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Norwegian Gross Domestic Product by industry 1830 - 1930

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OLA HONNINGDAL
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Norwegian Gross Domestic Product by industry 1830-1930

Preliminary version

Ola Honningdal Grytten¹
Norwegian School of Economics

Abstract

The present paper offers new knowledge of historical national accounting in Norway in several ways. Firstly, a new and novel set of annual gross domestic product series by industry are presented for the period 1830-1930. Secondly, the new estimates suggest revision of the historical national accounts published by Statistics Norway. Thirdly, this may lead to necessary revisions of both Norwegian industrial history and business cycle history.

Keywords: Historical national accounting, national accounts, industrial development, Norwegian economic history.

JEL classification codes: L6, L7, L8, L9, N3, N13, N14, O11, O14, O16.

¹ Ola Honningdal Grytten, Department of Economics, Norwegian School of Economics, Helleveien 30, N-5045 Bergen, Ola.Grytten@nhh.no

1. Problem defined

The current annual historical national accounts for Norway stretches back to 1830. However, before 1930 the annual records cover the expenditure side only. The present paper aims at constructing gross domestic product figures by industries, from the production side back to 1830. This will equip us to map industrial development for this period and to refine and revise the existing historical national account series.

Hence, in this paper we present new and novel series on GDP from the production side, by calculating the contribution of different industries 1830-1930. These are presented in three levels of aggregation. On the lowest level we present 30 industries, on the semi-aggregated level we present 18, and finally eight on the highest aggregated industrial level. By doing this, one might, in the first place, be able to refine the existing historical national account figures. Secondly, one might be able to revise the existing GDP series. Thirdly, it enables us to conclude more precisely on the sizes of the different industries, and thereby throw light on industrial development and business cycles.

2. Approach

National accounts represent a statistical system, which gives an overview of an economy. Its most important component is gross domestic product (GDP), which is a quantitative measure of total value creation or production in an economy. Thus, GDP reflects the sum of value added in all value creation units of the economy. More precisely it is a measure of the gross values added of all resident and institutional units engaged in production, added by taxes and subtracted by subsidies on products not included in the value of their outputs.

GDP can be calculated by three major approaches.² The production approach, the expenditure approach and the income approach. In the production approach we sum up value added in all production units (j), by subtracting input from output:

$$(1) \quad \sum y_{j,t} = \sum (q_{j,t} - h_{j,t})$$

where y denotes the gross value added, q is the gross value of output in period t and h denotes the value of intermediary consumption used in production (input) in period t . Economy wide aggregates (capital letters) are found by adding the sums of all production units:

$$(2) \quad Y_t = Q_t - H_t$$

When GDP (Y) from the production side describes the supply side of the economy, GDP from the expenditure side describes the demand side, where C denotes private consumption, I , gross investments, G , public expenditures, X exports and M imports in period t :

$$(3) \quad Y_t = C_t + I_t + G_t + (X_t - M_t)$$

Finally the income approach reports the income distribution of GDP on compensation of employees, W , gross operating surplus, OS , and taxes, T , less subsidies, S , on production, Q , and imports, M , in period t .

$$(4) \quad Y_t = W_t + OS_t + (T^Q_t - S^Q_t) + (T^M_t - S^M_t)$$

In this paper we use the production side approach in order to establish annual GDP by industry for Norway 1830-1930. Before we do that we will give a brief introduction to the state of the art in Norwegian historical national accounting.

² Fløttum, Erling J. 2006, *Nasjonalregnskapet: systemet og utfordringen i Norge*, Oslo: Universitetsforlaget, pp. 93-131.

3. First estimates

The history of national accounting in Norway starts as early as 1840, when Professor Anton Martin Schweigaard made estimates over total domestic production for most industries in a normal year around 1835.³ Trade and other services were excluded, as they were not considered production. Schweigaard's work was carried out on the basis of public production, trade and census statistics, records, files and archives compiled and kept by public servants, academics, industrialists and merchants.

Schweigaard's work was followed up by M. Braun Tvethe in 1848, a senior civil servant within Norwegian customs, and thus, an expert on exports and imports statistics. Tvethe estimated domestic production by industry for a normal year around 1845.⁴ He principally applied similar definitions and kinds of sources as Schweigaard. However, he was able to include larger parts of the economy. Both of them tried to estimate output and input, and thus, value added. However, they were not always consistent in their approach.

The third attempt of giving estimates of the size of the total economy came in 1887. In that year the contemporary director of Statistics Norway, Anders Nicolai Kiær, published estimates of total national income.⁵ Contrary to his predecessors in the field he included several services in his estimates. Kiær also had significantly richer and more valid and reliable data. Additionally he possessed a wider understanding of the importance of using value added figures in order to sum up total production by industry into national aggregates.

In the 1930s the take-off of empirical and quantitative economics gave way to the idea of collecting data in order to produce sets of aggregated accounts for the over

³ Schweigaard, Anton Martin 1840, *Norges Statistik*, Christiania.

⁴ Tvethe, M. Braun 1848, *Norges Statistik*, Christiania.

⁵ Kiær, Anders Nicolai 1887, "Nogle Bidrag til Bedømmelsen af den Økonomiske Udvikling med særlig hensyn til Norge", *Statsøkonomisk Tidsskrift*, s. 193-205.

all economy. The idea was initiated by two of the most prominent Norwegian economists, Ragnar Frisch and Ingvar Wedervang. It resulted in the collection of relevant data by Statistics Norway from 1930s onward, in addition to a historical archive of wages and prices, established and monitored by Ingvar Wedervang and his staff at the Norwegian School of Economics in Bergen. Today this archive probably is one of the richest manual archives of its kind in Europe, and has served as source for domestic and international research on the standard of living, economic growth, prices, wages, labour market, and maritime history.⁶

4. Historical national accounts by Statistics Norway

After World War II, Statistics Norway started its production of national accounts, and historical national accounts. These estimates were carried out on the basis of theoretical work, modelling and data collection started in the 1930s. The work was completed and refined after the war by Odd Aukrust.⁷ A small number of aggregated series for key macroeconomic indicators were published in the 1940s and 1950s.⁸ Until, in 1965, a set of historical national accounts, covering the period 1865-1960 was launched and published by Statistics Norway.⁹ A second edition of this volume was published in 1968. Both of these were developed on the basis of the international System of National Accounts of 1958 (SNA1958). However, some national modifications were done in order to fit into domestic data an industrial profile.¹⁰

Senior economist Juul Bjerke was responsible for the calculation of these series. Aggregated accounts of GDP from the expenditure side were presented annually from 1865 onwards until 1930. Thereafter, they are fairly detailed and accurate

⁶ Grytten, Ola Honningdal 2007, "Professor Dr Ingvar B. Wedervang's Historical Archive on Wages and Prices", Eitrheim, Øyvind et al (eds), *Historical Monetary Statistics for Norway – Part II*, Oslo: Norges Bank, pp. 203-230.

⁷ Aukrust, Odd 1955, *National Accounts: Theoretical principles*, Oslo: Statistics Norway.

⁸ Statistics Norway 1946, *National Income of Norway*, Oslo, Statistics Norway 1952, *National Accounts 1930-1939 and 1946-1951*, Oslo and Statistics Norway 1953, *National Accounts 1900-1929*, Oslo.

⁹ Statistics Norway 1965, *National Accounts 1865-1960*, Oslo.

¹⁰ Statistics Norway 1968, *National Accounts 1865-1960*, 2nd ed, Oslo.

from 1930 onwards until 1960. These have served as official historical national accounts for Norway, partly challenged and supplemented by series published by the central bank, Norges Bank, in 2004.

As for the figures from the production side, only benchmark year calculations were given for main production sectors until 1930.¹¹ From then on, they include fairly detailed accounts on 55 industries and sub-industries. From 1946 onwards, they are extended to include 63 industries and sub-industries. This richness made Norwegian historical national accounting in the forefront internationally. However, sadly enough, almost nothing happened thereafter in this field in Norway in the next three decades.

3. Historical national accounts by academics

In the 1990s economic historians at the Norwegian School of Economics started a new project on historical national accounting. This was part of a greater project, launched by the Swedish professor Olle Krantz, on standardisation of Nordic historical national accounts. Camilla Brautaset gave detailed accounts on Norwegian export and the size of the export industries for the period 1830-1865. This was done on the basis of a rich price material from the Wedervang Archive and public archives and volume figures recorded in the trade statistics.¹²

Ola H. Grytten calculated the annual GDP contribution for agriculture 1830-1865 by establishing consistent input and output series. In order to reach at fixed price calculations of agriculture's contribution to GDP a double deflation technique was used. This was possible due to the very rich price data sets in the Wedervang Archive.¹³

¹¹ Bjerke, Juul 1966, *Trends in Norwegian Economy 1865-1960*, Statistics Norway, Oslo.

¹² Brautaset, Camilla 2002, *Norwegian Exports 1830-1865: in Perspective of Historical National Accounts*, Bergen: Norwegian School of Economics.

¹³ Grytten, Ola H. 2004a, "Output, Input and Value Added in Norwegian Agriculture 1830-1865", Jonsson, Gudmundur (ed), *Nordic Historical National Accounts*, Reykjavik: Reykjavik University, pp. 47-76.

Elisabeth Bjørsvik established GDP series on public services for the same period. This was done by drawing on previous work by Fritz Hodne and published and unpublished public records kept by Statistics Norway and the National Archive. Bjørsvik series cover both local and central government levels. Due to the nature of the services she has not been able to apply any double deflation method for the public sector in her figures.¹⁴

Christian Venneslan calculated detailed series for value added in manufacturing by nine industries and 51 sub-industries, covering the period 1896-1939 (Sometimes they are presented as twelve main industries and 48 sub-industries). His calculations were carried out on the basis of detailed manufacturing statistics recorded and kept by Statistics Norway. Again, a rich price material made it possible for him to calculate fixed price series by adopting a valid and reliable double deflation technique.¹⁵

Recently Jan Tore Klovland has revised the series on gross output in manufacturing by presenting detailed production figures for 45 industries from 1896 to 1948. Klovland's figures by large support Venneslan's findings on aggregated levels. However, on branch levels, in particular for sub-industries, we find significant deviations during the first years of the period covered.¹⁶

Fritz Hodne and Ola H. Grytten computed estimates of total GDP 1835-1865 on the basis of the state of the art in 1994.¹⁷ Finally, in 2004 the latter concluded with historical GDP series, covering the entire period 1830-2003. These were published by the Norwegian central bank as part of a project on establishing key historical

¹⁴ Bjørsvik, Elisabeth 2004, *Public services in Norway 1830-1865 within the framework of historical national accounts*, Bergen: Norwegian School of Economics.

¹⁵ Venneslan, Christian 2007, *Industrial development in Norway 1896-1939: in view of historical national accounts*, Bergen: Norwegian School of Economics.

¹⁶ Klovland, Jan T. 2015, "Measuring trends and cycles in industrial production in Norway 1896-1948", Oslo: Norges Bank.

¹⁷ Hodne Fritz and Grytten, Ola Honningdal 1994, "Gross Domestic Product of Norway 1835-1865", Krantz, Olle (ed), *Nordiska Historiska Nationalräkenskaper*, Umeå: University of Umeå, pp. 93-113.

monetary series as far back as to 1516. These latter historical national accounts have been updated and revised until present times.¹⁸

However, a full set of historical national accounts from the production side has not yet been published for the period prior to 1930, despite benchmark calculations for the major sectors of the economy for the years 1865, 1875, 1890, 1900, 1910 and 1920. These calculations coincide with the population censuses. This is basically due to their dependence on employment figures. In this paper we present aims at calculating valid and reliable annual series of GDP from the production side. The methodology and historical data sets, which are used, are described in the next sections of the paper.

4. New series

This paper presents a production approach to historical national accounts for Norway covering every year 1830-1930. We have been able to follow 23 industries and sub-industries until 1896, and from then on 35, as 12 manufacturing industries are included. The new series are spliced with the accounts by Statistics Norway in 1930. In consequence, we now have consistent annual historical GDP series by industry for Norway stretching back another one hundred years in time.

In principle SNA-2010 has been followed as far as possible. However, the new series are spliced with the old in 1930, which has made it necessary to adjust somewhat to the standards of the previous historical accounts. Annual series of input and output by industries have been calculated, and in order to come up with relevant fixed price series, a double deflation technique has been applied as far as possible. This is a novel approach in historical national accounting, as data usually prohibits one from applying double deflation techniques. However, basically due to the rich price

¹⁸ Grytten, Ola Honningdal 2004b, "The gross domestic product for Norway 1830-2003", Eitrheim, Øyvind et al (eds), *Historical Monetary Statistics for Norway 1819-2003*, Oslo: Norges Bank, pp. 241-288.

material in the Wedervang Archive kept at the Norwegian School of Economics, it is possible to use a double deflation approach in the case of Norway.

5. GDP by industry

In order to make the new series comparable with existing historical national accounts series we present three levels of disaggregated GDP series here. The highest level of disaggregation consists of 30 sub-industries, stretching from 1896. The second level consists of 18 series, and the lowest of eight.

Different approaches have been used in order to come up with consistent annual series of GDP contribution by industry. The chosen approaches are very much dependent on what kind of sources that are available. In the following section we offer a description of approaches followed and sources available in order to calculate value added by industry for Norway 1830-1930.

5.1. Primary industries

5.1.1. Agriculture

There already exist annual series for value added for arable production and cattle production 1830-1865. These series are constructed on the basis of volume and price figures. In order to establish volume figures six benchmark years were used. Value added figures for these years were estimated on the basis of figures taken from farm censuses and county reports every fifth to tenth year and farm accounts from the Wedervang Archive.¹⁹

In order to interpolate between the benchmark years production reports from counties, farm accounts, exports and imports statistics were used. For some years there was lack of sufficient data. Hence, demand and production functions were constructed in order to estimate volumes. Relevant price data are found in the foreign trade statistics, in public records and in the Wedervang Archive. These

¹⁹ Wedervang Archive, files W501-W519.

contain both input and output prices. Thus, on the basis of these sources, fairly reliable series on annual value added in agriculture 1830-1865 were published in 2004.²⁰

On the basis of the same kinds of sources, it has been possible to continue these calculations until 1910. In these new calculations 1865, 1875, 1890, 1900 and 1910 serve as benchmark years. In addition work by Grytten and Hodne on volumes and prices of land crops 1830-1910 serves as a major source.²¹ Another major source of prices is the Wedervang Archive.²²

As for 1910 and onwards, we find reliable annual estimates of the production of milk, milk products, meat, and to some degree different kinds of crops. These are taken from publications from Statistics Norway, the Dairy Producers' organisations and in work done by economic historians.²³ However, farm input and output according to the agricultural censuses and the farm accounts still serve as important sources for the estimates. From the late 1920s Statistics Norway published annual series of farm production, which are used here.²⁴

5.1.2. Forestry

In her dissertation on the Norwegian export sector, Camilla Brautaset offers detailed series of forestry exports from 1830 onwards until 1865.²⁵ Thereafter, it is possible to make similar calculations on the basis of records from foreign trade accounts, tax

²⁰ Grytten, Ola H. 2004a, pp. 47-76.

²¹ Grytten, Ola H. and Fritz Hodne 1998, "Norwegian Production of Landcrops in the Nineteenth Century: Prices and Output 1830-1910", Christen, Jørgen Peter (ed), *Nordiske historiske nasjonalregnskaper*, Copenhagen: University of Copenhagen, 115-142.

²² Wedervang Archive, files W139, W269, W271, W269, W 272, W273 and W383

²³ Mork, R. 1941, *Melkeomsetning og meieridrift i Norge*, Oslo: , Benterud, O. 1978, *Norske Meieriers Salgssentral 50 år*, Oslo: NMS, pp. 22-24 and 194-278, Grytten, Ola H 1997, "The Consumers' Burden: What did regulations of the Norwegian milk market in the 1930s cost consumers?", Basberg, Bjørn L. et al (eds), *I det lange løp*, Bergen: Fagbokforlaget, pp. 143-164, Statistics Norway 1949, *Statistical Survey 1948*, Oslo, pp. 64-93.

²⁴ Statistics Norway 1978, *Statistical Survey 1978*, pp. 143-148.

²⁵ Brautaset 2002, pp. 168-189.

records and production records from Statistics Norway. They also serve as sources for input and production for domestic use.

The foreign trade statistics make up the main source until 1886. From then on the volumes of timber floated in domestic waterways along with previous estimates on use of firewood, provide reliable estimates of the size of forest production. From 1901 Statistics Norway report annual series of key variables regarding cultivation of private forests.²⁶

Along with the foreign trade statistics these data make it possible to construct volume series of both input and output.²⁷ To reach at value series we use price series from Brautaset, the Wedervang Archive and Statistics Norway, where we find both input and output prices.²⁸

5.1.3. Fisheries

The contribution of fisheries to GDP is by definition limited to the values of catches on board vessels. This means that the preserving of fish is considered food industry. If fish preservation were included, fisheries would have been at least twice as big in our accounts.

Thus, we have to find the value of the fishermen's catches. This is possible on the basis of volume series of exports and domestic fish consumption. Brautaset offers detailed series of fish exports 1830-1865. According to her 80-90 percent of the volume of fish catches were exported.²⁹ Consumption surveys give us information on domestic fish consumption. Thus, it is possible to calculate total production figures.

²⁶ Statistics Norway 1949, pp. 88-91.

²⁷ Statistics Norway 1949, pp. 162-184.

²⁸ Brautaset 2002, pp. 262-268, Statistics Norway 1949, pp. 80-91, Wedervang Archive, W139, W269, W271, W272 and W383.

²⁹ Brautaset 2002, pp. 251-256.

After 1865 we find detailed figures on volumes and prices on fish exports and consumption in benchmark years in publications from Statistics Norway. From 1866 Statistics Norway report quantity of fish brought to land and value to fishermen. From 1908 Statistics Norway reports annual values of catches.³⁰ Thus, on the basis of adequate information we are able to calculate input, output and, thus, value added series.

5.1.4. Whaling

This industry includes the catching of whales, seals and miscellaneous catches. Contrary from fisheries, where only the value of catches on board is considered as primary industry, the production of oil on board ships is considered part of this industry. Thus, whaling should be considered a hybrid between primary and secondary industries.

The data, basically taken from Statistics Norway, are fairly good from the early 1900s onwards. Before then we have to look at the foreign trade statistics in order to reach at output series. With the help of Anders Nicolai Kiær's work and population censuses we are able to establish benchmark data on input, output and value added for almost every tenth year 1835-1930.³¹

To interpolate we use foreign trade statistics and records on catches and oil production from Statistics Norway. These are splices to the 1930 values of the whaling industry according to the historical national accounts by industry published Statistics Norway.³²

³⁰ Statistics Norway 1949, pp. 91-104.

³¹ Kiær, Anders Nicolai 1877, *Bidrag til belysning af Skibsfartens Økonomiske Forhold*, Oslo: Statistics Norway.

³² Statistics Norway 1949, pp. 105 and 168-171.

5.2. Secondary industries

5.2.1. Manufacturing

Both Schweigaard and Tvethe give reliable estimates of input and output in manufacturing industry for 1835 and 1845. In addition we can add 1865, 1875, 1890, 1900, 1910, 1920 and 1930 as benchmark years, on the ground of calculations carried out by Bjerke.³³ By drawing on population and manufacturing censuses, export and import statistics and public reports from county officials, it has been possible to come up with fairly valid and reliable accounts of input, output and value added in manufacturing until 1896.

As for the period from 1896, we use reliable and detailed accounts for 12 manufacturing industries calculated by Vennesslan. These are established on the basis of impressively informative manufacturing production statistics recorded and kept by Statistics Norway. These provide us with a unique set of detailed input and output data on volumes and values.³⁴ Admittedly, Vennesslan had to make some courageous assumptions on productivity development for some of the industries for the late 1890s and early 1900s. However, a cross-check with Klovland's new production data for 45 manufacturing industries very much confirm Vennesslan's aggregated levels for the manufacturing sector, despite deviations at disaggregated levels.³⁵

Thus, from 1896, on the aggregated level, the manufacturing series are some of the most valid and reliable in this set of GDP by industry. From around 1907 the same accounts for these figures on sub-industry level.

5.2.2. Construction and power supply

We find output figures for power supply in a paper by Kjell Bjørn Minde. His estimates are made on the basis of different sources, basically sources from the

³³ Schweigaard 1840, Tvethe 1848, Bjerke 1966, pp. 53-56.

³⁴ Vennesslan 2007, appendix, pp. 12-48.

³⁵ Klovland, Jan T. 2015, pp. 51-73.

Statistical Office (Tabellkontoret) connected to the Ministry of Domestic Affairs from 1830 and Statistics Norway from 1876.³⁶ Input figures are found in work by Fritz Hodne on the size of the Norwegian infrastructure.³⁷ From 1914 onwards, we find relevant series in public budgets and accounts from both the central and local governments, along with data for private power supply companies.³⁸

We find volumes and values of construction in the work of Schweigaard and Tvethe for 1835 and 1845 respectively. In addition Bjerke's benchmark year calculations enable us to extract construction by deducting manufacturing and mining from the secondary sector calculations. Hence, construction is seen as a residual in these estimates. Thus, we also have benchmark years of construction for 1865, 1875, 1890, 1900, 1910, 1920 and 1930.³⁹ We interpolate between the benchmark years by using annual figures on public spending on construction and private spending on key sub-industries within construction, e.g. private road, railway, port and telecommunication construction.⁴⁰

5.2.3. Mining

As for mining, we again find valid and reliable estimates with Schweigaard, Tvethe and Bjerke. These are refined in the historical national accounts published by the Norwegian central bank.⁴¹ These benchmark years estimates provide us with both input and output figures, and, thus, with valid value added numbers.

We find reliable data on the development of volumes and partly values in the foreign trade statistics. Production for domestic use has been interpolated between industrial censuses and county reports by using series of mining as input into other industries of the economy and as fuel, after imports have been deducted.

³⁶ Minde 2015, "Norwegian energy consumption in the nineteenth and twentieth century", unpublished manuscript, Stord: HSH.

³⁷ Hodne, Fritz 1983, *Stortingssalen som markeds plass: Statens grunnlagsinvesteringer 1840-1914*, Oslo: Universitetsforlaget, pp. 298-313.

³⁸ Statistics Norway 1949, pp. 151-155.

³⁹ Schweigaard 1840, pp. 72-91, Tvethe 1848, pp. 93-118 and Bjerke 1966, pp. 53-56.

⁴⁰ Statistics Norway 1949, pp. 279-288 and 390-414.

⁴¹ Grytten, Ola H. 2004b, pp. 249-258.

From 1901 we also find annual production data for mining from Statistics Norway. We have been able to refine these with data from Venneslan's work on the manufacturing sector from 1896.⁴² The series is spliced with the GDP contribution of mining in 1930 according to Statistics Norway's historical national accounts.⁴³

5.3. Commerce

5.3.1. Trade

Annual trade statistics is missing for the early 19th century as trade was not esteemed as value creation activity. However, Schweigaard, Tvethe and Kiær all give us some information on both volumes and values. The same is found in population censuses and county reports. These have been compiled and summed up to aggregated trade figures in benchmark years in the historical national accounts published by the central bank.⁴⁴ Adding the work by Bjerke to these sources, we reach at benchmark years figures for trade about every tenth year 1830-1930. These report input, output and value added figures.⁴⁵

In order to reach at annual figures we have to interpolate between the benchmark year figures. For the 19th century, the Wedervang Archive holds records on trade activity, monthly prices, but to some degree volumes and values. As for the 20th century we find better records at Statistics Norway.⁴⁶

However, in order to reach at consistent annual trade series we also had to use other indicators. Thus, we interpolate with annual figures of money supply, i.e. banknotes and coins in circulation, since the great bulk of trade was paid in cash at the time of our calculations.⁴⁷

⁴² Statistics Norway 1949, pp. 111-146 and Venneslan 2007, appendix, pp. 12-48.

⁴³ Statistics Norway 1965, pp. 68-71.

⁴⁴ Grytten, Ola H. 2004b, pp. 250-258.

⁴⁵ Bjerke 1966, pp. 53-56.

⁴⁶ Wedervang Arhive, files W139, W267, W268, W269, W271, W272, W273 and W383.

⁴⁷ Klovland, Jan T. 2004, "Monetary aggregates in Norway 1819-2003", Eitrheim, Øyvind et al (eds), *Historical Monetary Statistics for Norway 1819-2003*, Oslo: Norges Bank, pp .181-240.

5.3.2. Finance

Due to detailed work by Klovland, published by the central bank of Norway, very reliable historical data on input, output and value added for the banking sector are available. Klovland has collected and compiled balance sheet data for almost every savings and commercial bank in Norway in the 19th century.⁴⁸ Using similar data for publicly owned banks and other public and private credit institutions 1900-1960, compiled by a former governor of the central bank, Hermod Skånland, and data from Statistics Norway for more recent years, we arrive at valid and reliable series on value added in the registered finance market.⁴⁹

In addition we have to add the volumes of unregistered finance services provided by private credits. This is done by following the hints given in the historical national accounts by the central bank and in a newly published banking history, published in 2013, on one of the largest banks throughout Norwegian banking history.⁵⁰

Cross checks with the mentioned bank history from 2013 and a quantitative study of the bank market by Sara Liseth confirm the new series.⁵¹ By splicing these with the finance industries' contribution to GDP in 1930 according to Statistics Norway, we arrive at adequate value added series for the entire Norwegian finance industry 1830-1930.

5.4. Property

5.4.1 Housing and commercial properties

⁴⁸ Klovland, Jan T 2007b, "A reconstruction of the balance sheets of savings banks in Norway 1822-1875", Eitrheim, Øyvind et al (eds), *Historical Monetary Statistics for Norway – Part II*, Oslo: Norges Bank, pp. 109-160 and Klovland, Jan T. 2007c, "A reconstruction of the balance sheets of commercial banks in Norway 1848-1900", Eitrheim, Øyvind et al (eds), *Historical Monetary Statistics for Norway – Part II*, Oslo: Norges Bank, pp. 161-202.

⁴⁹ Skånland, Hermod, 1967, *Det norske kredittmarked siden 1900*, Oslo: Statistics Norway, pp. 262-385.

⁵⁰ Grytten, Ola Honningdal (ed) 2013, *Banken i samfunnet*, Bergen: Bodoni, pp. 9-76 and 403-411

⁵¹ Grytten, Ola H. 2013, pp. 403-411 and Liseth, Sara 2012, *Bergen Banks markedsposisjon: En kvantitativ analyse av bankens stilling i markedet 1855-1990*, Bergen: NHH, pp. 91-131.

Due to the extensive project on historical monetary statistics monitored by the Norwegian central bank it has been possible to trace values of Norwegian housing and property management back to 1830. The series presented here reflect the value creation of providing private housing and properties for the business community. The value of the stock of dwellings consists of the housing volume and its value.

Stocks of dwellings are calculated on the basis of popular and industrial censuses 1825-1930. Between the census data, we interpolate on the basis of population records and estimated numbers of people per square meter.⁵² Thus, we arrive at annual volume figures of the stock of buildings. These are multiplied with prices of buildings as they are reported in the central bank's house price index.⁵³

Since housing in national accounts should reflect the value creation of housing services and not the market price of buildings, we should not use markets annual prices to conclude with values. Thus, we use smoothed series, with the help of a HP-filter, with a smoothing parameter (λ) of ten. This makes it possible to construct annual numbers of value added provided by housing. Smoothing is also favourable due to the annual uncertainties of the house prices in the early period in question.

5.5. Transportation

5.5.1. Ocean going transport

For the period in question the great bulk of the ocean going transport was either between domestic and foreign ports or between foreign ports only. Thus, Brautaset's and later Kiær's estimates of the scale of value creation of transport

⁵² Statistics Norway 1994, *Historical Statistics 1994*, Oslo: Statistics Norway, pp. 77-79.

⁵³ Eitrheim, Øyvind and Solveig K. Erlandsen 2004, "House price indices for Norway 1819-2003", Eitrheim, Øyvind et al (eds). *Historical Monetary Statistics for Norway 1819-2003*, Oslo: Norges Bank, pp. 349-376.

services from the Norwegian merchant fleet serve as reliable sources on this industry's contribution to GDP from 1830 and towards the turn of the century.⁵⁴

Thereafter, and even before, the Wedervang Archive give us detailed information on income and cost structures, freights and wages in the merchant fleet. The data are best for the fleet engaged in foreign ports. However, the data for the coastal fleet are also adequate.⁵⁵

In addition, publications by Statistics Norway report volumes of the fleet and the ships' engagements.⁵⁶ Thus, drawing on this information and splicing the new time series with the 1930 figures of value creation in ocean going transport, we reach at value added series for this industry 1830-1930.

5.5.2. Other transport and communication

Other transportation includes horse, railway and auto car transportation as well as telephone, telegraph and postal services. The number of horses is taken from the agricultural census held about every tenth year. Freight incomes and costs from horse transportation are taken from the Wedervang Archive.⁵⁷

Statistics Norway provides information on kilometres of road, number of cars, kilometres of railways and other types of communication, public income and costs from transport and communication.⁵⁸ With the help of these data we have been able to interpolate between benchmark years and splice with the 1930 estimates by Statistics Norway.

⁵⁴ Brautaset 2002, pp. 257-261, Kiær, Anders N., *Bidrag til Belysningen af Skibsfartens økonomiske Forhold*, Kristiania: Mallings and Kiær, Anders N. 1900, "Norges Siøfart", manuskript, Wedervang Arkivet., NHH, Bergen.

⁵⁵ Wedervang Archive, W030, W032, W034, W035, W036, W038, W039, W043, W044, W063, W172, W173, W174, W176, W182, W184, W185, W186, W187, W188, W189, W193, W320, W327, W329, W330 and W407.

⁵⁶ Statistics Norway 1978, pp. 376-408.

⁵⁷ Wedervang Archive, W118, W119A, W120A and W249.

⁵⁸ Statistics Norway 1978, pp. 419-445.

5.6. Public administration and defence

5.6.1. Public administration

For the period 1830-1865 we use Bjørsvik's series on GDP contribution from public administration. These are basically constructed on the basis of wages, depreciation and estimates of increase in productivity within public administration.⁵⁹ In addition we use detailed datasets from Hodne and Statistics Norway in our calculations until 1914.⁶⁰ These rich and precise sources make these series relevant, valid and reliable.

From 1915 onwards we use computations of the size of public administration by Grytten. These are computed on the basis of public accounts and provide us with generous information on wages, depreciation and productivity growth.⁶¹ By splicing them with our series in 1914 and Statistics Norway's GDP series by industry from 1930, we establish a persistent GDP series for public administration 1830-1930.

5.6.2. Defence

Again, for the period 1830-1865 we use Bjørsvik's series on value added in defence. These are basically constructed on the basis of wages, depreciation and estimates of increase in productivity within public administration.⁶² Records from the Wedervang Archive give us relevant information on the income and cost structure of Norwegian garrisons during the nineteenth century.⁶³ Additionally, we use detailed datasets from Hodne and Statistics Norway in our calculations until 1914.⁶⁴

From 1915 onwards we use compilations of the expenditure and income side of military services made by Grytten. These taken from public records, and give us

⁵⁹ Bjørsvik 2004, pp. 293-310.

⁶⁰ Hodne 1983, pp. 300-313.

⁶¹ Grytten, Ola H. 2014, "Growth in public finances as tool for control: Norwegian development 1850-1950", paper presented to ESSHC, Wien april 2014, pp. 24-30.

⁶² Bjørsvik 2004, pp. 293-310.

⁶³ Wedervang Archive, files W052-W078.

⁶⁴ Hodne 1983, pp. 300-313.

necessary information on depreciation rates and productivity growth.⁶⁵ By splicing them with our series in 1914 and Statistics Norway's GDP series by industry from 1930, we establish persistent GDP series for value added in the armed forces 1830-1930.

5.7. Services

5.7.1. Education

The same records and publications as for public administration serve as sources for this series. In addition we use the above described sources and data provided, compiled and processed by Bjørsvik, Hodne and Grytten on public education until 1865, 1914 and 1930 respectively.

We have included estimates of private schooling and education, where schools, and training programs connected to the church were quite important. This is done by drawing on information on the scale of these from popular censuses and county reports, reported annually in statistical yearbooks for Norway.⁶⁶ We assume the same value creation per employee in private and public schools.

5.7.2. Health

Bjørsvik, Hodne and Grytten are also our primary sources for this series, as they report the volumes and values of public health production until 1865, 1914 and 1930 respectively.

However, we have to add a substantial part for private health care. According to contemporary sources, private health care made up the bulk of this industry until 1930. And again, churches and Christian and humanitarian organisations and bodies played an important role. Around 1930 the public and the private sector of health

⁶⁵ Grytten, Ola H. 2014, "Growth in public finances as tool for control: Norwegian development 1850-1950", paper presented to ESSHC, Wien april 2014, pp. 24-30.

⁶⁶ Bjørsvik 2004, pp. 293-310, Hodne 1983, pp. 300-313, Grytten 2014, pp. 24-30 and Statistics Norway 1876-1930, *Statistical yearbook for Norway 1876-1930*, Oslo.

care were about even in their contribution to GDP, with local governments as the most important contributors in the public sector.⁶⁷

5.7.3. Other services

This industry consists of both public sector and private sector services. The public records are again found in the work by Bjørsvik until 1865, thereafter Hodne up to 1914 and Grytten until 1930.⁶⁸

The challenge is to estimate the total magnitude of private services. However, we already have benchmark year calculations for 1835, 1845, 1865, 1875, 1890, 1900, 1910, 1920 and 1930.⁶⁹ By refining these on the basis of SNA 2010 and including new knowledge of other industries' contribution to GDP, presented here, we establish a sound basis for interpolating annual series of other services in the private sector. The interpolation is made as a weighted average of other services in the public sector, starting at 30 percent in 1830, and ending at 50 percent in 1930, and private services within other industries, starting at 70 in 1830, ending at 50 percent in 1930.

5.8. Private services

5.8.1. Domestic services

This series is calculated on the basis of very rich wage data sets on domestic services from urban and rural districts. We find an impressive amount of data in this field in the Wedervang Archive and in the historical wage series as part of the central bank's monetary history project.⁷⁰

⁶⁷ Larsen, Øyvind, Ole Berg and Fritz Hodne 1986, *Legene og samfunnet*, Oslo: Den Norske Lægeforening.

⁶⁸ Bjørsvik 2004, pp. 293-310, Hodne 1983, pp. 300-313, Grytten 2014, pp. 24-30

⁶⁹ Grytten, Ola H. 2004b, pp. 252-255 and Bjerke 1966, pp. 51-54.

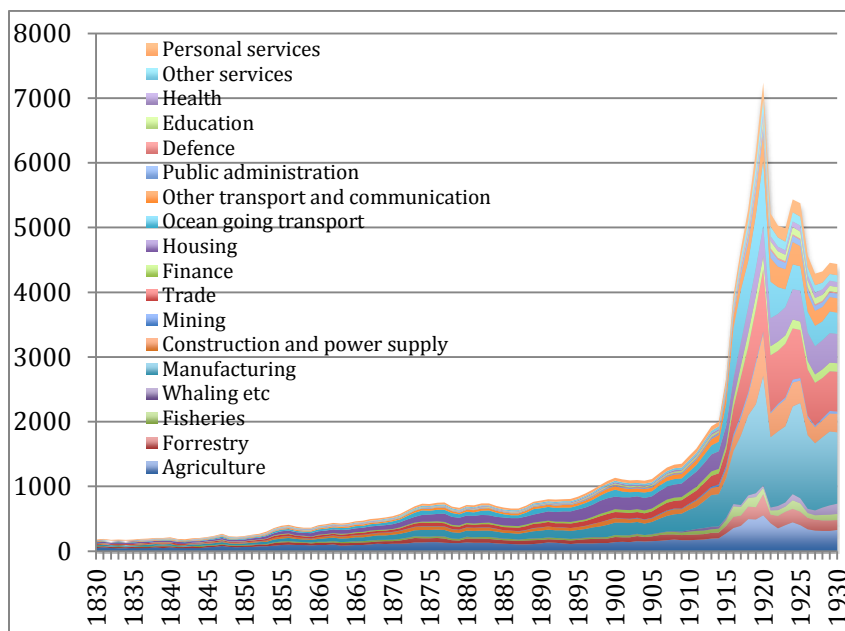
⁷⁰ Grytten, Ola H. 2009, "Purchasing power of labour: Norwegian real wages 1726-2006", *Scandinavian Economic History Review*, vol 57, 1/200., pp. 48-87 and Wedervang Archive, W009; W013; W014, W021, W028 and W204.

These sources provide us with a very good coverage of domestic services in households and also some data relevant for value added calculations in other types of private services, such as accounting, and in income and cost profiles. Thus, it is possible to construct value added series for this industry. Since board and lodging was a significant part of wages in this industry, they are of course added to the wage data, as described in the publications referred to here.

6. Aggregated GDP by industry

When we aggregate the value added series for the different industries, we arrive at a gross domestic output series for Norway in current values for 1830-1930. This output series is calculated on the basis of a production side approach. Like other historical national account series the new aggregated output series and its subcomponents will be subject to revisions and improvements. Their deviations from previous series give us a hint of satisfactory reliability of both the new and the old series. The deviations are limited, but however, significant for critical moments in historical national accounting.

Chart 1. Norwegian GDP by industry in current million NOK 1830-1930.



Sources, See text.

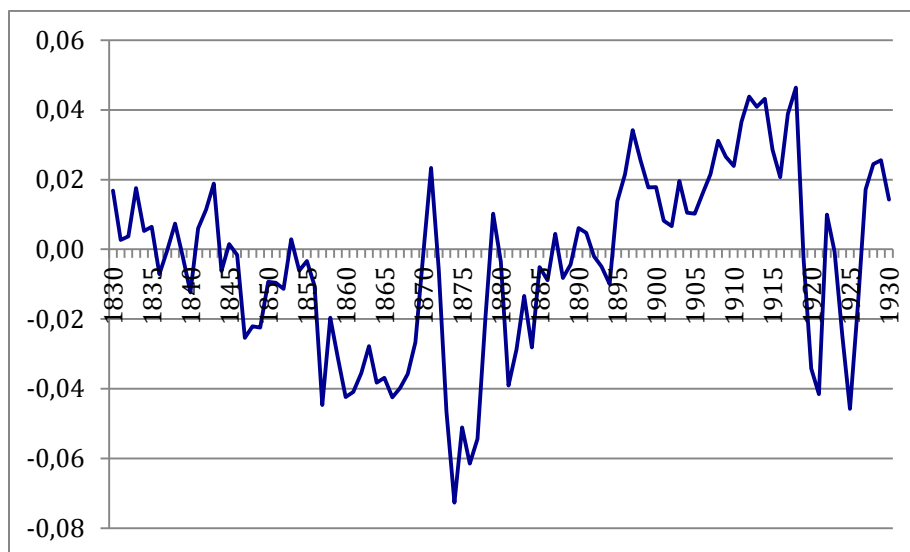
The new series of Norwegian GDP by 18 industries in current prices 1830-1930 are reported in chart 1. As for Chart 2, it reports the annual GDP gaps (Y^G) between the new (Y^N) and the old (Y^O) historical series in logs. The old series being those published by the central bank of Norway from 1830 and Statistics Norway from 1865. The gaps are for most years quite marginal:⁷¹

$$(5) \quad Y^G_t = \ln Y^N_t - \ln Y^O_t$$

A partial explanation for the small deviations between the new and the old series is that the benchmark year calculations behind the old series to a considerable extent also serve as benchmarks in the new series. However, they have still been revised, meaning that the new series should be considered to stand on their own feet.

The few significant deviations are most evident during booms and busts, when the new series clearly tend to show higher volatility than the old ones. This implies that booms and busts seem to be stronger than hitherto believed.

Chart 2. Relative gaps between new and old GDP series in current values 1830-1930.



Sources, See text.

⁷¹ Grytten, Ola H. 2004b, pp. 249-288.

The new figures show that the long depression started in the mid 1870s, not in the late 1870s as suggested by the old series. Thus, the new series are more in line with the international picture and with previous domestic business cycle analyses.⁷²

7. Fixed price calculations

In order to reach at gross domestic product in fixed prices a set of deflators for each industry and sub-industry is offered. By deflating the nominal figures by these deflators, we arrive at fixed price series.

7.1. Method

We use the standard Paasche price index (P_P) to calculate the deflators, where p denotes price, q denotes volume, i denotes industry or sub-industry, t denotes time in period, where $t=0$ is the base year:

$$(6) \quad P_P = \frac{\sum(p_{i,t}) * (q_{i,t})}{\sum(p_{i,t=0}) * q(q_{i,t})}$$

By using a double deflation technique, i.e. deflating both the input and output series separately, we arrive at value added (y) in fixed prices (f) for agriculture, forestry, fishing, whaling, mining, construction, manufacturing and trade:

$$(7) \quad y^f_{i,t} = \{q_{i,t} / [\sum(p_{i,t}) * (q_{i,t}) / \sum(p_{i,t=0}) * q(q_{i,t})] - h_{i,t} / [\sum(p_{i,t}) * (q_{i,t}) / \sum(p_{i,t=0}) * q(q_{i,t})]\}$$

For the rest of the service industries, we apply a single deflation technique, i.e. only deflating the value added series. Adding the sub-industry series we reach at value added per key industry (y) in fixed prices (f). Adding these again, we reach at national GDP in fixed prices (Y^f). By dividing GDP in nominal prices (Y^N) with GDP in fixed prices we find the implicit GDP deflator at the aggregated level:

⁷² Klovland, Jan T. 1998, "A reassessment of the United Kingdom business cycle chronology", Dick, T.J.O, (ed), *Business cycles since 1820: New international perspectives from historical evidence*, Cheltenham, pp. 49-90.

$$(8) \quad P_D = Y^N_t / Y^F_t$$

The same principle is applied for finding implicit deflators for key industries made up by sub-industries.

7.2. Price data

The explicit deflators are calculated on the basis of direct observations of prices. These are taken from a wide range of sources. For the previously published series for agriculture, public services, export industries and manufacturing industries, we use the established deflators.⁷³ In addition 19th century price records kept in the Wedervang Archive and in Statistics Norway publications serve as key data.⁷⁴ Some of these are already published as price indices by the Norwegian central bank constructed by Klovland and Grytten.⁷⁵ Admittedly, it is not always easy to construct annual price series for both input and output, particularly for the service sector. However, the bulk of the new series follow the double deflation technique.

In principle the fixed price series are calculated by deflating the nominal series with Paasche price indices. However, for some time spans it has been difficult to find annual volumes, and Laspeyres indices have been used. Thus, fixed price periodizations have in principle been set to every 20th year until 1890, and thereafter every tenth year. The base years chosen are as far as possible representative years towards the middle of the periods.

⁷³ Grytten, Ola H. 2000, "Deflateringsprinsipper for nordiske historiske nasjonalregnskaper, Lindmark, Magnus and Peter Vikström (eds), *Nordic Historical National Accounts*, Umeå: Umeå University, pp. 21-47, Grytten 2004b, pp. 241-288, Brautaset 2002, pp. 251-268, Bjørsvik 2004, pp. 293-310, Venneslan 2007, statistical appendix, pp. 7-138.

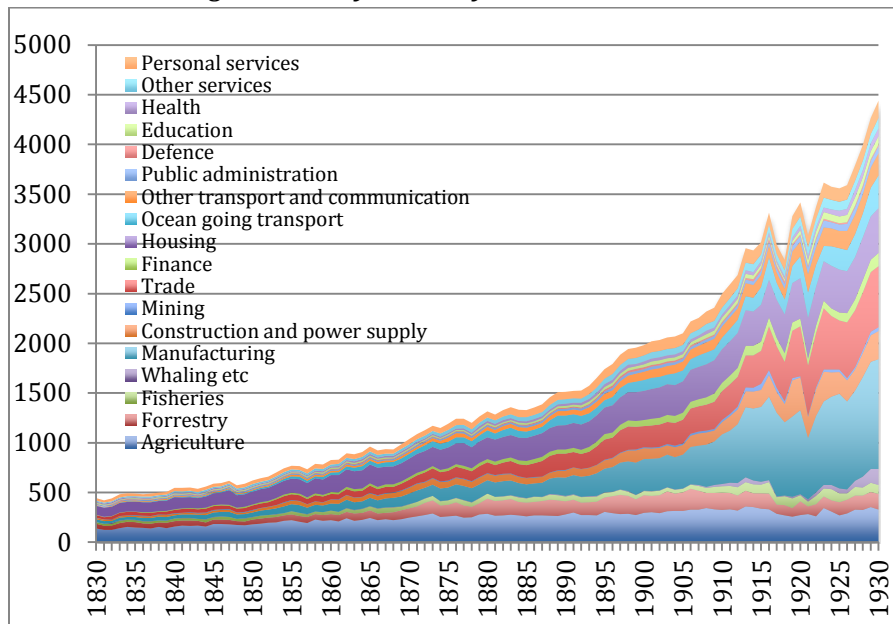
⁷⁴ Wedervang Archive, files W051, W128, W137, W138, W139, W140, W141, W142, W206, W207, W208, W209, W210, W213, W217, W218, W219, W220, W268, W269, W270, W271, W272, W273, W275, W276, W383, W386, W397 and W397 and Statistics Norway 1949, pp. 333-359.

⁷⁵ Klovland, Jan T. 2014, "New methods for construction of historical price indices, with an illustration from Norway, 1777-1920", *European Review of Economic History*, 02/18, pp. 277-305. Grytten, Ola H. 2004c, "A consumer price index for Norway 1516-2003", in Eitrheim, Øyvind et al (eds), *Historical Monetary Statistics for Norway 1819-2003*, Oslo: Norges Bank, pp. 47-98.

7.3. GDP by industry in fixed prices

By using the constructed deflators, we arrive at annual series of gross domestic product by industry in fixed prices. These are presented in Norwegian 1930- kroner (NOK), which might make the early figures somewhat over or under estimated due to different price developments of the industries.

Chart 3. Norwegian GDP by industry 1830-1930 in mill 1930-NOK.



Sources, See text.

8. Reliability of new series

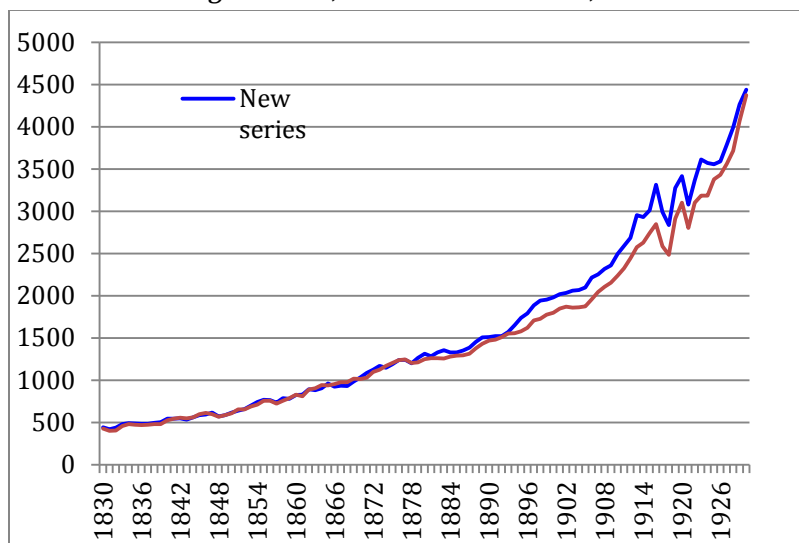
One has to make assumptions in historical national accounting. Thus, historical national accounts will always be subject to disputes. Hence, it is important to map how reliable the accounts might be. In order to throw light on their reliability we compare them with the already existing historical GDP series for Norway and our knowledge of the business cycle development. These cycles are operationalized as output gaps calculated on the basis of the annual data established here.

8.1. Comparison of old and new series

When comparing the old and the new fixed price calculations one finds that the gaps based on the new fixed price figures are much larger than those based on the old fixed price figures. One major feature is that GDP according to the new series was slightly higher than reported by the old series for most of the nineteenth century and the first decades of the twentieth century. A second feature is that the tremendous economic growth reported at the end of the period under investigation in the old series is significantly downgraded.

Taking into account the huge problems in the Norwegian economy in the 1920s, with the greatest Norwegian bank crisis ever and rocketing and persistent unemployment problems, the new series might solve a hitherto unexplained dilemma for economic historians. That of reconciling the deep crises with the substantial growth rates reported for the decade leading up to 1930.⁷⁶

Chart 4. Norwegian GDP, old and new series, in mill 1930-NOK.



Sources, See text.

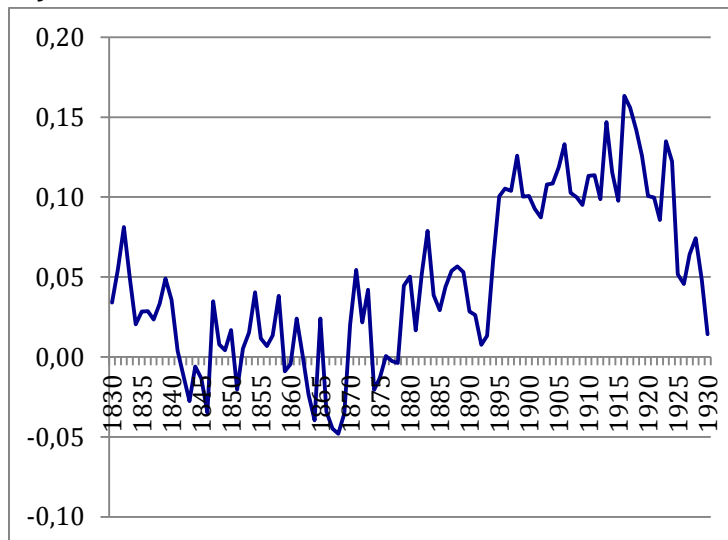
Again, we find that booms and busts stand out as being more distinct in the new series. This concerns in particular the boom of the 1890s and the bust during the long depression from the mid 1870s to the early 1890s. Also, the long depression

⁷⁶ Grytten, Ola H. and Arngrim Hunnes 2014, "An anatomy of financial crises in Norway, 1830-2010, *Financial History Review*, 01/21, pp. 25-57.

starts earlier according to the new series, which is more in line with other qualitative and quantitative records and evidence.⁷⁷

Admittedly, the gaps during World War I seem very high. But still the results for the greater part of the new series are within the suggested margins of error in the old series according to Statistics Norway.⁷⁸ Also, it should be noted that the old estimates were not based on detailed annual production side calculations, but rather on interpolations between fairly aggregated benchmark years estimates. Thus, the new series should be both more valid and reliable than the old ones.

Chart 5. Relative gaps between new and old GDP series in fixed NOK-1930 values 1830-1930.



Sources, See text.

8.2. Output gaps

The deviations between levels and annual fluctuations between the series have some impact on the output gaps, the new series reflecting a development more in line with international business cycles and alternative domestic qualitative and quantitative sources.⁷⁹

⁷⁷ Klovland, Jan T. 1998, pp. 49-90.

⁷⁸ Bjerke 1966, pp. 8-14.

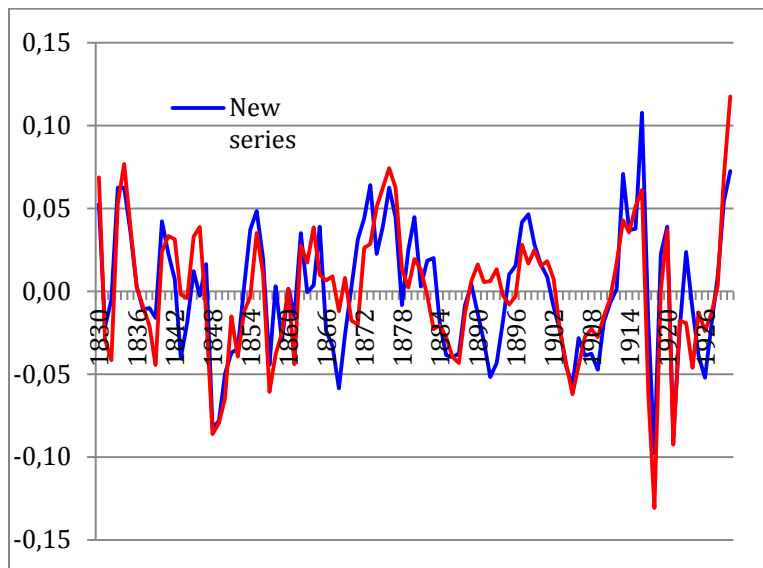
⁷⁹ Hanisch, Tore J. 1996, *Om valget av det gode samfunn*, Kristiansand: Høyskoleforlaget, pp. 53-84.

Chart 6 reports output gaps, or cycles (C) according to the old and new GDP series calculated as annual log-differences between annual estimated GDP (Y) and a HP-trended series (T) for every year (t) with 2,500 as smoothing parameter (λ).

$$(8) \quad C_t = \ln Y_t - \ln T_t$$

The output gaps also confirm that Norway, as a small open economy did indeed experience the international bust in the early 1890s, contrary to the story told by the old series.⁸⁰ In addition the new estimates reports more significant slumps during the 1848-crisis, the Crimean crisis in the late 1850s and the domestic deflationary crisis in the mid 1920s. All these findings seem to be reasonable, as they are more in line with our general knowledge from reading Norwegian economic history than the old series.

Chart 6. Relative output gaps 1730-1830 according to old and new GDP-series. Calculated by HP-filter with lambda value 2,500.



Sources, See text.

⁸⁰ Statistics Norway 1965, pp. 348-349.

9. Conclusions

The present paper presents calculations of Norwegian gross domestic product 1830-1930 from the production side in three levels. It presents series for 30 industries on the lowest, level, 18 on the next level, and finally eight on the highest level. These are the first annual series presented for Norwegian GDP by industry for this hundred-year period.

The calculations are conducted on the basis of available sources on input, output volumes and prices. The new figures measured in current values correspond well with the old series. However, they seem to mirror the international business cycles better.

The fixed price calculations are carried out when possible with a double deflation technique , i.e. for primary and secondary industries along with trade. As for other services, a simple deflation technique has been used.

The old and the new fixed price series are still in good accordance both regarding levels and developments. However, some differences exist. The new aggregated series is more in line with international trends and domestic business cycles than the old one. The new series also revise the growth rates of the 1920s down to a level, which is easier to understand and explain for writers on Norwegian economic history. Thus, the new series on GDP by industry, presented in this paper seem fairly consistent, valid and reliable.

Table 1. Norwegian GDP per industry in manufacturing 1830-1930 in current 1000 NOK

	Foodstuff	Textiles	Clothing	Leather & rubber	Lumber products	Fabricated wood products	Wood processing	Chemicals	Non-metallic minerals	Metal products	Electrochemicals & metallurgicals	Oils & fat	Total
1896	36776	9680	9491	4381	23789	3586	16161	3229	9676	16470	-	1373	134612
1897	42090	9959	10244	4793	26564	3811	18369	3581	10935	18222	-	1507	150075
1898	47223	10251	11594	4958	27876	4265	21771	4123	12873	20637	-	1476	167047
1899	51993	10987	13281	5728	29757	4786	23185	4677	15318	23142	59	1409	184322
1900	54139	11542	14917	5902	33667	5315	23001	4546	13338	24032	894	1235	192528
1901	54646	11556	16490	5771	32597	5026	23343	4709	13321	24903	408	1722	194492
1902	53289	10962	17243	5024	29158	4596	22866	4004	12640	24747	518	2009	187056
1903	52076	10546	17135	4657	30801	4691	22796	4227	11957	24484	1260	1699	186329
1904	50519	10014	13062	4448	28441	4647	22809	4539	12146	24429	1598	1634	178286
1905	53097	11116	15486	5036	27747	5274	25684	4764	12436	25474	2153	1471	189738
1906	61007	12571	16670	5228	31256	5947	29299	5386	13497	28555	3744	1837	214997
1907	66745	13894	16969	5651	34545	6908	33894	5935	13536	34346	6193	2146	240762
1908	70981	14641	19426	6270	30038	7460	41804	6909	14794	38901	11220	2770	265214
1909	72498	16546	21032	5961	30078	7679	46160	7068	15292	38884	11532	2963	275693
1910	82153	17405	23366	6135	32592	8951	55065	7447	16962	45105	15902	3215	314298
1911	85316	18180	25674	6619	32166	9992	59882	7830	18893	50655	23239	3778	342224
1912	101825	20068	32421	7370	33758	10917	75245	9193	21850	66964	38513	4271	422395
1913	126458	22166	37433	8109	33030	13359	90804	9681	23489	78610	41392	4302	488833
1914	133844	23024	39086	8171	31182	14370	94241	9623	22428	79228	41522	5501	502220
1915	155945	27617	47350	13449	33155	24036	115230	12548	23424	92110	57079	9813	611756
1916	193228	41496	60526	20178	48680	48926	143538	19705	29055	114397	86729	13827	820285
1917	238683	52314	77663	32165	60916	76802	144636	32274	34983	150487	153060	16679	1070662
1918	236550	59569	91783	35178	75329	70741	201036	37953	53204	204039	149778	22810	1237970
1919	317643	67867	107576	36346	78090	70177	221794	38052	54380	242896	117403	24015	1376239
1920	410626	78401	155527	45124	80207	78317	269791	57168	61921	295633	136147	25996	1694858
1921	321420	43507	88346	31127	49399	41484	163762	29971	44338	180324	68957	22307	1084942
1922	332988	46989	109210	27485	50576	38627	196893	28197	47143	189076	60591	20704	1148479
1923	332404	46646	111806	28372	49213	46056	187041	30443	51215	190032	74826	24405	1172459
1924	399956	51885	119394	33487	76058	51660	182489	39912	62655	207077	92327	34164	1351064
1925	432349	59507	128521	36323	62288	53201	220836	40618	61309	232455	112314	33197	1472918
1926	373235	47747	100902	26786	41650	35312	166578	34432	37752	166025	82287	26135	1138841
1927	346655	45802	96659	23844	37647	30807	160619	30183	40738	140627	66107	19890	1039578
1928	316982	44305	101197	21529	43528	31773	162867	33813	45630	174577	86369	24816	1087386
1929	346620	48952	97736	20691	39975	32660	162592	32024	47758	190669	96950	22371	1138998
1930	329388	49115	99388	20737	30311	33909	146192	33678	50198	186099	108272	17266	1104553

Table 2. Norwegian GDP by industry 1830-1930 in fixed million NOK-1930.

	Foodstuff	Textiles	Clothing	Leather & rubber	Lumber products	Fabricated wood products	Wood processing	Chemicals	Non-metallic minerals	Metal products	Electrochemicals & metallurgicals	Oils & fat	Total
1896	155726	22164	27459	6249	18040	18775	23454	8964	34416	24701		2527	351087
1897	174998	22152	28764	7250	19569	19350	26078	9120	38040	27862		2689	385977
1898	193497	22170	31562	7173	19965	21020	30139	10478	43544	31782		2557	425654
1899	204823	23118	35117	8324	20737	22912	31226	11088	50403	33829	81	2371	456402
1900	202092	23645	38513	7806	22843	24735	30262	10866	42201	33838	1207	2020	450915
1901	206146	23676	42784	7204	22118	23392	30581	11043	42417	35432	551	2816	459867
1902	208357	23065	45986	6681	20319	22649	30148	10566	41334	35899	718	3479	461245
1903	208382	22555	46589	6370	21818	23119	30936	11488	39722	36306	1776	2942	463677
1904	209129	21900	35732	6421	20600	22903	32194	12154	41528	37273	2509	2829	457480
1905	216665	23906	41416	7129	19763	24545	36127	12691	41821	38857	3233	2407	481715
1906	243627	26450	43433	7322	21781	26222	40511	13594	44162	43075	5467	2846	533103
1907	250937	28169	42340	7640	23196	28934	45198	14685	42290	49943	8739	3159	559829
1908	256082	29225	47924	8456	19858	31250	55336	17545	45769	54979	14930	4078	600801
1909	253041	33200	52040	8083	19988	33858	61370	18637	47777	53566	15953	4591	617036
1910	285851	34417	56503	8746	27172	40470	70614	20215	51010	62739	22229	5556	700022
1911	284324	35239	60634	10470	32933	46384	73883	21054	53895	70837	32864	7162	739952
1912	319154	37133	73035	11782	39758	48331	85852	21700	58232	91809	53344	7940	857042
1913	396622	39928	81012	14063	44814	59505	98222	22002	58776	105006	56501	8596	997308
1914	401184	41768	84462	15074	49454	63073	101593	20853	55003	109339	58395	11170	1021929
1915	392639	43925	90516	21146	52284	75388	108821	20744	47600	120114	73543	14489	1065640
1916	416653	46431	107409	23108	64779	102669	117214	24823	46939	133608	93671	13722	1185779
1917	373381	49079	115773	28489	68140	108333	106823	26783	43571	157108	113441	11056	1188628
1918	284499	41256	98415	24881	62479	96311	107218	25467	45604	145792	107974	15039	1038930
1919	350061	45562	108177	25503	63144	100337	113938	25505	45642	160662	89328	17250	1138140
1920	364017	46301	131356	26432	58105	98068	121153	31509	46441	172065	87257	16231	1197232
1921	303751	29709	82494	21561	40490	62819	86117	19725	36195	113059	56294	18041	873751
1922	360473	40047	124696	24266	52045	74264	126314	22707	45415	141250	67723	21955	1107094
1923	356281	43616	137144	26486	56166	88007	134158	24480	54055	157570	84533	26586	1188226
1924	365837	45928	134658	29170	83026	93329	129190	27610	61506	164256	92095	33529	1251285
1925	376872	52359	142509	32984	70033	91148	158906	28019	58899	185055	113793	37608	1342875
1926	373465	51310	135835	29693	58062	76519	148757	28382	42885	158048	105769	40185	1247657
1927	388827	54313	143741	30291	57999	79265	156093	29093	51318	147075	101973	36886	1277688
1928	374234	54367	159980	29323	71841	79201	163056	35113	64744	199735	135471	54418	1412864
1929	422973	62923	151875	26308	70858	81932	170039	37217	65141	236292	151388	51818	1523332
1930	406215	65387	144561	24119	65287	86205	165530	37063	70796	232528	254608	34683	1559052

Table 3. Deflators for Norwegian GDP per industry 1830-1930 (1930=100).

	Foodstuff	Textiles	Clothing	Leather & rubber	Lumber products	Fabricated wood products	Wood processing	Chemicals	Non-metallic minerals	Metal products	Electrochemicals & metallurgicals	Oils & fat	Total
1896	29.12	58.14	50.27	81.55	284.03	48.56	78.02	39.64	39.65	83.31		109.14	54.12
1897	29.66	59.85	51.80	76.89	292.38	50.07	79.76	43.21	40.54	81.72		112.59	54.88
1898	30.10	61.56	53.43	80.39	300.73	51.58	81.79	43.30	41.69	81.13		115.96	55.39
1899	31.31	63.27	55.01	80.04	309.07	53.10	84.07	46.42	42.86	85.48	170.71	119.36	57.00
1900	33.04	64.99	56.34	87.94	317.45	54.63	86.06	46.04	44.58	88.74	174.20	122.83	60.27
1901	32.69	64.98	56.06	93.17	317.43	54.62	86.43	46.93	44.29	87.82	174.28	122.83	59.70
1902	31.54	63.27	54.54	87.46	309.09	51.59	85.88	41.70	43.13	86.13	169.73	115.98	57.24
1903	30.82	62.25	53.50	85.02	304.08	51.58	83.43	40.49	42.45	84.26	166.86	115.99	56.72
1904	29.79	60.88	53.17	80.57	297.38	51.58	80.22	41.10	41.25	81.89	149.79	116.02	55.01
1905	30.22	61.90	54.39	82.17	302.41	54.63	80.50	41.31	41.94	81.91	156.62	122.78	55.60
1906	30.88	63.27	55.83	83.05	309.09	57.66	81.89	43.60	43.10	82.83	161.05	129.66	56.92
1907	32.80	65.66	58.29	86.03	320.78	60.70	84.91	44.48	45.14	85.93	166.64	136.45	60.70
1908	34.18	66.69	58.96	86.24	325.80	60.69	85.54	43.34	45.59	88.41	176.72	136.46	62.31
1909	35.33	66.35	58.78	85.77	324.13	57.66	85.17	41.74	45.14	90.70	169.99	129.65	63.07
1910	35.44	67.32	60.15	81.58	258.36	56.23	88.30	40.54	46.90	89.83	168.22	116.24	63.37
1911	37.01	68.68	61.59	73.53	210.37	54.76	91.77	40.93	49.44	89.35	166.29	105.97	65.28
1912	39.35	71.95	64.57	72.75	182.89	57.42	99.24	46.62	52.92	91.14	169.78	108.06	69.56
1913	39.32	73.91	67.21	67.06	158.75	57.07	104.68	48.42	56.36	93.54	172.27	100.53	69.18
1914	41.14	73.39	67.31	63.05	135.81	57.92	105.03	50.78	57.51	90.54	167.21	98.93	69.37
1915	48.98	83.70	76.09	73.97	136.59	81.05	119.90	66.57	69.40	95.82	182.51	136.05	81.03
1916	57.19	118.98	81.96	101.56	161.86	121.15	138.66	87.36	87.30	106.98	217.73	202.41	97.64
1917	78.83	141.91	97.57	131.32	192.56	180.23	153.31	132.61	113.24	119.68	317.28	303.03	127.14
1918	102.54	192.23	135.65	164.44	259.69	186.73	212.30	164.01	164.54	174.87	326.20	304.67	168.19
1919	111.90	198.30	144.64	165.75	266.37	177.81	220.41	164.19	168.03	188.90	309.06	279.65	170.68
1920	139.11	225.43	172.22	198.56	297.32	203.02	252.14	199.67	188.04	214.68	366.92	321.73	199.82
1921	130.50	194.96	155.77	167.91	262.78	167.88	215.32	167.21	172.76	199.29	288.05	248.37	175.26
1922	113.92	156.21	127.39	131.73	209.31	132.23	176.50	136.66	146.40	167.25	210.39	189.42	146.42
1923	115.06	142.38	118.58	124.59	188.73	133.04	157.86	136.86	133.62	150.69	208.15	184.40	139.27
1924	134.83	150.40	128.96	133.52	197.31	140.72	159.94	159.09	143.67	157.52	235.75	204.68	152.40
1925	141.48	151.30	131.17	128.08	191.57	148.39	157.36	159.54	146.80	156.95	232.10	177.31	154.82
1926	123.25	123.88	108.04	104.92	154.51	117.32	126.79	133.51	124.15	131.25	182.95	130.64	128.84
1927	109.95	112.27	97.81	91.55	139.81	98.81	116.51	114.17	111.96	119.47	152.45	108.31	114.84
1928	104.46	108.49	92.01	85.39	130.50	101.99	113.10	105.98	99.40	109.21	149.92	91.60	108.63
1929	101.06	103.57	93.60	91.47	121.51	101.34	108.27	94.69	103.40	100.82	150.60	86.72	105.54
1930	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00