Hungary than Germany. A proximate cause for the TFP growth differential may be found in far smaller positive externalities derived from lower initial human capital endowments in the Habsburg lands.

1. Introduction

At the beginning of the nineteenth century, the Hereditary Lands of the Habsburg monarchy were economically broadly on a par with the territories of Germany proper in general, and probably in a better position

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than Prussia (Freudenberger, 2003). Yet by the end of the century, a large and persistent growth differential had opened up between the economies of Austria and the newly unified German empire. By 1870 Austria had become considerably poorer in terms of per capita income than Germany and the income gap continued to widen over the next forty or so years. The impression of slow growth is confirmed in broader European comparison: with GDP per capita increasing at less than 1 per cent per annum, the Austrian economy failed to catch-up with the leaders and continued to fall behind most other European economies between 1870 and 1913. Hungary's economy, by contrast, ranked about mid-range in the European growth league (Figure1). These growth differentials are not trivial: at the given rates, it would haven taken seventy years for Austrians to see their average real incomes double. North of the border this was achieved within forty years. In short, if the initially low levels of per capita output hold the potential for faster growth than in the more advanced economies (Abramovitz, 1986; Gerschenkron, 1962), then the question arises why the western half of the empire (imperial Austria) failed to expand at a rate broadly commensurate with its relative GDP position.

This paper examines some of the proximate sources of productivity growth in the empire, drawing on new empirical evidence on physical and human capital as well as new labour force estimates. A variant of shift-share analysis (Fagerberg, 2000; Timmer and Szirmai, 2000) and a standard growth-accounting exercise are used to addresses three issues. First, what was the role of labour productivity growth in per capita income growth? Second, how did structural change impact on productivity advance in the Habsburg Empire compared to Germany? Third, how important were physical and human capital in aggregate labour productivity growth in Austria, Hungary and Germany?

[FIGURE 1 HERE]

The rest of the paper is organized as follows: The next section describes briefly the relevant output, labour force and capital stock data. Section 3 documents the growth of employment, GDP, aggregate and sectoral output per worker. This is followed by a discussion of the approach used in the de-composition of aggregate labour productivity growth and its results. Section 5 examines the contribution of physical and human capital to aggregate productivity growth. The concluding section summarizes the main findings and points to some wider implications.

2. Data

Building on recent estimates of value-added in constant 1913 prices for both halves of the empire (Schulze, 2000), output at sector and aggregate level is matched with labour force data extracted from the Austrian and Hungarian employment and population censuses 1869-1910.[1] In the absence of any reliable data on hours or days worked, productivity growth is measured by changes in value-added per worker. When reconciling the data for the census years and between Austria and Hungary, the labour force in the aggregate economy and in individual sectors was derived using the re-classification employed by Bolognese-Leuchtenmüller (1978) and Good (1998). This re-classification is more in tune with modern labour force definitions and makes for a greater degree of consistency over time and between regions. In addition, the census

[1] There are minor corrections of the construction, building materials and crafts series for Austria which combine to reduce the overall GDP growth rate (1870-1913) from c. 1.9 to c. 1.8 per cent per annum. For Hungary, new series have been constructed for distribution, finance and transport as well as for public and private services. However,

data on the agricultural labour force have been adjusted to correct for over-counting in Austria and under-counting in Hungary (Appendix A).

New annual capital stock estimates for the Austrian half of the empire are documented in Appendix B and form the basis for the discussion in Section 5. The new estimates comprise buildings, machinery, vehicles and infrastructure with a total of fifteen component series. Since more comprehensive time series data are as yet not available for Hungary, the analysis for this part of the empire relies on Katus' (1970: Table 42) spot estimates for 1867 and 1913.

The contribution of human capital is assessed on the basis of new annual human capital stock estimates for Austria, Hungary and Germany (Appendix C). These estimates build on the formal education experience at primary, secondary and tertiary levels of the cohorts present in the labour force in any one year.

In the spirit of Tilly's (1989) call for more explicit comparisons of economic development in Germany and the Habsburg Monarchy, some key features of macroeconomic change in Austria-Hungary are contrasted with those prevalent across the border. To this end, the analysis draws on Hoffmann (1965) for data on employment and physical capital stock in Germany. The recent literature adopts a generally critical stance towards Hoffmann's national income (Holtfrerich, 1983; Fremdling, 1988, 1991, 1995; Ritschl and Spoerer, 1997; Burhop, 2005; Burhop and Wolff, 2005). Here, an augmented version of the Hoffmann national product series was used that takes account of Burhop and Wolff's (2005) substantial upward revision of the 1913 level of industrial value added and draws on Burhop (2005) for re-worked indices of industrial production. The combined effect of these revisions is to reduce estimated growth of real product over 1871-1913 from c. 2.9 per cent to 2.8 per cent per annum.

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these have no discernible impact on estimated growth compared to the earlier (Schulze, 2000) estimates. Details are available from the author.

3. Employment structure, economic growth and sectoral output per worker

In both Austria and Hungary, the total labour force increased by about 0.6 per cent per annum from 1870 to 1910. However, there are marked differences between the two halves of the empire. First, Hungary's employment structure continued to be dominated by the agricultural sector to a much larger degree than Austria's. Even at the end of the period under review did the secondary sector account for less than a seventh of the total labour force. Second, in Austria the quantitatively most significant change lies in a marked absolute increase in employment in producer-orientated services such as distribution, finance and transport, and in the secondary sector. These two sectors account for more than three quarters of the total increase in employment. The rest results from significantly lower increases in agricultural employment, which, however, started off from a much higher initial level. These shifts in the employment structure (Table 1) are compatible with standard accounts of the impact of sectoral differences in income elasticities of demand during growth processes. The comparison with Germany shows, though, that the Habsburg Empire remained far more committed to the rural sector than its northern neighbour. Even in the richer and economically more developed Austrian economy, a larger proportion of its total labour force worked in agriculture on the eve of the First World War than in Germany forty years earlier.

[TABLE 1 HERE]

In both halves of the Habsburg Empire, economic growth in the late 19th century was far from uniform over time. The Austrian economy expanded at a markedly lower rate during the Great Depression of the 1870s and '80s than in the following two decades, while Hungarian output growth decelerated after the early 1890s (Schulze, 2000). Table 2 reports the changing composition of aggregate output during the late 19th century. These changes correspond fairly closely with the observed shifts in the labour force structure. In the western half of the empire, the share of agriculture declined (but only after 1890), that of the secondary sector (mining, manufacturing, crafts, construction) increased markedly, and within the tertiary sector the emphasis shifted towards the producer orientated services such as distribution, finance and transport. Owing to slow growth in population and urbanization rates, the housing sector lost continuously in relative importance. The Hungarian pattern differs in so far as the percentage contribution of primary output to GDP stayed almost constant over the longer term. Here the rise in the secondary sector's output share from about 10 to about 20 per cent corresponded with a stronger relative decline in services and housing than in Austria.

[TABLE 2 HERE]

Thus the differential rates of aggregate (peak-to-peak) growth between Austria and Hungary, both over the whole period under review and the two sub-periods 1871-1895 and 1895-1912, originated largely from differences in sector-specific performances (Schulze, 2000, Tables 9, 10). In Austria, GDP growth was driven primarily by the expansion of manufacturing output, with a particularly strong contribution after the end of the Great Depression. Weighted by its share in GDP, the secondary sector accounted for nearly half of total GDP growth between 1895 and 1912. Agriculture contributed about one quarter of the increase in total output over the whole period. In contrast, the overall faster growth of Hungarian GDP was first and foremost an outcome of the rapid increase in agricultural production – this holds for 1871-1912 as well as for the two sub-periods. Here, the impact of even faster growth in non-agricultural goods production was reduced by the low initial share in aggregate output.

How were these changes in output reflected in the growth of aggregate and sectoral labour productivities? The significant differences in GDP growth during and after the (Austrian) depression of the 1870s and '80s (Schulze, 1997, 2000) are mirrored in the rates of change in total output per worker (Tables 3, 4). When Austrian GDP growth increased, i.e. after 1890, so did Austrian labour productivity. Moreover, measured over the whole period under review, labour productivity in Hungary increased at a higher rate than in the western part of the empire and this matches well with the relative performance in terms of GDP and GDP per capita. Tables 3 and 4 document pronounced inter-sectoral productivity growth differentials whose impact on aggregate productivity change was modified by stark contrasts in absolute levels of output per worker.[2] In Austria, it was in mining and, after 1890, manufacturing as well where output per worker grew fastest. In Hungary, mining and, during the 1870s and '80s, also manufacturing displayed the highest rates of productivity growth. However, the agricultural sector appears to be of particular significance in both cases. Throughout the late 19th century, Austrian agriculture remained a sector characterized by low (absolute and relative) productivity levels that increased at a rate below that of the aggregate economy. Here, the reasons for the low rate of out-migration of labour and, apparently, low rates of productivity enhancing technical progress require further research.[3] The data suggest that the large rural sector, accounting for well over half of the total labour force on the eve of the First World War, was a substantial constraint on Austrian growth. This is

[2] The broadly low rates of productivity growth in the service sector are not entirely unexpected given the limited scope for labour saving technical progress in this area in the 19th century and the conceptual and empirical difficulties in measuring government or personal services output other than through labour inputs.

in stark contrast to the Hungarian case. Although initial productivity levels there, too, were low in comparison to other sectors of the economy, they increased relatively fast. This would indicate that the burden of keeping a large proportion of the labour force in comparatively low productivity agriculture was considerably lighter in growth terms than in neighbouring Austria. The agricultural sector was indeed the main driving force of Hungarian growth between 1870 and 1913 (Schulze, 2000) - and a marked increase in output per worker played a major role in this (Table 4).

[TABLES 3 AND 4 HERE]

Leaving aside the substantial difficulties of converting GDP estimates for different economies into a common unit and ignoring the potential distortions such attempts entail (Prados de la Escosura, 2000), a basic comparison using Maddison's (2003) purchasing power parities based converters from national currencies into 1990 international dollars and the relevant GDP indices (Schulze, 2000, with minor amendments; Hoffmann, 1965, on German product but with its industrial output component replaced) is nevertheless instructive.[4] It suggests that German aggregate per capita output was about 35 per cent higher than Austrian per capita product in 1870. By 1913 this gap had widened to about 78 per cent. In terms of GDP *per worker*, however, the initial difference between Germany and Austria was larger (reflecting higher participation rates in Austria) but increased subsequently at a much lower

[3] The evidence in Sandgruber (1978: Table 54) points to, on average, extremely low levels of machine utilization in Austrian agriculture.

[4] Though conceptually preferable, common benchmark-based comparisons of labour productivity as used, for example, in Broadberry (1998) are not feasible in the present case: the one source potentially matchable with the German survey of 1907, i.e Austria's 1902 industrial census, does not report branch specific output figures.

rate (reflecting more rapid labour force growth in Germany).[5] By these rough comparative measures, Hungary's overall productivity lag to Germany was significantly larger but decreased slightly over the late 19th and early 20th centuries (Table 5).

[TABLE 5 HERE]

One of the main reasons for the continuous projection of the initial gap in output per worker between the Habsburg and German economies was the particular situation of agriculture in Austria. Unlike its Hungarian counterpart, this sector displayed a low rate of productivity *growth* that augmented the effects of low initial *levels* of output per worker relative to the rest of the economy. Although Austrian agricultural output per worker grew at about the same rate as German, this growth proceeded from a much lower level, both in absolute terms and relative to other sectors of the economy. Moreover, labour productivity growth in industry was measurably faster in Germany where mining, manufacturing, crafts and construction accounted also for a significantly higher employment share than in Austria (Tables 1, 8). While inter-economy productivity comparisons pose difficult problems (cf. Broadberry, 1998), the magnitudes involved here would point to very large differentials that were perpetuated over the course of the late 19th century. Austria, in contrast to her Hungarian partner in the Habsburg customs union, was not displaying the characteristics of *catching-up*. Further, the evidence on output and productivity growth provides no support for Kausel's (1979) flattering interpretation of imperial Austria's comparative growth record.

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[5] A simple cross-check, using the working age population rather than the labour force figures extracted from the censuses, suggests that the observed rise in level differences is not an outcome of differential changes in participation rates between the two economies (or varying census definitions): on this measure, too, Austria had fallen further behind by 1913.

Still, the *relative* performance of the Habsburg economy does appear in a somewhat more favourable light if measured in terms of output per worker rather than output per capita. This reflects more rapid German employment growth that outstripped the rise in population – the opposite was the case in Austria-Hungary (Table A.1). Yet Germany's higher population growth and urbanization rates may, ultimately, have made for faster aggregate labour productivity growth – directly, by increasing demand for housing (where practically all income generated accrues to capital) and, indirectly, by permitting larger gains from economies of scale and specialization. That the first factor (i.e. housing) did matter is readily demonstrated in the next section where the housing sector is excluded from the productivity and shift-share calculations: Austrian and German growth rates of output per worker so measured are much closer over the longer term 1870-1910 than those for output per capita.

4. Shift-share analysis of structural change

Going back to Fabricant (1942), shift-share analysis is a widely used tool to assess the impact of structural change on productivity growth (e.g. Syrquin, 1984; Broadberry, 1998). The following discussion draws on a variant of the approach (Fagerberg, 2000; Timmer and Szirmai, 2000) where growth in aggregate output per worker is decomposed into three elements, with the 'residual' common in studies based on fixed weight index numbers being given an explicitly economic interpretation. The first term reflects the contribution of changes in the allocation of labour between sectors (static shift effect). This effect is positive if the employment share of sectors with high productivity levels increases at the expense of sectors with low productivity. A second term measures the impact of interaction between changes in intra-sectoral productivity and changes in the allocation of labour between sectors (dynamic shift effect). This effect is positive if the sectors displaying marked productivity growth also increase their employment share over time. Finally, there is the contribution from growth of output per worker within individual sectors (weighted by their respective employment shares). More formally:

Define

Q = aggregate value-added

L = total labour input

P = value-added per employee

Then

$$P = Q/L = \Sigma Q_i/\Sigma L_i = \Sigma[(Q_i/L_i)(L_i/\Sigma L_i)] \tag{1}$$

with i = sector (i = 1, …, m).

Define

$$P_i = Q_i/L_i \quad \text{(value-added per employee in sector } i\text{)} \tag{2}$$

$$S_i = L_i/\Sigma L_i \quad \text{(share of sector } i \text{ in total employment)} \tag{3}$$

Then, substituting (2) and (3) into (1),

$$P = \Sigma[P_i\, S_i] \tag{4}$$

Further

$\Delta P = P_t - P_o$ and $\Delta S = S_t - S_o$

where t = final year, o = base year

From (4) follows

$$\Delta P = \Sigma[P_{io}\,\Delta S_i + \Delta P_{io}\,\Delta S_i + S_{io}\,\Delta P_i] \tag{5}$$

As growth rate:

$$\Delta P/P_o = \Sigma(P_{io}\,\Delta S_i)/P_o + \Sigma(\Delta P_{io}\,\Delta S_i)/P_o + \Sigma(S_{io}\,\Delta P_i)/P_o \tag{6}$$

Table 6 below reports the results for the Habsburg Empire as a whole, its major constituent parts and, for comparison, Germany. According to this new evidence for the Habsburg economy, structural shifts were generally growth promoting. There are two exceptions: a negative, yet small dynamic effect for Austria during the 1870s and '80s, and a modest negative static effect for Hungary over the same period. Both are primarily related to decreases in the overall employment share of government, professional and personal services. In the Austrian case, this was the sector with the second highest initial productivity level and, during this period, an above average rate of productivity growth, driven by an increase in the already relatively large number of highly paid public officials and a rapid decline in low-paid domestic servants. Hungarian public and private services displayed initially high levels of output per worker and a slightly below average rate of productivity growth. [6] Over the longer term 1870-1910, though, the signs on both structural effects are positive. Thus neither in the Habsburg Empire nor in Germany was the factor labour re-directed into uses with lower productivity levels or lower productivity growth. However, contrary to the growth potential entailed in the initial productivity differentials between the two economies, aggregate output per worker in Austria expanded more slowly over 1870-1910 than in Germany. The productivity gap between the poorer Austria and the richer Germany did not narrow in the late nineteenth century and in that sense there was no catching-up. Second, labour productivity growth in all three economies was dominated by sector-internal changes in output per worker which accounted for 78 to 88 per cent of the increase in the aggregate over 1870-1910. The Austrian economy, though, was characterized by a measurably lower rate of sector-internal labour

[6] Note that for want of alternative output data, constant price output in this sector was approximated on the basis of employment statistics and 1913 salaries. Estimated 'productivity' growth is, therefore, entirely an outcome of intra-sectoral employment shifts between public servants, the professions and domestic servants (Kausel, 1979).

productivity growth than both the Hungarian and German economies. This could be viewed as a pointer to capital formation as a key factor in differential productivity growth – the issue will be taken up in the next section. Third, apart form the years of depression in Austria, the 1870s and ‘80s, the contribution of structural change as a whole was larger in the economically less developed Habsburg Empire than in Germany. This was mainly the outcome of Austria’s dominance in the Habsburg economy: over the longer term, structural change played a less significant role in Hungary than in Austria. At first sight, that seems somewhat surprising, given the larger potential to realize static gains obtained from reallocating labour from lower productivity agriculture into higher productivity uses in the secondary and tertiary sectors. A plausible explanation can be found in natural resource advantages (and intra-sectoral shifts towards higher value-added products) that permitted relatively high internal productivity growth in Hungarian agriculture (and thus the aggregate economy) without a fall in the rural labour force (cf. Eddie, 1968). Fourth, the extent to which labour inputs were channelled into industries with higher productivity growth was more limited in the Habsburg Empire, indicating smaller dynamic gains from structural change than in Germany (measured over 1870-1910). Fifth, the Great Depression left particularly deep traces in the Austrian economy: not only was aggregate productivity growth in the 1870s and 1880s far slower than in Hungary as a result of less rapid intra-sectoral advances, this was also a period of only muted structural change. In fact, the dynamic structural component for 1870-1890 is negative To some extent this was made up for in the post-1890 decades when Austrian labour productivity growth accelerated above German rates – this, in turn, was sustained by resource shifts previously delayed that were now feeding into productivity growth.

[TABLE 6 HERE]

5. The impact of physical and human capital growth

Empirical work by economic historians and applied economists suggests that physical capital formation did matter for both growth rates and levels of productivity and income across industrialized nations in the nineteenth and twentieth centuries (e.g. De Long, 1992; O'Mahony, 1996). This ties in well with an earlier literature that viewed capital stock expansion as a key ingredient in labour productivity growth (Denison, 1967; Maddison, 1987). There is an equally good fit with an historiography that stresses the role of mechanization or machinery investment (Gerschenkron, 1962; Rosenberg, 1963; Pollard, 1986). In brief, there are some very good reasons for looking at physical capital growth as a potential source of Austria's output and productivity growth lag.

Starting point here is a standard Cobb-Douglas production function with constant returns to scale:

$$Q = AK^{\alpha}L^{\beta} \tag{7}$$

where $\beta = (1-\alpha)$ and α represent factor income shares of capital (K) and labour (L) in total product (Q).

In this framework, total factor productivity growth is measured as a residual, i.e. as the difference between output and weighted factor input growth (ignoring time subscripts for convenience):

$$\Delta(Q/Q) = \alpha(\Delta K/K)+ (1- \alpha)(\Delta L/L)+\Delta(A/A) \tag{8}$$

This can be reformulated so as to decompose aggregate labour productivity growth into the contributions made by changes in the capital-labour ratio and total factor productivity growth:

$$\Delta(Q/L)/(Q/L) = \alpha(\Delta K/L)/(K/L)+\Delta(A/A) \tag{9}$$

Capital per worker growth was faster in the Habsburg Empire and - assuming the usual factor shares in value added (70 per cent labour and 30 per cent capital) applied across all three economies - made a larger contribution than in Germany (Table 7). In the Hungarian case, this was due to the comparatively rapid expansion in aggregate capital stock (at 4.0 per cent per annum over 1870-1910 vs. 3.0 per cent for Germany) *and* a lower rate of employment growth (0.6 per cent vs. 1.3 per cent). In contrast, change in the Austrian capital-labour ratio was dominated by slow employment growth (0.6 per cent) rather than capital growth (Table 8). However, according to this basic formulation of the issue, TFP growth played a far more prominent role in German labour productivity growth over 1870-1910 compared to both Austria and Hungary. This would suggest that at least part of the Austrian catch-up problem was down to technology and organization and not just capital formation.

The analysis can be extended further by considering the impact of human capital which is generally recognised by both economists and economic historians as playing a critical role in output and productivity growth (Barro, 1997, 2001; Broadberry and Wagner, 1996; Lucas, 1988; Maddison, 1987; Mankiw, Romer, Weil 1992; Romer, 1990). Here the discussion draws on an augmented Solow-type model where human capital (H) features explicitly as a third factor of production:

$$Q = AK^{\alpha}H^{\beta}L^{\gamma} \tag{10}$$

where $\alpha + \beta + \gamma = 1$.

Further transformation yields

$$\Delta(Q/L)/(Q/L) = \alpha(\Delta K/L)/(K/L)+ \beta(\Delta H/L)/(H/L)+\Delta(A/A) \tag{11}$$

Adopting, as before, a common 30 per cent income share for physical capital but assuming that about half the return to labour accrues to human capital, leaves a β of .35.[7] There are, then, stark contrasts in the effects of the rise in human capital, here proxied by the stock of educational experience of the labour force, on observed productivity growth in the three economies. First, including human capital leads to marked decline in the contribution of TFP growth to aggregate productivity growth in both Austria and Hungary. With the given weights, the increase in educational attainment accounted for about 21 to 32 percentage points of the rise in output per worker. Second, in the German case human capital stock growth appears to have made little difference. That is because the initial level of schooling on average across the labour force was already high in 1870 relative to 1910 and further increments were small. Moreover, German schooling levels were well above those prevalent in the Habsburg domains and remained so up until the First World War, even if the differentials declined over time (Appendix C, Table C.1). Some implications of this 'schooling lead' for comparative productivity growth are discussed further below.

[TABLE 7 HERE]

The growth in physical capital and capital intensity cannot be broken down by sector to a satisfactory standard. Hoffmann's (1965) German data allow some differentiation by asset types, yet they are rather limited in terms of sector delineation. His estimates for 'Gewerbe' lump together mining, manufacturing, distribution and finance. Katus (1970) provides spot estimates of Hungarian capital stocks (1867, 1913) and some broad indication of asset type *and* sectoral origin. The new capital stock estimates for Austria (Appendix B) are concerned with asset types, though some additional quantitative information can be used to derive sector-specific ‘best-guesses’ of capital stock growth in agriculture and industry.[8] These serious limitations should be borne in mind when reading the comparisons in Table 8. However, the data confirm the broader picture mapped out in Table 7. Austrian aggregate productivity growth was held back by a large rural sector that displayed low rates of capital formation. This contrasts with Hungarian agriculture where far more rapid capital stock growth sustained a rate of labour productivity advance above the whole economy average. The industrial capital stock increased broadly at the same rate in Austria, Hungary and Germany. However, the comparatively rapid change in capital intensity in Austrian industry, where the labour force rose relatively slowly, did not translate into higher or even similar rates of industrial labour productivity growth. It was, then, mainly the rising employment share of high productivity services (or static shift effect) that kept the overall growth rate of output per worker in Austria near that in Germany, though it failed to push it above that level.

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[7] Cf. Mankiw, Romer and Weil (1992: 417).

[8] Sandgruber (1978: Table 54) reports contemporary spot estimates of machinery and equipment used in agriculture for 1860 (Fillunger, 1868) and 1910 (Pribram, 1915). These have been deflated using a general machinery price index (Schulze, 1996: Appendix A, Table A.12) for 1870-1913 and trend extrapolation to 1860, and were then log-linearly interpolated to arrive at a ‘guesstimate’ for 1870. Adding the new agricultural building series (Appendix B, Table B.1) gives an approximate total of physical capital in agriculture (excluding inventories and farm animals). For industry, capital stock growth is estimated on the basis of the general machinery stock series (net of agricultural machinery) and the new series for commercial buildings (Appendix B, Table B.1). Bearing in mind the data limitations, the alternative of letting the 1910 level of agricultural machinery stocks move in line with the overall stock of machinery makes no material difference to the argument.

[TABLE 8 HERE]

6. Some implications

The origins of industrialization in the western half of the Habsburg Empire reach back into the 18th century as elsewhere in western Europe (Good, 1984; Komlos, 1983, 1989). Yet by 1870 a substantial gap in per capita product had opened up between Austria and the leading economies on the Continent that was not to be narrowed before the First World War. It is not the causes of this initial falling behind that are of interest here, but rather the question why so much of the growth potential reflected in the productivity differentials to other economies remained unexploited before 1913. Low rates of structural change appear to have adversely affected Austrian labour productivity growth before 1890. Thereafter, inter-sectoral labour re-allocation made a significant positive contribution to the rise in productivity. However, keeping a large proportion of the labour force in an agricultural sector that was characterized by low productivity levels and slow productivity growth proved a major constraint. The new evidence further suggests that the factors shaping sector-*internal* productivity growth are of particular significance in explaining Austria's growth record. It is in this area where the differences to Hungary and Germany are particularly pronounced. Several issues require, therefore, further research.

Why was capital formation in Austrian agriculture so low and why was there such a slow exit of workers from the sector? To some extent, relatively high tariff barriers may have protected marginal agricultural producers at least in those areas of agriculture where they faced no direct competition from their Hungarian counterparts. However, these enjoyed ready access to the more urbanized and higher income Austrian markets than they faced at home, due to the customs and monetary union. Yet the issue of low exit rates from the rural sector may well have been linked to the constraints the manufacturing sector faced which reduced growth in industrial demand for labour.

Further, if the new estimates of output growth, labour productivity and TFP are about right, then some interesting questions arise about the origins of Austria's persistent productivity lag. First, combining the evidence on structural change (Table 6) and the sources of labour productivity growth (Table 7) would suggest that, in the Austrian case, most of TFP growth can be accounted for by the effects of shifting labour into higher productivity sectors or those that displayed higher productivity growth. There is, then, little room left for the impact of 'pure' technical and organizational change as a driving force of productivity growth. This holds for the whole period under review but is particularly pronounced for the years of the Great Depression. In the case of Germany, a different story emerges. Here, TFP growth was not only much faster but also much less dominated by the impact of structural change over 1870-1910. Or: technical and organizational advances appear to have played a far more important role in overall labour productivity growth than in Austria in both relative and absolute terms.

Second, the key difference between the Habsburg Empire and Germany in terms of growth accounting results lies in the significance of human capital formation, more precisely – schooling. Compared to both Austria and Hungary, German input of schooling per worker grew slowly. But it started from a much higher level: even by 1910, schooling levels across the Habsburg Empire were well below those that prevailed in Germany forty years earlier – simply put, the labour force was much less well educated than across the border.

Third, it is, thus, not too far fetched to hypothesize that lower *rates* of productivity growth in imperial Austria over the long term may have been causally linked to lower *levels* of human capital. Such reasoning is compatible with recent work in economics that argues for threshold levels only beyond which human capital growth becomes a force pushing productivity growth and for a positive link between initial human capital endowments and subsequent technology growth (Kyriacou, 1992). Likewise, it is compatible with the evidence from economic history demonstrating the positive effects of high initial levels of accumulated human capital on output and productivity growth once demand conditions permit the exploitation of this factor advantage (e.g. Sandberg, 1979).

Finally, if comparative levels of human capital stock play a significant role in explaining, at least partially, the Austro-German productivity differential, then the focus of analysis shifts back in time: given the long lead time required to raise the educational standard of the working-age population as a whole, any human capital 'problem' of the post-1870s period had its origins in the first half of the 19th century. To put it crudely: in terms of growth forgone, Austrian society in the late 19th century paid the price of previous generations' low investment in education.

However, comparatively low rates of TFP growth may be indicative not only of relatively low rates of technological or organizational progress, but may well be a pointer to issues of scale or specialization economies (which, strictly speaking, do not feature in a constant returns framework) and industrial location. In this context, enquiries that account for both Heckscher-Ohlin type (factor endowments) and New Economic Geography type (market access) interactions between region and industry characteristics offer a promising way forward.

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Appendix A

Labour Force Estimates for Austria-Hungary, 1869-1910

1. Re-classification: procedure

The labour force estimates are based on the official censuses for both halves of the empire. When reconciling the census data for the five census years (1869/70, 1880, 1890, 1900, 1910) and between Austria and Hungary, the labour force in the aggregate economy and in individual sectors was derived using the re-classification employed by Bolognese-Leuchtenmüller (1978: 119-122), Good (1993: 7-12) and Good and Ma (1998: 21-22). This re-classification is more in tune with modern labour force definitions and makes for a greater degree of consistency over time and between regions. The labour force data refer to both sexes. Excluded from the category of *Berufstätige* (as summarized in the censuses) are those not in active employment/work (i.e. pensioners and those living on annuities/rental incomes; those who have passed on their farms to the next generation; the poor receiving benefits; patients in asylums and inmates of prisons; those in school), women working in the household and the small number of those with unknown occupations to derive the number of *Erwerbstätige*. This categorization corresponds closely with modern labour force definitions or the 'economically active population'. Day labourers are assigned to the sectors in which they worked. Domestic servants are not assigned by sector but form a separate group within the total labour force. Hence those working in an agricultural setting are not assigned to agriculture but counted as part of the service sector. Following Bolognese-Leuchtenmüller (1978), day labourers working in *several* sectors ('wechselnde Beschäftigung') were allocated to the agricultural sector on the assumption that most of their work was done there.[9] This is a plausible simplification: according to the census data for Austria, between 69 and 73 per cent of *all* day labourers were counted explicitly as being in agriculture during 1890-1910. Given this sectoral bias, most of the remaining 30 or so per cent of day labourers (which accounted for less than 3 per cent of the total labour force) are likely to have worked in agriculture as well.

The labour force figures for mining (mining and metal-making in the case of Hungary) are taken from the official annual statistics of the mining district administrations published in *MSE*, *ÖSH* and *SJB*. Matlekovits regards these as more reliable and consistent over time (1900, I, 522-523).

The pre-1890 employment censuses for Hungary subsume a significant proportion of service sector activity (including catering, local transport) under the heading of 'industry'. This has been corrected and the approximate labour force figures involved have been re-allocated to the category of 'distribution, finance, transport'.

2. Adjustments: agricultural labour force

The census data for 1869 and, especially, 1880 are somewhat problematic and generally regarded as less reliable than the data for 1890-1910 because of (1) uncertainties surrounding the counting of individuals in full-time and part-time occupations, especially within agriculture, and (2) the assignment of women to the labour force (Bolognese-Leuchtenmüller, 1978: 103). Similar issues arise with the census treatment of working family members.

The Hungarian censuses, in particular, appear to underestimate the actual agricultural labour force by a large factor (cf. Eddie, 1968; Good,

[9] The 1870 Hungarian census lumps together day labourers and domestic servants. Here Thirring's estimate of the total's distribution between the groups has been used; cf. Eddie (1968: fn. 28, 209).

1993; Good and Ma, 1998). The comparison with the Austrian data would suggest that this is an outcome of systematic under-counting of family members as farm hands and female participation, in particular, which is reflected in implausibly low proportions of the agricultural population counted as agricultural labour. In short, the official numbers on the labour force in agriculture require substantive revision. According to Austrian census returns, female agricultural participation rates varied between 57 and 61 per cent of the agricultural population during 1890-1910; in Hungary, the corresponding figures range between 19 and 28 per cent. At the same time, there are only small differences in recorded male participation rates in agriculture between the two parts of the empire and also over time (averaging at 62 per cent over 1890/1910 in Austria and 63 per cent in Hungary). Yet there is no historical evidence whatsoever suggesting that female participation in Austrian agriculture was thrice as high as in Hungary, which is what the official numbers imply. What seems far more likely is that, 'on the ground', census officials in the two parts of the empire employed different definitions of female family members' labour force participation at any given point in time and that these definitions varied over the course of time. For example, in Austria about 45 per cent of the female agricultural population was counted as 'working' in 1880. Ten years later (and with only modest variation over the next two decades) this number had risen to over 60 per cent. Moreover, the official Austrian census numbers suggest that the female labour force in agriculture was larger in absolute terms than the male labour force in 1890-1910. To deal with the issue of likely under-counting of female labour in Hungarian agriculture and over-counting in Austrian agriculture, we assume for both halves of the Habsburg Empire that female participation rates were ¾ the level of male participation rates, implying that slightly less than half of the total female agricultural population was in more or less full-time agricultural employment. The effect of this is to raise the estimated female labour force in Hungary and to lower it in Austria compared to the official statistics. This adjustment seems plausible in light of the age composition of the female population and suggests that approximately 2/3 of the female agricultural population of working age were working in agricultural production.[10]

The agricultural population has been computed from the census data for 1880-1910 as the sum of those actively working and the number of their dependents and household members (excluding servants). For Austria 1869, the agricultural population was taken from Sandgruber (1978: Table 51, 115) and it was assumed that its sex composition matched that of the total population. To derive the male agricultural labour force in 1869, the 1880 male participation rate was used;[11] the female labour force in agriculture was estimated as for the other census years. For Hungary 1870 and 1880, the agricultural population was derived using its share in the total population as reported in Eddie (1968: Table 4, 210). Again, it was assumed that the sex composition matched that of the total population. The male labour force in agriculture is reported in the 1880 census and for 1870 it has been estimated, using the 1880 male participation rate. The female labour force in 1870 and 1880 was estimated as for the other census years.

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[10] The table below reports the new estimates of the agricultural labour force as a proportion of the total labour force and compares them to both the unadjusted census figures and Good and Ma's (1998) regression-based backward extrapolations for 1869/70 (for 1890-1910, they used the official census figures).

	census unadjusted		**Good & Ma**		**new estimate**	
	Austria	**Hungary**	**Austria**	**Hungary**	**Austria**	**Hungary**
1869/70	.649	.702	.736	.822	.627	.783
1890	.645	.754	.645	.754	.615	.795
1910	.569	.672	.569	.672	.540	.730

Sources: See Table A.1; Good and Ma (1998: Appendix).

[11] Note that the 1880 male participation rates in agriculture are either almost identical with (Hungary) or very close to (Austria) the respective 1890/1910 means.

Measured over 1870-1910, the impact of these corrections of the official census data on estimated aggregate labour productivity growth in Austria is negligible.[12] In the case of Hungary, though, the adjustments make for more significant differences: estimated growth of output per worker in agriculture declines from 2 per cent per annum (census data) to 1.7 per cent and for the aggregate economy from 1.85 to 1.65 per cent. If anything, the new labour force estimates thus bias the results against the view advanced here, namely that overall output per worker grew significantly faster in Hungary than in Austria and that it did so primarily because of differential productivity growth in agriculture. Further, the new estimate correct for a major problem: the official census estimates of the agricultural labour force imply relative *levels* of aggregate output per worker in 1910 that are implausible. There is no historical evidence, qualitative or quantitative, suggesting that on the eve of the First World War Hungarian income or productivity levels were on a par with those prevailing on average in the western half of the empire.

Table A.1 reports the labour force estimates for 1869/70, 1890 and 1910 which have been used in the labour productivity computations.

[TABLE A.1 HERE]

[12] The census labour force figures imply output per worker growth of 1.28 per cent per annum compared to 1.29 per cent for the new estimates.

Appendix B

An Estimate of Imperial Austria's Gross Domestic Fixed Capital Stock,1870-1913

As for many other 19th century economies, the scarcity of essential historical data poses severe conceptual and empirical problems for the derivation of capital stock time series for Austria. While, in line with current practice in most statistical offices, the perpetual inventory method would be the preferred technique of estimating capital stock levels as the sum of past real investments that have survived up to the period under consideration (O'Mahony, 1996: 165), the lack of both investment figures and appropriate producer goods price indices for most types of assets renders this not viable in the present case. Of course, in some cases investment series could be constructed from changes in directly observed historical stock levels as documented in fire insurance records and censuses, e.g. residential and non-residential buildings, or railway rolling stock inventories. Yet to use such investment series as an input into perpetual inventory calculations of the capital stock would add very little and, as Broadberry (1998: 399) has pointed out, 'involve some circularity of argument'. Here the perpetual inventory method was used only to estimate the gross stock of machinery and equipment. In all other cases, the estimates build on direct contemporary observations of capital stocks. Accordingly, it is only for machinery and equipment stocks that the choice of asset lifetime assumptions becomes a practical issue. Maddison (1995: 137-140) argues for using standardized asset lives in cross-country comparisons and assumes asset lives which approximate those in the USA (39 years for non-residential structures, 14 years for machinery and equipment) for all six economies in his study. Focusing on the analysis of catch-up with the leading economy, the point is to correct for the impact of differing asset live assumptions on the comparative levels and growth of capital stocks. At the aggregate level, such standardization can lead to problems, for instance, of inter-country differences in capital per worker being incompatible with observed inter-country differences in output per worker (Broadberry, 1998: 399). The available Hungarian (Katus, 1970: Table 42, 109) and German capital stock data for the pre-1914 period (Hoffmann, 1965: Table 39, 253-254) cannot readily be broken down and re-assembled for standardization purposes, regardless of whether standardization is desirable in the first place. Hence no attempt was made at standardization along the lines suggested by Maddison.[13]

There is much debate in the literature on whether to choose gross or net measures of fixed capital stocks in productivity computations and comparisons (cf. O'Mahony, 1996: 166). In the present case, the nature of the available data suggests that gross measures can be re-constructed in a far more coherent and consistent fashion than net measures. Fellner's (1915) wealth survey provides the starting point for the approximation of Austria's gross domestic fixed capital stock in 1911/13 and its extrapolation back to 1870.

The new estimates comprise

(1) buildings: agricultural, commercial/industrial, public, non-agricultural dwellings;
(2) machinery;
(3) vehicles: steam ships, sailing ships and boats, vessels for inland navigation, locomotives, passenger cars, freight cars;
(4) infrastructure: roads and bridges (state and regional roads, district roads, municipal roads), railway tracks.

They exclude livestock, inventories and work in progress.

[13] See O'Mahony (1996) for a careful comparative evaluation of the impact of alternative asset life assumptions on capital stock growth and capital's contribution to both labour productivity levels and growth for the post-1950 period.

Table B.1 below reports the capital stock estimates for selected years. For details on methods and sources used in the estimation as well as the full annual data set see Schulze (2005).

[TABLE B.1 HERE]

Appendix C

Educational Attainment of the Labour Force: Austria-Hungary and Germany

The human capital approximations for the Habsburg Empire and Germany are based on the average number of years' schooling at primary, secondary and tertiary. Following the procedure set out in Matthews, Feinstein, Odling-Smee (1982, Appendix E), they have been constructed, first, by estimating the number of years' schooling of each cohort in the population and, then, multiplying this number by the cohort's presence in the labour force. The estimates comprise both males and females. No adjustments were made for changes in attendance rates or effective length of the school year due to lack of data. Reflecting contemporary practice, the underlying sources report primary and secondary school enrolment for partially overlapping age groups. To avoid undue 'allocation' and weighting issues (which, in the end, would make no material difference in light of comparative enrolment numbers), no distinction has been made here between primary and secondary school attendance and, effectively, equal weights were accorded to any year of formal school education received during and over the whole age span of 6 to 18 years. Tertiary education (approximated over the age group 19 to 24 years), on the other hand, was given double weight in the overall measure of average years of schooling, reflecting the approximate remunerations premium accruing to those educated to university level or equivalent (Maddison, 1987).

The number of children enrolled at school (students at university) in given age ranges and at particular dates is converted into average years of schooling (AYS). This conversion is based on the assumption 'that the average number of years' schooling received between ages *m* and *n* by cohorts born in years *t-n* through *t-m* is equal to the proportion of children aged *m* through *n* in school in year *t*, multiplied by (*n*-*m*+*1*)' (Matthews, Feinstein, Odling-Smee, 1982, Appendix E, 572).

Details of the methods employed, sources used and results obtained on an annual basis are available from the author upon request. Table C.1 reports the educational attainment measures for selected years.

[TABLE C.1 HERE]

Table 1: Sectoral Employment Shares (per cent)

	Habsburg Empire						Germany	
	1869/70		1890		1910		1871	1910
	Austria	Hungary	Austria	Hungary	Austria	Hungary		
Agriculture	62.7	78.3	61.5	79.5	54.0	73.0	49.3	35.8
Mining	0.8	0.6	1.1	0.6	1.2	0.8	1.5	2.8
Manufacturing, crafts, utilities	17.3	6.6	18.9	7.3	21.4	11.1	27.5	29.4
Construction	2.2		2.4	1.0	3.3	1.6	-	5.2
Distribution, finance, transport	5.3	2.9	8.3	4.4	11.3	5.9	7.8	14.5
Govt., professional & personal services	11.7	11.6	7.8	7.2	8.8	7.6	13.9	12.3
Total	100	100	100	100	100	100	100	100

Sources: Appendix A; Hoffmann (1965).

Table 2: Composition of GDP in Constant 1913 Prices (per cent)

	1870		1890		1910	
	Austria	**Hung.**	**Austria**	**Hung.**	**Austria**	**Hung.**
Agriculture	26.7	48.8	26.8	53.1	22.7	49.9
Mining	0.8	0.6	1.5	0.7	1.9	1.1
Manufacturing	18.9	6.5	20.8	9.5	24.9	13.3
Crafts	6.4	2.4	6.7	3.4	7.9	4.5
Construction	3.5	1.4	2.7	2.3	2.6	2.3
Distribution, finance, transport	9.3	4.2	14.3	6.4	16.6	8.7
Public and private services	20.2	20.1	15.1	12.2	13.9	10.8
Housing	14.2	16.0	12.1	12.4	9.5	9.4
Total	100	100	100	100	100	100
Source: Schulze (2000), with minor corrections (see text).						

Table 3: Value-Added per Worker in Constant 1913 Prices (K), Austria

	1870	**1890**	**1910**	**□ p.a. (%) 1870/1890**	**□ p.a. (%) 1890/1910**	**□ p.a. (%) 1870/1910**
Agriculture, forestry	349	416	544	0.88	1.35	1.12
Mining	823	1,382	2,122	2.63	2.17	2.40
Manufact., crafts, construction	1,207	1,354	1,855	0.58	1.59	1.08
Distrib., finance, transport	1,438	1,650	1,899	0.69	0.71	0.70
Public, private serv.	1,413	1,842	2,039	1.33	0.51	0.94
Total of above	702	840	1,171	0.90	1.67	1.29
GDP[a]	818	956	1,292	0.78	1.52	1.15
[a] includes housing.						
Sources: See text.						

Table 4: Value-Added per Worker in Constant 1913 Prices (K), Hungary

	1870	1890	1910	□ p.a. (%) 1870/1890	□ p.a. (%) 1890/1910	□ p.a. (%) 1870/1910
Agriculture	338	475	662	1.72	1.67	1.69
Mining	648	1,058	1,525	2.48	1.85	2.16
Manufact., crafts, construction	837	1,278	1,514	2.14	0.85	1.49
Distrib., finance, transport	784	1,039	1,438	1.42	1.64	1.53
Public& private serv.	934	1,205	1,373	1.28	0.65	0.97
Total of above	455	623	877	1.58	1.72	1.65
GDP[a]	542	711	968	1.37	1.55	1.46

[a] includes housing

***Sources**:* See text.

Table 5: GDP per Worker (1990 Intl. $)

	Austria	Hungary	Habsburg Empire	Germany
1870	2,731	1,809	2,333	4,592
1890	3,191	2,373	2,841	6,012
1910	4,316	3,232	3,849	8,092

Sources: See Figure 1 on GDP. Labour force: Austria, Hungary – Appendix A; Germany – Hoffmann (1965).

Table 6: Decomposition – Growth in Aggregate Output Per Worker (per cent per annum)

	Δ Y/L (% p.a.)	Intra-sector	Static shift	Dynamic shift
Austria				
1870-1910	1.29	1.01	0.20	0.08
1870-1890	0.90	0.89	0.06	-0.05
1890-1910	1.67	1.22	0.37	0.08
Hungary				
1870-1910	1.65	1.46	0.08	0.11
1870-1890	1.58	1.67	-0.10	0.01
1890-1910	1.72	1.36	0.32	0.04
Habsburg Empire				
1870-1910	1.41	1.15	0.18	0.08
1870-1890	1.14	1.18	0.00	-0.04
1890-1910	1.69	1.22	0.39	0.08
Germany				
1871-1910	1.42	1.15	0.15	0.12
1871-1890	1.38	1.12	0.20	0.06
1890-1910	1.45	1.27	0.15	0.03
Note: growth of total product per worker *excluding* housing.				
Sources: See text.				

Table 7: Sources of Labour Productivity Growth (per cent per annum)

	□ Y/L	contribution □ K/L	contribution □ H/L	contribution □ TFP
Austria				
1870-1910	1.29	0.57 *0.57*	 *0.36*	0.72 *0.36*
1870-1890	0.90	0.54 *0.54*	 *0.29*	0.36 *0.07*
1890-1910	1.67	0.59 *0.59*	 *0.43*	1.08 *0.65*
Hungary				
1870-1910	1.65	1.01 *1.01*	 *0.34*	0.63 *0.30*
Germany				
1871-1910	1.42	0.51 *0.51*	 *0.04*	0.91 *0.85*
1871-1890	1.38	0.44 *0.44*	 *0.04*	0.94 *0.90*
1890-1910	1.45	0.57 *0.57*	 *0.05*	0.88 *0.81*
Sources: See text.				

Table 8: Output and Factor Input Growth, 1870-1910 (per cent per annum)

	Output	Capital[c]	Labour	School	TFP[d]
Agriculture					
Austria	1.39	1.08	0.27		
Hungary	2.15	2.86	0.45		
Germany[a]	1.63	1.16	0.46		
Industry					
Austria	2.40	4.74	1.26		
Hungary	3.82	4.62	2.25		
Germany[a]	3.55	4.82	2.00		
Total Economy[b]					
Austria	1.94	2.55	0.64	1.68	0.36
Hungary	2.29	4.01	0.63	1.61	0.30
Germany[a]	2.74	3.02	1.31	1.43	0.87

[a] 1871-1910
[b] GDP *excluding* housing
[c] non-residential
[d] weights as used in Table 7

Sources: See text.

Table A.1: Sectoral Labour Force Levels and Population (1,000)

	1869/70		1890		1910	
	Austria	**Hungary**	**Austria**	**Hungary**	**Austria**	**Hungary**
Agriculture (ALF)	6,821.72	6,459.68	7,507.88	7,250.62	7,591.10	7,727.06
Mining	85.27	46.93*	129.56	53.77*	165.03	83.01*
Manufacturing, crafts, utilities	1,883.51	540.86	2,302.71	669.05	3,005.91	1,182.02
Construction	235.51	-	293.58	94.21	466.58	166.09
Distribution, finance, transport	576.49	239.69	1,012.04	398.79	1,579.92	616.57
Govt., professional, personal services	1,273.93	962.45	955.81	656.20	1,240.16	807.69
Total labour force (TLF)	10,876.43	8,249.61	12,201.58	9,122.64	14,048.71	10,582.44
Total population (TPOP)	20,394.98	15,512.38	23,895.41	17,463.79	28,571.93	20,886.49
ALF/TLF	.63	.78	.62	.79	.54	.73
TLF/TPOP	.53	.53	.51	.52	.49	.51

* mining and iron smelting

Sources: Austria, Hungary - Censuses 1869/70-1910; Eddie (1968: Table 4, 210); Sandgruber (1978: Table 51, 115); *MSE* 1874-1912; *SJB* 1869-1889; *ÖSH* 1890-1912.

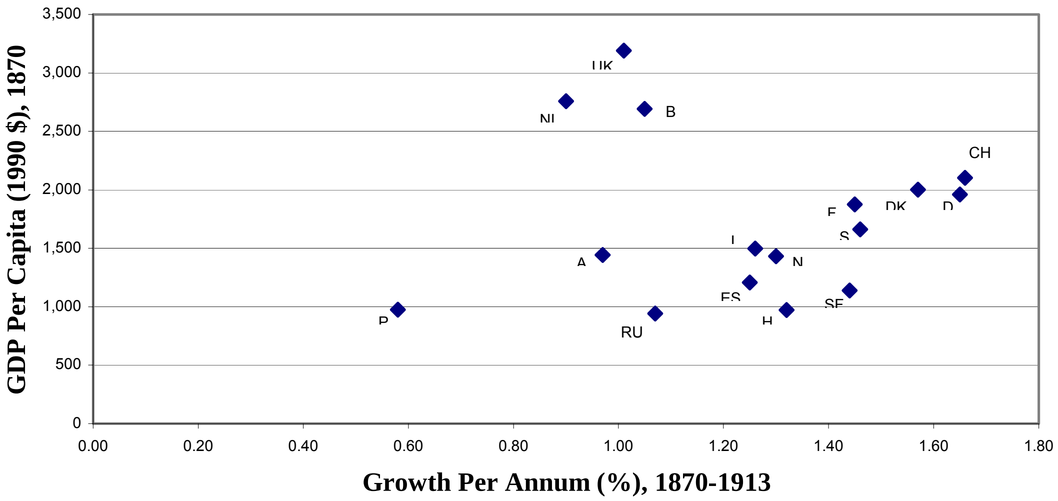
Table B.1: Austria - Gross Stock of Domestic Reproducible Fixed Assets in Constant 1913 Prices (mill. K)

	1870	1880	1890	1900	1910
buildings	9,901.0	11,518.9	13,189.6	15,489.2	18,311.8
of which					
agricultural	*5,255.1*	*5,612.6*	*5,754.4*	*6,349.1*	*7,335.0*
public, comm.	*1,550.3*	*2,344.4*	*3,206.3*	*4,112.5*	*5,081.1*
residential	*3,095.6*	*3,561.9*	*4,229.0*	*5,027.6*	*5,895.7*
machinery	605.4	1,144.4	1,897.5	3,603.8	6,803.5
vehicles	473.7	736.5	999.9	1,423.0	2,053.2
of which					
ships, boats	*169.9*	*176.5*	*178.0*	*277.9*	*461.3*
rolling stock	*303.8*	*560.0*	*821.9*	*1,145.1*	*1,591.9*
infrastructure	2,415.1	3,692.4	4,692.7	5,789.8	6,878.6
of which					
roads, bridges	*1,034.8*	*1,101.0*	*1,212.9*	*1,373.4*	*1491.9*
railways	*1,380.3*	*2,591.4*	*3,479.8*	*4,416.4*	*5,386.7*
total	13,395.2	17,092.2	20,779.7	26,305.8	34,047.1
total non-residential	10,299.6	13,530.3	16,550.7	21,278.2	28,151.4
Sources: Schulze (2005).					

Table C.1: Educational Attainment of the Labour Force

	Austria		Hungary		Germany	
	AYS	LF schooling (index)	AYS	LF schooling (index)	AYS	LF schooling (index)
1870	4.12	52.5	3.36	52.9	7.78	57.5
1880	4.35	55.4	3.54	55.2	7.84	64.5
1890	4.86	68.1	4.04	70.4	7.94	74.2
1900	5.51	79.7	4.63	88.6	8.05	85.7
1910	6.20	100	4.95	100	8.17	100
Source: See text.						

Figure 1: Levels and Growth Rates - GDP Per Capita



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