National Accounting and the Business Cycle in Germany 1851 – 1913

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Abstract

We explore and compare the cyclical behavior of three measures for the net national product in Germany 1851 – 1913. The two income-based estimates and one expenditure-based estimate, taken from Hoffmann (1965)'s and Hoffmann and Müller (1959)'s classical contributions, were adapted to recent historical research findings, most importantly newer estimates of the capital stock. While differences in the net national product levels of the three series have already been noted, we also find differences in their cyclical behavior. The cyclical behavior of each series differs when analyzed with different econometric techniques. We show that the income and expenditure measures for net national product exhibit substantially different cyclical behavior, irrespective of the econometric methodology. Especially for the 1870s, the usual boom from 1870-73 with the subsequent recession is not found in the income series according to Hoffmann/Müller, instead we find a recession in the early 1870s. We offer some economic facts, which explain this recession. Furthermore, the "Great Depression" was only found with one method.[1]

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The trend we decide upon will determine what fluctuations will be. But irregularities and cyclical fluctuations will, in turn, determine the trend (Schumpeter, Business cycles, Vol. 1, p 202).

1 Introduction

Investigation of business cycles occupies a central position in macroeconomic history. Questions of the dating of cycles in Germany remain controversial. This paper contributes to the dating and interpretation of business cycles during 1851-1913. German economic history in the investigated period can be characterized by three main periods, see e.g. Tilly (1978), p. 386/7. The take-off period (1850-73) is marked by growth of the heavy industry and culminated in a boom (Gründerzeit) following German unification, 1870-73. The second phase, called the "Great Depression" (1873-95) is triggered by the financial crisis in 1873 and characterized by falling prices and relatively slow growth. The final period (1896-1914) is coined by very rapid growth and structural change, led by new industries.

Economic historians use different concepts for the measurement of German economic history. In the 19th century itself, the business cycle was identified by observable price or financial market data due to missing national accounting data before 1891, see e.g. Wirth (1874). More recent contributions rely on two different measurement approaches. On the one hand, a variety of diffusion indices is calculated as the sum of several real and monetary time series. A recession is then defined as a period with more contracting than expanding series. Spree (1977), Spree (1978), and Grabas (1992) employ this method. On the other hand, business cycles are identified using estimated national accounting data, see e.g. Craig and Fisher (1992). National accounting data are also employed for an assessment of growth during the German industrialization, e.g. Borchardt (1977), Metz (1998).

Researchers, who follow the second approach, commonly use output and expenditure based estimates of German net national product (NNP). Output- and expenditure-based estimates of German NNP have been investigated by Anglo-American and German contributions respectively, see e.g. Craig and Fisher (1992), Backus and Kehoe (1992) and Borchardt (1976). The third national accounting concept, the income-based estimate, has so far been neglected. We compare two income- and one expenditure-based estimate of German NNP. The estimates are taken from Hoffmann and Müller (1959) and Hoffmann (1965). One expenditure data set and one income data set are taken from Hoffmann (1965). They are calculated by estimating consumption, investment and external balance figures or capital and labor income data for the income series. The second income based series is taken from Hoffmann and Müller (1959). Here a completely different approach is applied by estimating income from official tax records. We correct the estimated series by

using results of more recent historical research, most importantly the estimates of the capital stock.

An important issue in business cycle measurement is the employed methodology. To get a business cycle from a univariate time series like NNP, one needs to decompose the data into a trend component and a cyclical component. Clearly, the method for calculating a trend will influence the resulting cycle. We decided to employ a log-linear and a piecewise log-linear trend model, the Hodrick-Prescott filter and the Beveridge-Nelson decomposition to calculate the trend and the business cycle. Thereby we can check the robustness of the results to changes in methods for trend-cycle decomposition.

Several results are noteworthy. First, we show that the cycles of the series are different. While the income and expenditure cycle according to Hoffmann are quite similar, substantial differences arise between these two and the income series according to Hoffmann and Müller. The quality of the data should be discussed, and it is not clear, which estimate correctly depicts German NNP.

Second, the income cycle of Hoffmann and Müller does not exhibit a "Gründerzeit", that is a boom for the early 1870s, but it shows a boom for the late 1870s. This contradicts the evidence from the series by Hoffmann and earlier contributions. Spiethoff (1955), Borchardt (1976), Spree (1978), Metz and Spree (1981) and Craig and Fisher (1992) report a recession in the late 1870s and find a boom in the early 1870s. During the 1870s, after the German unification, several major events occurred in economic policy, such as monetary unification, foundation of the Reichsbank (central bank), introduction of external trade tariffs and nationalization of railways. While there are many arguments for a "Gründerzeit" with a following recession, in section 5 we report economic evidence supporting the alternative view of a recession followed by a boom.

Third, we do not find evidence for a "Great Depression" lasting from 1873 - 1896, except for one econometric method, the log-linear trend model, which overstates the length of the business cycle. In line with Henning (1996), we thus question the general hypothesis of a "Great Depression".

The paper is organized as follows: The next section describes the employed econometric methods, followed by a section on the data. Section 4 presents the results and section 5 discusses the results in the historical context. The final section concludes.

2 Trend-Cycle Decomposition: Empirical Strategies

To investigate the German business cycle during 1851-1913, we use several econometric techniques. The univariate time-series is decomposed into a secular or growth component and a cyclical component. The cyclical component, interpreted as the

business cycle, is analyzed to assess recessions and booms.[2] We define a recession as a period of actual NNP lower than trend NNP until the local minimum. A boom is a period of actual NNP higher than trend NNP until the local maximum. Local refers to the interval between two crossings of the trend line. Canova (1993) examines the business cycle properties of time series using a variety of detrending methods. Stylized facts vary widely across detrending methods, and alternative detrending filters extract different types of information. By employing several detrending techniques, we can check the robustness of the boom-recession pattern.

The log-linear model and piecewise log-linear model rely on calculating a deterministic linear trend. The Hodrick - Prescott filter smoothes a given time series. The final method, the Beveridge-Nelson decomposition, decomposes a series into a stochastic trend and a stationary residual.

For the log-linear trend model, we define y_t to be our one of our NNP series of interest (in logs), the cycle will be defined as the residual of the following OLS regression:

$$y_t = \alpha + \beta t + u_t \tag{1}$$

Since y_t is in logs, the estimate for β, $\hat{\beta}$, gives the average trend growth over the investigated period.

The second method, a piecewise log-linear trend model, is motivated by the fact that trend NNP growth might vary over a certain period. We look at a time period of more than 60 years, therefore it is quite likely that trend output growth has changed. It is, of course, a matter of judgement how often the growth path has changed.[3] To get sensible estimates of the trend, we decided to allow at most for one change in the growth path. We have focused on years for which the economic history literature suggests that there is a clear a priori evidence that the growth path changed.[4] We tested formally the existence of a structural break with the Chow-breakpoint test.

The Hodrick - Prescott filter (HP) is a method for smoothing a time series.[5] Technically speaking, it consists of two components: (i) minimize the distance between the actual and the trend value, (ii) minimize the change of the trend value. As these two objectives contradict each other, one has to assign a relative weight to the components.[6] Depending on the weight, the HP filtered series looks like a moving average of the original series.

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[2]For an extensive overview of business cycle analysis refer to Diebold and Rudebusch (1999).

[3]For a discussion and application to historical data, see Evans and Quigley (1995).

[4]Visual inspection of the series, the residuals of the model with just one linear trend, and the recursive residuals, were further indicators of the determined years in which a breakpoint is most likely.

[5]For details see Cogley and Nason (1995). They point out that in case of stochastic trends (difference-stationary series) the HP filter can artificially generate cycles.

[6]For yearly data the standard is to choose a relative weight of $\lambda = 100$. We tested for the robustness of the smoothing to different λ's. The results remain similar.

Modern macroeconemetric research often finds stochastic trends in GDP (e.g. Nelson and Plosser (1982)).[7] The French-German war could be an example of a stochastic shock impacting on the trend. In order to account for the stochastic nature of the trend, we performed our last method, proposed by Beveridge and Nelson (1981). It allows to decompose a series into a stochastic trend and a stationary residual. If the national product can be characterized by a stochastic trend, shocks to the economy (e.g. an innovation) will have a permanent and lasting effect on the economy. The trend rate of NNP is represented by a deterministic drift component and a stochastic component, which is the sum of all past shocks. Whereas the drift rate is constant, the stochastic component of the trend varies every period, since in every period there can be a realization of a shock, which has, by the nature of the process, a permanent impact on the economy. The idea is that the trend reflects productivity change.[8] The total trend component thus includes some cyclical movements of productivity, since positive and negative real shocks drive the behavior of the economy. The method relies on estimating an ARIMA model; problems inherent to ARIMA specifications are thus carried over to this detrending method.[9]

3 The Data

The net national product at factor costs or market prices can be calculated in three ways: from the expenditure, income and output sides.[10] In the national accounting scheme, the three approaches are based on the expenditure, output and income accounts, and should lead to identical aggregates. In Germany, national accounting starts in 1891, and up to World War I only the income approach is calculated by the Statistische Reichsamt (Imperial Statistical Office). The German economic historian, Walther Hoffmann, estimated in two seminal contributions national accounting figures for Germany (Hoffmann and Müller (1959) and Hoffmann (1965)). Fremdling (1988), and Fremdling (1995) already pointed out that there are large

[7] However, the validity of the statistical approaches to measurement of unit roots has been questioned frequently. Rudebusch (1993), for example, argues that unit-root tests have low power, not only with near unit root alternatives, but also with substantially different alternatives. For details on this in a historical context, see e.g. Metz (1998).

[8] Lippi and Reichlin (1994) question this assumption and show that the empirically observed slow diffusion of technological progress leads to smoother trends. This can be of special relevance for the 19th century since communication networks were far less developed. Furthermore missing patent laws in Germany until 1877 prevented the fast spread of new knowledge via licensing.

[9] Christiano and Eichenbaum (1990) point out that several specifications fit the sample autocorrelation of the data fairly well. Since different ARIMA models having the same short run properties may have very different long-run features, alternative specifications may lead to very different decompositions into trend and cycle.

[10] We did not use the output approach, since data for the critical periods are interpolated over long periods and substantial critique was already pointed out by Holtfrerich (1983), Fremdling (1988), and Fremdling (1995).

differences in the level of these series and recalculations for the early 1850s indicate that Hoffmann (1965) understates the true level of economic activity in Germany.[11]

In the following we discuss the expenditure and the two income approach data and present our corrected NNP series. Hoffmann (1965, pp.825) estimates private and public consumption, net investment, and exports and imports to derive the NNP from the expenditure side. Hoffmann's expenditure series is the most popular series for macroeconomic history within Germany.

One of the main problems is the calculation of investment expenditure for the secondary sector. In effect, Hoffmann estimates a capital stock for Germany based on capital tax (Gewerbekapitalsteuer) data in the duchy of Baden. From these tax records Hoffmann estimates the capital stock in Baden. He then multiplies it with an average number of 31, a number reflecting population and economic size of the duchy relative to the whole of Germany, to extrapolate the Baden figures to Germany. The yearly change in capital stock is the net investment Hoffmann used. Therefore, the expenditure approach excludes depreciation and leads to a NNP at market prices, not to a GNP. Schremmer (1987), based on the same archival records, re-calculates Hoffmann's figures. Schremmer accounts for changing tax legislation in Baden, left out by Hoffmann. He ends up with investment figures around 2.89 times higher than Hoffmann for the years up to 1877. In other words, Hoffmann's NNP at market prices is too low. In addition, the calculation of net investment from a capital stock series left out unplanned investment in inventories. This can dampen the cyclical behavior of NNP, because inventories rise during downturns and fall during upswings.

To account for the low investment figures in Hoffmann's calculations, we re-calculated the expenditure series with the higher capital stock data by Schremmer, resulting in higher net investment and thus NNP. The series, like the other employed series, was deflated with Hoffmann's implicit price index[12] and is thus expressed in constant 1913-prices. We label the series "EH".

National income is calculated by adding up labor and capital income in the economy.[13] There are two independent estimates available, one by Hoffmann (1965, pp.505) and a second by Hoffmann/Müller (1959, pp.39). Both series lead to a NNP at factor costs in current prices.

Hoffmann and Müller (1959) present a NNP at factor costs series based on the official income calculation of the Statistische Reichsamt, which published such a series from 1891 onwards. Hoffmann/Müller extend the official series back to 1851

[11] Differences between the income, output, and expenditure series are well known for the UK, see e.g. Crafts (1995) and Greasley and Oxley (1995).

[12] We compared this price index with an independent price index by Jacobs and Richter (1935). Both are nearly identical.

[13] Rent income and profits are included in capital income.

by using archival material from several tax offices, starting with Prussia in 1851.[14] After 1871, data for other states become available and in 1913 over 90% of population are covered by these data.[15]We label this series "IHM".

However there are three shortcomings in using data from the tax offices (see Ritschl and Spoerer (1997), p. 30). First, only after the Prussian tax reform of the early 1890s, and with similar reforms in other states, was the taxation base large enough to give detailed accounts. Second, tax free minimum income was not measured and, therefore, the resulting income estimation depends on the personal income distribution.[16] Finally, there could have been tax evasion, especially of capital income.[17]

In a second publication, Hoffmann (1965) estimated national income with a totally different method. He estimated the number of employees in each subsector of the economy and calculated for the subsectors the average yearly income per worker.[18] The product of both gives the labor income of the economy. Capital income was calculated by applying an average rate of return on the capital stock.

As already discussed, Hoffmann's capital stock estimation is too low; In addition he assumes a constant profit rate on capital of 6.68 per cent, a rather low value as Fremdling points out (see Fremdling 1995, pp.88). Again we took the capital stock figures by Schremmer and applied the constant profit rate on the corrected capital stock to get our capital income. We label the series "IH".

Income series yield a NNP at factor costs. We add indirect taxes to get NNP at market prices.[19] Spoerer (1998), p. 178, already calculated the indirect taxes for 1901 to 1913, and he roughly estimated that the growth rates of indirect taxes for Germany were around 7 per cent from 1850 to 1880, and circa 1 per cent from 1880 to 1900. By applying these growth rates a far lower level of indirect taxes in 1850 was calculated compared with Hoffmann's figures. We decided to reduce the

[14]We linearly interpolated the income series according to Hoffmann/Müller for the missing values 1867, 1868 and 1870. This is unproblematic since the series is quite smooth anyway. Furthermore only three years are concerned.

[15]From 1851 to the mid 1860s, Prussian data cover around 48 per cent of the German population. After the unifications wars (1864/66) this figure rose to 60 per cent. Prussia was a very heterogenous state (agriculture in the east, industry in the west) and later studies showed that the Prussian income development was representative for Germany. In 1874, data from Prussia, Saxony, Hesse, Hamburg and Bremen are available and 70 per cent of the German population are covered.

[16]In Saxony - other data are not available - the lowest quartile earned 8.2 per cent of the total income in 1874 and 7.2 per cent in 1913; calculated from Jeck (1970). The bias from this source seems quite small.

[17]In 1913, a Reichstag (national parliament) commission estimates the tax evasion in Germany, the data in Hoffmann/Müller include the findings of this study.

[18]Fremdling (1995), pp.85, argues that there is no clear bias in this calculation.

[19]We left out any correction for subsidies because in 1913 they amounted to only 30 Million Mark, whereas the indirect taxes were around 2867 Million Mark.

growth rate of indirect taxes for the years 1850 to 1880 from 7 to 5 per cent. For an overview of the corrections undertaken to get NNP at market prices see Table 1.

Abbreviations	**source**	**capital stock correction**	**Indirect taxes**
IHM	Hoffmann/Müller 1959		yes
IH	Hoffmann 1965	capital income	yes
EH	Hoffman 1965	net investment	no

Table 1: National product corrections. IHM = Income Hoffmann/Müller, IH = Income Hoffmann, EH = Expenditure Hoffmann.

In this way, we obtained three series for the German NNP at market prices and the three should be similar. Figure 1 shows the evolution of the real national product

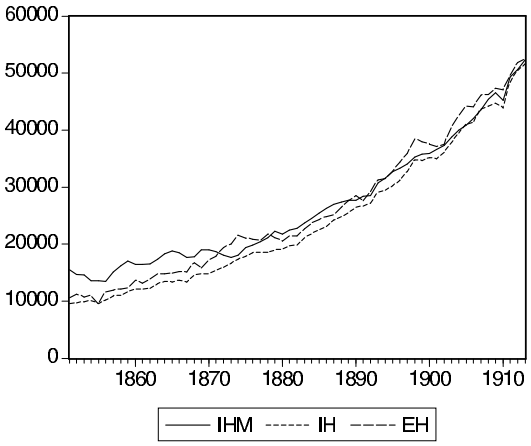

Figure 1: The evolution of real NNP according to three different measures, in million Mark.

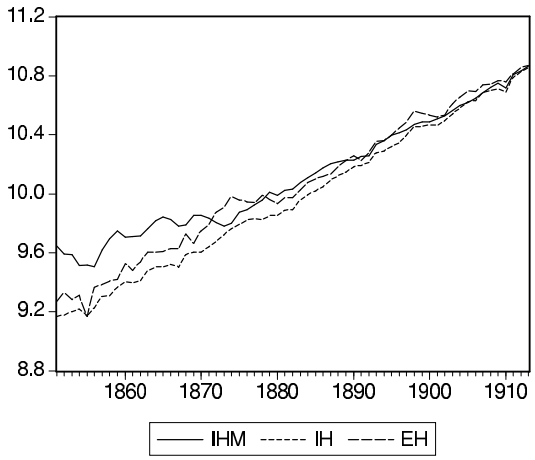

Figure 2: The evolution of the log of real NNP.

in Germany according to three different measures in million Mark. Figure 2 shows the log of the real NNP series.

4 Results

This section compares the three series of NNP analyzed with the log-linear and the piecewise log-linear trend model, the Hodrick-Prescott filter and the Beveridge-Nelson decomposition. Table (3) in the appendix precisely summarizes all the recession and boom years of all series.

The basic results of the log-linear model are depicted in Figure 3. The Figure shows a very long period with actual NNP lower than trend NNP from the 1870s to the 1890s. Especially for IHM there is a clear downturn in the beginning of the 1870s and the series series does not cross the trend line before 1894. Rosenberg (1967) has labelled the period 1873-96 as the "Great Depression". During this period, prices and profits fell significantly. Tilly (1978) equally calls this period the time of

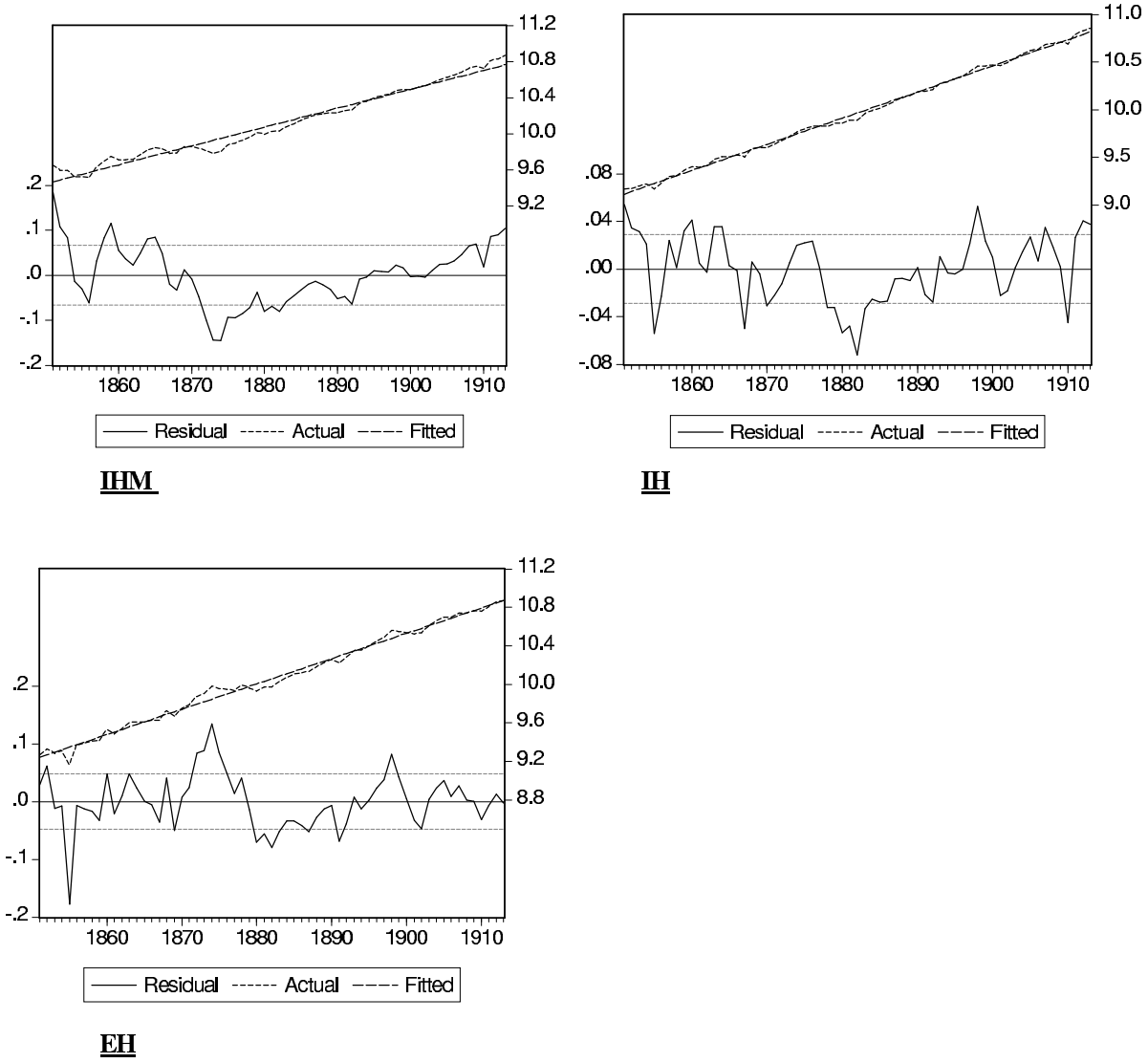

Figure 3: The business cycle calculated as the residual of a regression of the log series on a linear trend.

the "Great Depression". Thus, with the log-linear trend model we find supportive evidence.

However, the term "Great Depression" was criticized later, see e.g. Borchardt (1985). The existence of the "Great Depression" appears to depend on the econometric method. As can be seen especially for the IHM data, there is a clear sustained upward movement of the cycles from 1874 to 1913. The log-linear model tends to exhibit long cycles. This results from the fact that the model assumes only one constant linear growth component for the entire sample period. The depicted "cycle" appears to capture changes in long-term growth patterns.[20]

Noteworthy is the development of the cycle in the 1870s. The EH series shows a

[20]Similarly, for IH and EH, the cycle is in an upward movement from 1880 to the mid/late 1890s.

strong boom for 1870 to 1874, and the IH series for 1873 to 1876 but less pronounced, whereas the IHM series does not show a boom, but a long recession from 1870 to 1874. IHM shrinks by 5.2 percent from 1870-74, whereas EH grows 26 percent. The early 1870s are usually described by strong industrial growth and booming stock markets, a period labelled "Gründerzeit". Borchardt (1985), p. 168, for example, points out that the investment rate reached 17.2 percent of NNP in 1874, compared to 8.7 percent in the 1850s. This high investment rate boosted capacity, output and income, but this was not found in IHM data.

To account for the above mentioned long cycles, which capture changing trend growth, we estimated the piecewise log-linear model with two subperiods of differing trend growth paths. Chow breakpoint tests indicate breakpoints in 1873 for the IHM series, 1877 for EH and 1882 in IH. The thesis of changing growth rates is thus confirmed. Classical contributions, e.g. Waltershausen (1923), support our finding of a structural break. For the IHM series we calculated a growth rate[21] of 2% for the entire period. For the first period 1851 - 1872, the growth rate was lower at 1.5%, for the remaining time the growth rate was 2.55%. For the IH series the growth rate is 2.7% for the entire period. For the first period 1851 - 1878, the growth rate was lower at 2.58%, for the remaining time the growth rate was 2.92%. For the EH series, growth is at 2.63% for the entire period. For the first period 1851 - 1876, the growth rate was higher at 2.99%, for the remaining time the growth rate was 2.76%.[22]

Thus, trend growth is generally higher in the second subperiod. Several reasons for higher growth can be found, e.g. the political unification with better interregional allocation of goods and factors, monetary unification and foundation of the Reichsbank, the new joint-stock company law, the patent, trademark and copyright laws.

The resulting business cycle is depicted in Figure 4. The piecewise log-linear model adds some information with respect to the cycle. Again, for IH we detect a recession 1869/70 and a following boom, lasting from 1873-76. In EH we find a boom starting only in 1872, whereas with the log-linear model the boom already starts in 1870. Also, the IHM series has a clear recession 1871/72. Noteworthy again is the countercyclical behavior of the series in the period 1870-72. While IHM has a recession, the other two series do not exhibit a recession. The data are therefore again to be interpreted with caution.

A boom period for IHM in the 1870s lasts from 1875 to 1879. For the (normal) linear model, we did not find a boom for the entire time span from 1870 to 1895. But with a variable log-linear model, we detected four booms. Thus, with the piecewise

[21] The slope coefficient of the regression.

[22] The lower growth rate of the entire period compared with the two subsamples can be explained by the econometric method. A downward outlier in the middle of the sample can bias the estimate of the second period growth rate upward.

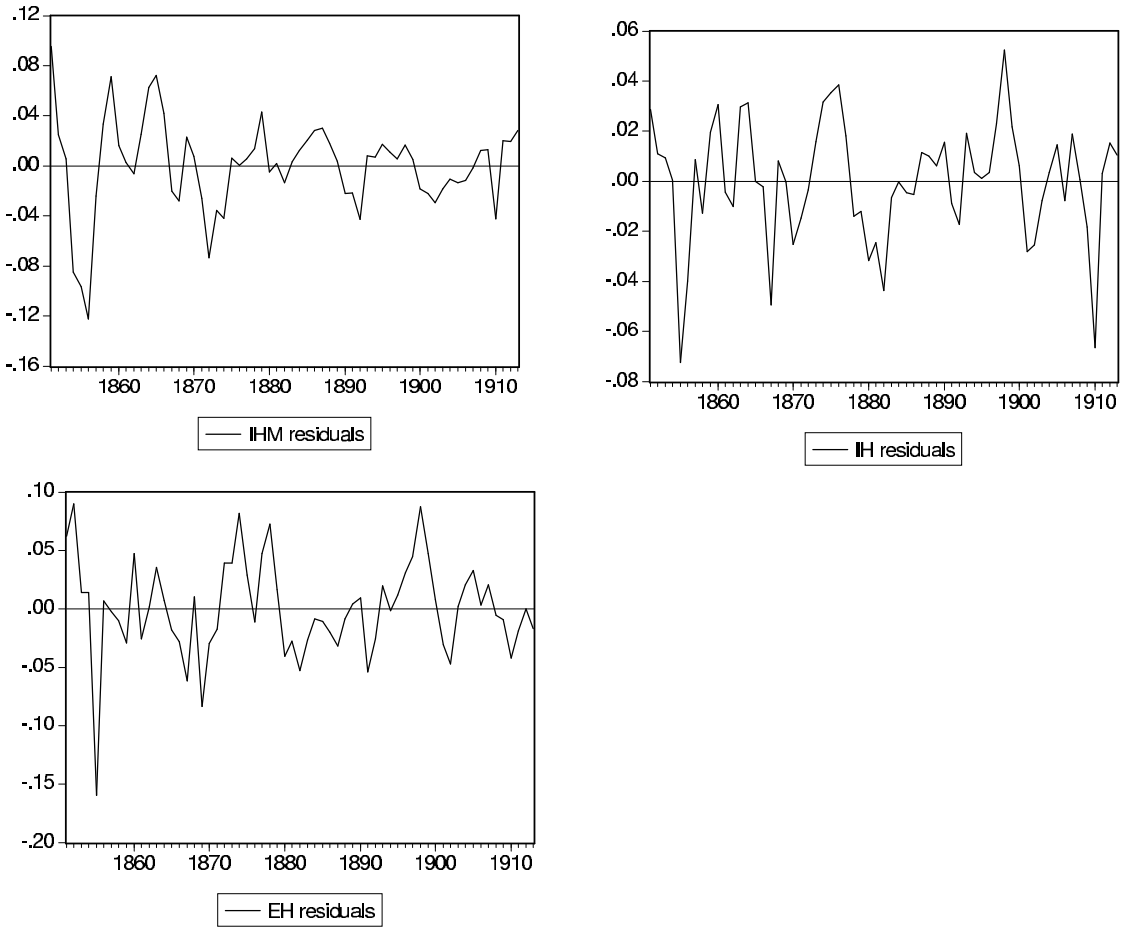

Figure 4: The business cycle calculated as the residual between the original series and a variable linear trend.

log-linear model, there is no evidence for a "Great Depression". Heavy industry, as well as chemical and electric industries indeed resumed strong growth during the 1880s, a fact captured by the piecewise log-linear model.

The basic results of the Hodrick-Prescott filter can be seen in Figure 5. The HP filter is much more sensitive to changes in trend, and therefore, we report a significantly higher number of boom and recession periods than in the linear model and the results correspond well to the piecewise log-linear model. With respect to booms we have evidence for upswings in the mid to late 1870s and the mid to late 1880s. Both again contradict the hypothesis of a "Great Depression", which appears to be a statistical artefact. Again, special emphasis should be put on the results concerning the early 1870s for EH and IHM data. By HP-filtering the EH data the boom lasts from 1872 to 1874. It thus starts two years later than in the linear model and is as in the piecewise model. For IHM, the recession now lasts from 1872-1873, and thus starts one year later than in the piecewise model.

The usual economic interpretation given to the Beveridge-Nelson decomposition is that the trend component of the output series represents the behavior of the

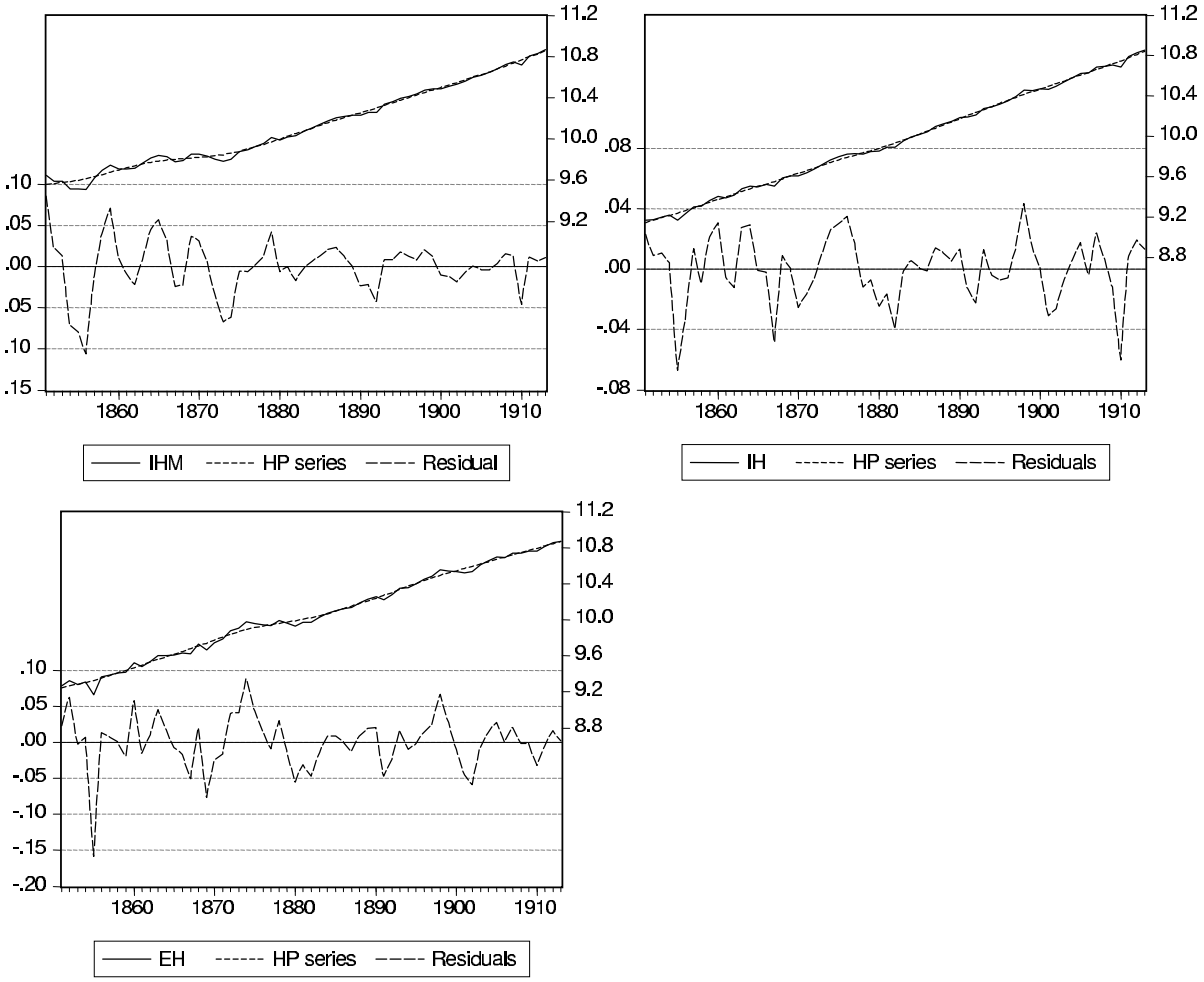

Figure 5: The business cycle calculated as the residual between the original series and the HP transformed series.

technology level in the economy. This level is supposed to follow a random walk with drift. The remaining component of the series captures those shocks that do not have lasting effects on the economy.[23]

[23]For performing a Beveridge-Nelson (BN) decomposition one has to test for the presence of a unit-root, which is a prerequisite for BN decomposition. By employing the Augmented Dickey-Fuller test (ADF), the null-hypothesis of a unit root could not be rejected for IHM. We also performed a test according to Kwiatkowski, Phillips, Schmidt and Shin (1992) (KPSS), and could reject the H_0 of trendstationarity. We chose as lag truncation parameter the value of $l = 8$ as done in the article by Kwiatkowski et al. (1992) for GDP. For the series IH, the evidence is mixed. While the ADF test indicates that we need to reject the unit-root hypothesis, the KPSS test indicates that we need to reject the trend-stationarity hypothesis. It is therefore not clear whether BN decomposition can sensibly be performed. For EH, the evidence suggests that the series does not contain a unit root but is trend stationary. Since the power of unit root tests is low and to get a complete picture of the series, we decided to perform the BN decomposition with all three series. However, results, especially for IH and EH, should be interpreted with caution. We performed a Box-Jenkins approach for fitting an ARMA(p,q) model on the stationary, differenced variable. The approach indicated a specification for IHM with $p = 0, q = 2$. The approach indicated a specification for IH with $p = 0, q = 3$ and for EH with $p = 0, q = 2$. The decomposition was performed according to an

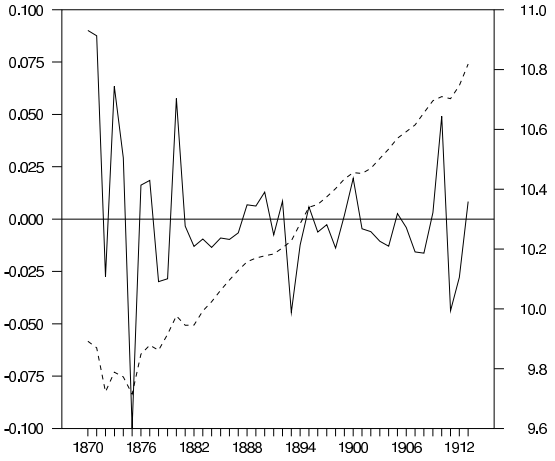

Figure 6: Beveridge-Nelson decomposition for IHM.

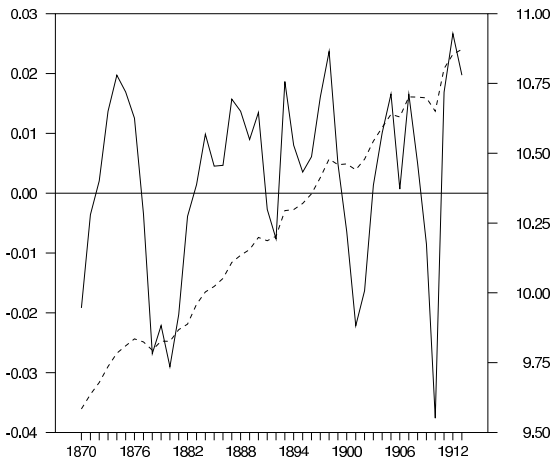

Figure 7: Beveridge-Nelson decomposition for IH.

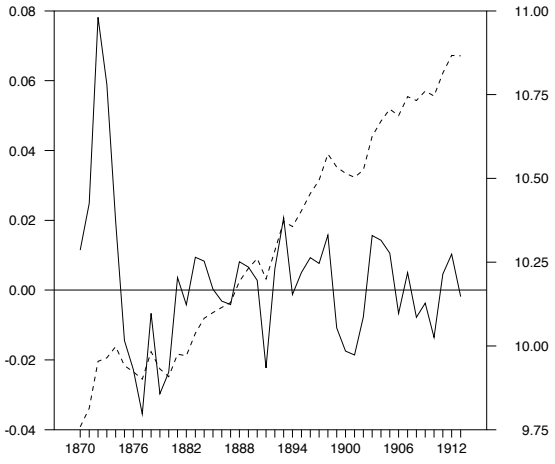

Figure 8: Beveridge-Nelson decomposition for EH.

The behavior of the trend component is very similar to the three original series. This means that a large portion of the variation in the original series is caused by permanent shocks. The three measures for the national product discussed in this section again show quite different behavior.

First, if we look at the behavior of the permanent component, IHM is clearly in a downward movement for the beginning of the 1870s (1870-72 and, after a short upward movement, until 1875). Whereas for IH, the trend component clearly moves upward until 1876. Also, the EH series moves upward until 1874 and again from 1880 onward. The IHM series appears to capture some negative shocks in the beginning of the 1870s, which cannot be found in the two other series.

Second, the variance of the cyclical component appears to be larger for the IHM series. Especially in 1870-1882, the amplitude is three times larger than for the two

algorithm of Newbold (1990); the algorithm was programmed for RATS by Paul Meguire.

other series. This indicates that, especially in the 1870s, the economy was hit by many short-term irregular shocks that are not captured by the IH and EH series.[24]

5 Discussion

In this section we discuss our results in the economic context of the epoch and relate it to previous research. We focus on three points: (1) the coherence of the data (2) the economic development during the 1870s, and (3) the "Great Depression".

A survey of our results ends up with only three clear recessions (1855, 1867, 1901) and three clear boom periods (1863, 1893, 1898), which can be found in all series irrespective of the econometric method. This indicates that the three series exhibit substantially different cyclical behavior. However national accounting requires equality of the series. It is not clear, which of the series correctly depicts German National Product.[25] However, the recessions of 1855, 1867 and 1901 have generally been found in the literature, see table 2.[26] Thus, these recessions can be considered as clear economic facts. But, for example, many contributions report a trough in 1879, which is interpreted as the end of the "Gründerkrise". We find only little evidence for the "Gründerkrise" and no evidence at all for the turning point in 1879.[27]

We can only partly confirm the "Gründerzeit", preceding the so-called "Gründerkrise" with our data and by our methods. For the EH data, we detect a boom period from 1872 to 1874, and with the simple linear model the boom already starts in 1870. This view of the boom is in line with those publication that employ EH data, e.g. Borchardt (1976), and Henning (1996). For the IH series, the boom lasts - independent of the method- from 1873 to 1876. The IH boom starts, when the EH boom is nearly over. Even more astonishing are the results won from the IHM data. With this data set, we report a recession period from 1871 to 1874, most significant in 1872. In the late 1870s we find signs of a recession in EH and IH, but a boom in IHM.

[24] This is not exactly in line with the evidence of the structural break analysis which indicated a structural break around 1873. But still the behavior of the series appears to be different in the period after 1880.

[25] Although EH and IH evolve quite similar, we cannot take this as evidence against IHM, since EH and IH are estimated in a similar way and published in the same book.

[26] Spree (1) from Spree (1979), p. 103; Spree (2) from Spree (1979), p. 108; Spree (3) from Spree (1977), p. 91; Spree/Metz from Spree/Metz (1981), p. 359; Grabas (1991), p. 103; Craig/Fisher (1992), p. 154; Spiethoff (1955), p. 146, Borchardt (1976), Bry (1960), pp.474. Spiethoff employs a diffusion index, Borchardt the expenditure series of Hoffmann.

[27] A similar data inaccuracy arises in the late 1850s. With all methods, the EH series shows a recession for 1859, but IHM shows a boom in 1858 - 59, and IH shows a boom in 1859 - 60. These booms in two series contradict not only the evidence from EH, but also from the literature reporting a recession in 1859. The difference is thus a data problem.

Spree (1)	Spree (2)	Spree (3)	Metz/Spree	Grabas	Craig/Fisher	Spiethoff	Borchardt	Bry
1820-1913	1820-1913	1840-1880	1820-1913	1895-1914	1870-1910	1850-1913	1850-1913	1870-1913
		1855						
1859 / 61							1859	
		1861				1860		
			1863 / 67			1867	1866	
		1870			1870			1870
	1874				1877			1878
1878 / 80	1879		1876 / 80		1880	1879	1879	
1886 / 88	1886				1882	1887	1886	1886
	1892		1890 / 91		1891			
1893 / 95				1894	1894	1894	1893 / 94	1894
1901 / 03	1901		1901 / 02	1902	1901	1902	1901	1902
								1905
1909 / 11	1908				1910	1908	1908	1908

Table 2: Recessions found in the literature. The year indicates the bottom or turning point of a cycle, and the dates under the author the covered time span.

This raises the fundamental question which boom-recession pattern corresponds to the real historical economic development in the 1870s. The boom in the early 1870s can be related to two economic interpretations. Following these interpretations, we give some supportive evidence for a recession in the early 1870s, which is a stylized fact of the IHM series.

In the view of Henning (1996), the prosperity of the early 1870s was evoked by several factors: rising military expenditure due to the German-French war, catching-up of private demand after the German victory, a positive monetary shock from the French reparation payments (15-20% of national product), the deregulation (the new joint-stock company law). The main cause for the following depression was the stock market crash 1873. The stock market crash was triggered by overinvestment in the industrial sector resulting in overcapacities and falling prices. Many companies were highly indebted and unable to pay back their debts, many industrial companies and banks therefore failed. The crises was prolonged by two decades of deflation, which increased the real interest rate.

The boom in the early 1870s can be interpreted in a different way. The large gold inflow resulting from French reparation payments increased the money supply significantly, and no central monetary authority existed to sterilize the inflow of gold. Therefore, M2 rose 45.1% between 1870 and 1873 (Tilly (1972/73), p. 347). This in turn led to increasing prices. The average inflation rate from 1860 to 1869 was 0.55%. The average inflation from 1869 to 1873 was 5.26%. If people inferred price expectations from past experience, they expect inflation to be far below the actual values. A further indicator of constant price expectations is the nearly unchanged nominal interest rate.[28] Companies, in view of rising prices for their own products and constant inflation expectations, increased production. Thus, they assumed a

[28]The nominal interest rate for Prussian government bonds was around 4.1-4.7% during the 1870s, Donner (1934), p.98.

rising relative price of their products, whereas, in fact, the general price level rose. In addition, companies also increased production capacities, financed with stocks and bonds. The government paid back its debt with French reparation payments. The former owners of government bonds now invested in company stocks and bonds, which explains the stock market boom. In 1873, companies and investors realized the inflation increase. The nominal profit-increase therefore did not equal the real profit-increase, the stock market bubble burst.

However, there are some indicators of a bad economic performance in the early 1870s, supporting the validity of the IHM data. First, in 1870/71, the French-German war might have influenced the economic development in a negative way, since scarce resource were destroyed or in unproductive use. During the course of the war, some big companies failed, e.g. Strousberg, the German "railway king". The impact of the Strousberg failure is around 400 - 600 Million Mark in current prices, or 3 - 4 % of 1871 NNP, see e.g. Stern (1978) pp.439.[29] After reforming German joint-stock companies law in June 1870, it was for the first time possible to found joint-stock companies without legal concessions, among these companies were many banks. The stock market index rose by 100% in 1871/72. In only a few years, nearly three billion Marks, around a quarter of yearly NNP, are invested in stocks, often by inexperienced investors. This investment and the following investment of firms is seized by the expenditure data. However, in the following years, many newly founded joint-stock companies did not pay dividends since the funds were invested unproductively. Many firms failed in the following years. Therefore only little income was generated in this period by the investments recorded in the EH series.[30] Furthermore there is evidence for a recovery in the mid to late 1870s, reflected in the IHM boom. For example, the turnover of Krupp increased from 35 million Mark in 1872 to 47 million Mark in 1878, an increase of 34 percent, see Gall (2000), p. 202.

The recession of the 1870s marked the beginning of the "Great Depression", which supposedly lasts until 1896. We only find evidence for this by analyzing the data with the simple linear model, since the period is without any boom. Employing more elaborate econometric techniques questions the "Great Depression", especially we find long boom periods interrupted by several recessions in the period under discussion. The "Great Depression" thus exhibits normal cyclical behavior, see again table 3 in the appendix. Furthermore there is evidence for a structural break[31] in the 1870s with higher growth thereafter, thereby questioning the "Great Depression".

[29]Strousberg had built around 25% of new German railways in the 6 years preceding its failure. It was a vertically integrated trust, which produced coal, steel, locomotives, etc..

[30]Pohl (1978) points out that 186 banks were founded during 1869-73 of which around 100 failed until 1880.Most banks started the liquidation process in 1874/75 after considerable losses on stocks and credits.

[31]A structural break is supported in two ways: the Chow breakpoint test and the changing variance of the short-term irregular shocks in the Beveridge-Nelson decomposition.

6 Conclusions

We investigated three different estimates of German net national product from 1851 - 1913. First, we adapted the data taken from the two publications by Hoffmann and Müller (1959) and Hoffmann (1965) to recent historical research by including new investment figures and made them comparable measures of German economic activity. Second, we used a set of econometric tools to derive the cyclical behavior of the data. Thereby we verify the robustness of our results. In a third step, we compared the cycles of the series. Finally, we confronted our results with earlier economic-historical contributions.

Our analysis shows that Hoffmann's series do not only differ in level, but also in cyclical behavior. The "Great Depression" was only found with the linear trend model, with the other methods we find booms in all three series in the period 1873-96. Furthermore we report a structural break in the 1870s in all series. For two of the three series, the growth rate in the second subperiod is higher.

Regarding the 1870s, some fundamental questions arise. The well known boom in the early 1870s, the so called "Gründerzeit", was only found in the series published by Hoffmann (1965). Whereas data collected with a substantially different method by Hoffmann and Müller (1959) did not show any sign of a boom, but instead a recession. This difference in the data raises the question of the proper historical interpretation of German macroeconomic development in the 19th century. We can not confirm a specific view of the cyclical behavior on the basis of the data. However we argue that there are economic interpretations in line with both developments. A boom is supported by rising military expenditure and a stock market boom, a recession is in line with the Strousberg failure and French-German war. An exploration of this time could reveal the relative importance of these and other economic factors for German national product.

Future research could address the revealed data problems especially in three areas. First, more information about indirect taxation for the years up to 1900 appear valuable. Second, data on depreciations are so far not available, and finally an estimation of investment in inventories could allow more precise estimates of the cycle. Our analysis, based on the best available data, questions the "Great Depression" and showed an ambiguous cyclical behavior during the 1870s.

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7 Appendix

Recessions

	IHM			IH			EH		
Jahr	Lin.	HP	VL	Lin.	HP	VL	Lin.	HP	VL
1851									
1852									
1853									
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1909									
1910									
1911									
1912									
1913									

Booms

	IHM			IH			EH		
Jahr	Lin.	HP	VL	Lin.	HP	VL	Lin.	HP	VL
1851									
1852									
1853									
1854									
1855									
1856									
1857									
1858									
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Table 3: Summary of the recessions and booms.