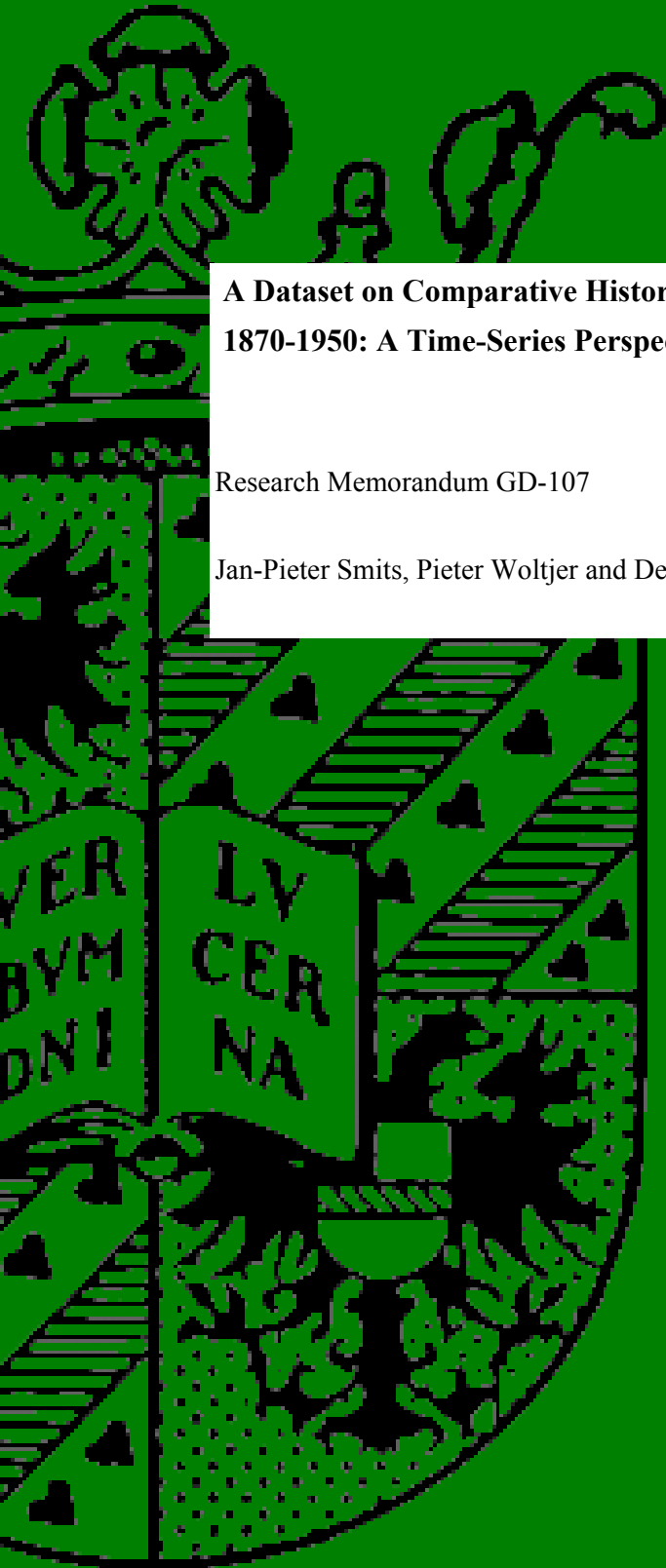


**A Dataset on Comparative Historical National Accounts, ca.
1870-1950: A Time-Series Perspective**

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A Dataset on Comparative Historical National Accounts, ca. 1870-1950: A Time-Series Perspective¹

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Abstract:

This paper accompanies the Historical National Accounts datahub which presents an overview of the currently available studies on long-term economic growth across countries. Now that more and more detailed historical national accounts have become available, the *Groningen Growth and Development Centre* (GGDC) in collaboration with the Department of Economic History of the London School of Economics (LSE) has initiated a new research project aiming to enhance our knowledge on comparative economic performance. The basic idea of this datahub is to bring together the available, but fragmented, data on GDP at the industry level for all major economies and to standardise these series to make a consistent long run international comparison of output and productivity feasible. GDP data and their components are presented in local currencies, both at current as well as constant prices.

¹ We thank Herman de Jong for his valuable input.

1. Introduction

Ever since Simon Kuznets embarked upon his project to systematically chart the economic development of countries, historians and economists have tried to construct datasets on long-run economic growth and structural change. This research is flourishing nowadays as many “regional initiatives” have been taken to construct the historical national accounts for East-Asian-, Latin American- and European countries. Now that more and more detailed historical national accounts have become available, we feel it is time to present these estimates on one datahub and to focus on the comparability of these estimates.

Reconstructions of historical national accounts across countries may vary in methods and methodologies applied (e.g. in classification schemes of economic activities), depending on the availability and quality of the basic data. Information on these working procedures and the resulting outcomes enhance our knowledge on comparative economic performance. It is for this reason that the *Groningen Growth and Development Centre* (GGDC) in collaboration with the Department of Economic History of the London School of Economics (LSE) has initiated a new research project dealing with the construction of comparative historical national accounts. Debin Ma and Tirthankar Roy (on South Asia) will seek to include as many countries in East, Southeast and South Asia as there are available reliable published data series. The basic idea of this datahub is to bring together the available, but fragmented, data on GDP at the industry level for all the major economies and to standardise these series to make a consistent long run international comparison of output and productivity feasible. GDP data and their components are presented in local currencies, both at current as well as constant prices.

Section 2 of this paper focuses on the way in which this datahub is related to important activities carried out by members of the GGDC, such as the comprehensive database of Angus Maddison on long-run changes in World GDP; the work of, most notably, Bart van Ark and Angus Maddison for the ICOP project (International Comparison of Output and Productivity); and the EU KLEMS project, co-ordinated by Bart van Ark, Mary O’Mahony and Marcel Timmer. Section 3 introduces the datafiles per country and provides a short description of the sources and methods underlying the GDP estimates. Finally, section 4 discusses the research agenda and potential additions to this database for the coming years.

2. Standardising national accounts

The Maddison dataset

In the last couple of decades a number of initiatives have been taken to build-up long-run series of GDP and its main components. These research efforts are highlighted by the many publications of

Angus Maddison.² He devoted a lifelong energy to amass various data sets and to make disparate estimates more comparable as well as to encourage scholars to pursue research on the historical accounts for countries for which no previous data are available. These efforts have now led to a large dataset which covers large parts of the world economy for long periods of time.³

Of course the work on long-run GDP estimates can be improved and extended in a number of ways. For example there is a general consensus among German scholars that the original GDP-estimates of the German economy made by Walther Hoffmann are flawed and are in need of revision. Furthermore, Maddison's dataset relies on a single, fairly recent, benchmark to convert levels of GDP in national currency into one common currency unit (e.g 1990 Geary-Khamis dollars). One could improve on this and take relative price changes over time into account by making international Purchasing Power Parity (PPP) comparisons for earlier benchmark years, which would particularly benefit GDP estimates farther removed from the 1990 base year.

The present datahub in relation to other research initiatives

The work done at the Groningen Growth and Development Centre aims to build on the ongoing work of Maddison. We present historical national accounts data for the period ca 1870-ca 1950, but in more detail than has been done so far. In order to enhance the analysis of structural change, we disaggregate the GDP data by providing sectoral estimates (agriculture, industry and services) and, whenever possible, by covering 25-30 of the major underlying industries.

This project is supported by the International Economic History Association and financed by the Netherlands Organisation for Scientific Research (NWO). In this project we closely co-operate with existing networks in the field of historical national accounting. For example, this database refers to the Eastern Asian research project carried out at Hitotsubashi University under the supervision of professor Kyoji Fukao. For the Latin American countries, contacts have been established with Albert Carreras, André Hofman and C ezar Yanez who are working on an extension and a standardisation of time series of the various Latin American countries. Besides, this work is carried out in close co-operation with our Scandinavian colleagues of the project on Nordic Historical National Accounts. Last but not least, this project is embedded and partly financed by the ESF/SCSS Scientific Programme *Globalizing Europe Economic History Network* (GLOBALEURONET), co-ordinated by Stefano Battilossi (Carlos III, Madrid) in which 14 countries participate, among which the Netherlands.

This historical research is linked to more contemporary work that has already been carried out within the research group of the Groningen Growth and Development Centre. Above all the EU

² See for example: A. Maddison, *The world economy: a millennial perspective* (Paris: OECD, 2001).

³ Publications and data from Angus Maddison can be found at the website of the Groningen Growth and Development Centre: <http://www.ggdc.net/Maddison/>.

KLEMS project (Productivity in the European Union: A Comparative Industry Approach) should be mentioned.⁴ EU KLEMS provides information on economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards. Productivity measures have been developed, in particular with growth accounting techniques. Substantial methodological and data research on these measures will be carried out to improve international comparability.

The present datahub *Historical National Accounts* will in some cases refer to these other GGDC datasets. The same kind of methodologies will be used as much as possible in order to arrive at a consistent picture of the levels and growth rates of output and productivity in the long run.

3. Presentation of data

The first generation of data files presented on the datahub *Historical National Accounts* provide an overview of the historical evolution of GDP - disaggregated at industry level - for a number of European and Asian countries, as well as the United States. Data are given at current and constant prices. Most series cover the period 1870-1950. Whenever earlier reliable GDP estimates and underlying time series are available, these estimates have been included.

Restricting time series to the period until 1950

The year 1950 has been taken as the end year of the historical time series for methodological reasons. From the 1960s onwards a number of important revisions of the System of National Accounts (SNA) have been introduced. These revisions have led to new (and mostly higher) GDP estimates for the recent period which in turn are projected backwards using existing GDP time series. One statistical result of this is that countries become increasingly richer in the past. Some, but not all, of these revisions are relevant for the pre-1960 period; a clear example are the revisions which are linked to ICT phenomena, and which should be ignored when constructing long-run time series. In future updates of this site we will attempt to tackle this problem by identifying which aspects of the revisions should be taken on board when building historical GDP series.

For the moment we will link GDP volume series for the period 1870-1950 with post-1950 data derived from the GGDC ten-sector database. However, we will only present these long-run series in the form of index numbers instead of presenting absolute levels of GDP for the reason mentioned above. In case authors have published long-run time series (such as for Spain and Sweden) covering the whole 19th and 20th century, we have included these estimates in the datahub. For the Eastern European countries we only provide data for the period 1950-1990 (and one data point for the late

⁴ The information of EU KLEMS is derived from the website: <http://www.euklems.net>.

1930s). We made this decision because these data are presently not available to the general public and may serve as an important addition to the GDP estimates as presented by Maddison (based on the reports published by the research group of Thad Alton). We plan to extend these series to earlier periods of time to allow for the comparison between the other countries in our dataset.

Structure of datafiles

In all files we have used the NACE industry classification (rev. 1.1) at the 2-digit level to provide an industry breakdown of GDP (<http://ec.europa.eu/eurostat/ramon/>; for details see appendix 1). In some cases we chose not to show the lowest available industrial nodes - which went beyond the level of industrial detail used for the other countries - to ensure the comparability between countries. In some cases industries were regrouped into more general categories in order to arrive at units that can be identified for the majority of countries.

The country files are structured as follows. The first sheet gives basic information about the variables that are included in the file and the main data sources on which the estimates are based. The three subsequent sheets deal with value added at current prices (VA), value added at constant prices (VA-K) and volume indices of GDP (VA-Ki). For each of these files the industry classification is presented in the way it was published by the scholars who made the original estimates.

Different types of estimation procedures

The GDP estimates of the various countries sometimes differ in the kind of methodologies used. The estimates of the first generation, which are the result of the international research project that Simon Kuznets initiated to chart the long-run economic development of countries, are not entirely in line with the recommendations of the latest SNA. Often, GDP (at industry level) was estimated on the basis of volume series for a number of important products which were supposed to be representative for larger industries. These volume series in their turn were often weighted using value added weights derived from a census for a benchmark year at the end of the period under investigation. Some prime movers in the field of historical national accounting have followed these methods, e.g. for the United Kingdom, Germany and France. The results surely give a fair impression of the long-term trends in GDP. However, we should realise that a number of methodological problems can occur mainly due to changes in the relative price levels between countries - which are not always taken into account - the changes in input/output relations - which are often ignored - and as a result of course estimates of the value added in services, which primarily affect estimates at the sectoral or industrial level. The second generation estimates, which started in many countries in the 1980s, are less vulnerable to these problems.

One final remark should be made as to how these time series relate to the work of Angus Maddison. Where possible we used the same data sources as he did, and we tried to add the underlying industry data for the aggregated GDP data he published. This could not be done in those cases, where Maddison had to rely on GDP figures that were primarily based on expenditure estimates. In case we found output estimates for these countries, we chose to take these as the starting point for our database.

Last but not least two general files will be provided with indices on agricultural and industrial value added for the whole period ca. 1870-present. Due to problems concerning SNA revision no absolute levels are given, however general long-run trends will be provided.

Country sources

For each of the countries included in this version of the datahub not only the main sources are cited, but also a short characteristic of the dataset is given. Following Maddison (1995, pp. 120-123) we distinguish the following characteristics of the indicator sets⁵:

VA: The cited sources contain current values;

VO: The sources provide volume indices or constant price estimates;

P: Appropriate deflators are given (or they are implicitly available in the source cited).

The datahub presents data for the following countries:

Western Europe

Belgium

-*Source*: For an overview of the sources and research methodology on which the Belgian project is based, see: E. Buyst, J.P. Smits and J.L. van Zanden, 'National Accounts for the Low Countries: The Netherlands and Belgium, 1800-1990', *The Scandinavian Economic History Review* 43, 1 (1995): 53 -76. The Belgian project on the reconstruction of the Historical National Accounts (led by H. van der Wee and E. Buyst) has resulted in new estimates for GNP (based on the income and expenditure approach) for the interwar period, see E. Buyst, 'New GNP estimates for the Belgian economy during the interwar period', *Review of Income and Wealth* 43, 3 (2005): 357-75. However, long-run time series for the 19th and 20th century, based on output calculations, have not been published. For now provisional historical GDP series for Belgium are derived from: E. Horlings, *Estimates of Value Added in the Belgian Service Sector 1830-1953* (Leuven: Research Memorandum Catholic University of Leuven, 1996). In this paper Horlings combines own new estimates of services with work on agriculture and industry by: Martine Goosens, *The Economic Development of Belgian Agriculture: A Regional Perspective (1812-1946)* (Leuven: Leuven University Press, 1993); Jan Blomme, *The economic development of Belgian agriculture 1880-1980. A quantitative and qualitative analysis* (Brussels: Studies in Belgian Economic History III, 1992); A. Soete, *The evolution of the competitiveness of the Belgian manufacturing industry in the long run, 1880-1990*. (Paper presented at the economics department of the Catholic University Leuven 1994); J. Gadisseur, 'Contribution à l'étude de la production agricole en Belgique de 1846 à 1913', *Revue Belge d'histoire contemporaine*, vol. IV, 1973.

-*Method*: VO, 12 industries, 1835-1913; 1920-1939 and 1946-1953.

⁵ A. Maddison, *Monitoring the world economy* (Paris: OECD, 1995).

Finland

-Source: R. Hjerpe, *The Finnish Economy 1860-1985: growth and structural change* (Helsinki: Bank of Finland, 1989); R. Hjerpe, *Finland's Historical National Accounts 1860-1994: Calculation Methods and Statistical Tables*, Jyväskylän yliopisto historian laitos, Suomen historian julkaisuja 24 (Jyväskylä: Kopi-Jyvä Oy, 1996).

-Website: <http://old.nhh.no/forskning/nnb/>

-Method: VAVOP, 15 industries, 1860-1985.

France

-Source: J.-C. Toutain, *Le produit interieur brut de la France de 1789 á 1982. Économies et Société* (Grenoble 1987).

-Method: VAVOP, 7 industries, 1815-1938.

Germany

-Source: W.G. Hoffmann (with F. Grumbach and H. Hesse), *Das Wachstum des deutschen Wirtschaft seit der Mitte des 19. Jahrhunderts* (Berlin: Springer, 1965).

-Method: VO, 5 industries, 1850-1913; 1925-1938; 1950-1959.

Italy

-Source: S. Fenoaltea, 'The Growth of the Italian Economy, 1861-1913: Preliminary and Second-generation Estimates', *European Review of Economic History* 9 no. 3 (2005): 273-312.

-Method: VAVOP, 15 industries, 1861-1913.

Netherlands

-Source: An overview of historical GDP at current prices for the period 1807-1939 (including a breakdown into industries for the period 1807-1913) can be found in: R. van der Bie and J.P. Smits. *Tweehonderd Jaar Statistiek in Tijdsreksen, 1800-1999* (Voorburg: CBS-RUG, 2001); an industrial breakdown of GDP for the period 1921-1939 is taken from G.P. den Bakker, 'The Dutch Interwar Economy Revisited. Construction and Analysis of National Account' (unpublished manuscript); data for 1948-1960 derived from the GGDC 10 sector database. For detailed series at constant prices for the period 1807-1913 see: Smits, J.P., E. Horlings and J.L. van Zanden. *The Measurement of Gross National Product and its Components 1800-1913* (Groningen Growth and Development Centre Monograph series no 5, 2000); Agricultural value added at constant prices based on the current price estimates in Van der Bie and Smits (2001) deflated with an agricultural price index taken from Knibbe, M. *Agriculture in the Netherlands 1851-1950. Production and institutional change* (Amsterdam: NEHA, 1993). For changes in real industrial value added in the interwar period see: CBS, *Vijfentachtig jaren statistiek in tijdsreksen* (CBS-Den Haag, 1984).

-Website: <http://nationalaccounts.niwi.knaw.nl/>; Smits, J.P., E. Horlings and J.L. van Zanden. *The Measurement of Gross National Product and its Components 1800-1913* (Groningen Growth and Development Centre Monograph series no 5, 2000): <http://www.ggdc.net/publications/monoabstract?id=5>

-Method: VAVOP, 30 industries, 1807-1939; 6 industries 1914-1939.

Spain

-Source: L. Prados de la Escosura, *El Progreso Económico de España 1850-2000* (Bilbao: Fundación BBVA, 2003).

-Method: VAVOP, 15 industries, 1850-1958.

Sweden

-Source: Olle Krantz and Lennart Schön, *Swedish Historical National Accounts 1800-2000* (Lund: Lund Studies in Economic History, 2007)

-Website: <http://www.ehl.lu.se/database/LU-MADD/national%20accounts/Default.htm>;
<http://old.nhh.no/forskning/nnb/>

-Method: VAVOP, 4 industries, 1800-1997.

United Kingdom

Source: C.H. Feinstein, *National Income Expenditure and Output of the United Kingdom 1855-1965* (Cambridge: Cambridge University Press, 1972).

-Method: VO, 15 industries, 1855-1913; 1920-1938; 1946-1965.

Eastern Europe

-Sources: For Bulgaria, Czechoslovakia, Hungary, Poland, Romania and Yugoslavia estimates are presented for one year in the late 1930s and for the period ca. 1950-1991 (the data for Yugoslavia cover the period 1975-1991). The disaggregated GDP estimates are derived from the occasional reports that were presented by Thad Alton and his research group. In this project an “adjusted factor cost framework” was used to construct prices. These prices reflected average costs and imputations were made for capital costs. On the basis of this framework, weighting schemes were constructed for a number of benchmark years. A benchmark during the mid-1950s was used for 1950-1965; a figure for the late 1960s for the period 1965-1975; mid-1970s weights for the period 1975-1985 and finally a weight for the period 1985-1991.

All estimates are based on the occasional papers by Thad Alton and Associates, ‘Statistics on Eastern European Structure and Growth’. For more details, see the references in Maddison, *Monitoring the World Economy*, pp. 139-143.

-Method:

Bulgaria: VO 25 industries, 1939; 1948-1991.

Czechoslovakia: VO, 26 industries, 1937; 1948-1991.

Hungary: VO, 32 industries, 1938; 1946-1991.

Poland: VO, 15 industries, 1937; 1946-1991.

Romania: VO, 13 industries, 1938; 1948-1964; 27 industries 1965-1991 (less detailed industrial data for 1968-1974).

Yugoslavia: VO, 29 industries, 1975-1991.

United States:

-Source: The output index at constant prices for the entire period has been based on J.W. Kendrick, *Productivity Trends in the United States* (Princeton: Princeton University Press, 1961); *Agriculture, Hunting and Forestry*: pp. 362-364; *Fishing*: p. 361; *Mining and Quarrying*: pp. 397-398; *Manufacturing*: pp. 465-475; *Electricity, Gas and Water Supply*: pp. 578, 590-593; *Construction*: p. 498; *Trade*: p. 506; *Transport*: p. 540; *Communications*: p. 583-584; *Financial Intermediation, Real Estate and Business Activities*: p. 610. However, the data at industry level are in general not on an annual basis (see below).

The current output data and prices were taken from J. Attack, and F. Bateman, ‘Manufacturing’, *Historical Statistics of the United States Millennial Edition*, Volume 4 Economic Sectors (Cambridge: Cambridge University Press, 2006): 579-617, 621-646. Additional current output data was based on figures taken from various editions of the U.S. Bureau of the Census, *Census of Manufactures*. Output at current prices was estimated as follows: the current value added figures from Attack and Bateman (2006) were interpolated using *Census of Manufactures* data for various years to fill the gaps (in particular Manufacture of food products, beverages and tobacco and Manufacture of basic metals and metal products for the period 1899-1939). The *Censuses of Manufactures* were concorded to comply with the U.S. Standard Industrial Classification of 1987. To calculate output in constant prices specific price deflators were constructed based on the Kendrick data for constant output and on the current value added census data. These price deflators were interpolated based on individual price data taken Attack and Bateman (2006) and the *Censuses of Manufactures* as well as the trend for the overall Manufacturing price index. From these price indices implicit quantity indices for census years were constructed. The quantity indices were then aggregated using a chained Fisher index which closely resembles the Marshall-Edgeworth formula applied by Kendrick. Prices were used as weights for the years 1899, 1909, 1919, 1929, 1937, 1948, 1953 and 1957. The original Kendrick index series was used for industry D, Manufacturing.

-Method: VO, 17 industries, 1869; 1879; 1889-1957.

Asia

(See also the database by the Institute of Economic Research at Hitotsubashi University at <http://goe.ier.hit-u.ac.jp/english/research/database/index.html#point03>)

China

-Source: Ta-chung Liu and Kung-chia Yeh (1965), *The Economy of the Chinese Mainland: National Income and Economic Development, 1933-1959*. (Princeton NJ: Princeton University Press, 1965). Table 8, p. 66.

-Method: VA, 13 industries, benchmark 1933.

India

-Source: For 1868/1869 to 1899/1901: Alan Heston, 'National Income'. in: Dharma Kumar and Meghnad Desai (eds.), *The Cambridge Economic History of India. Volume 2: c.1757-c.1970* (Cambridge: Cambridge University Press, 1983): p. 397. Post 1900 data are taken from: S. Sivasubramonian. *The National Income of India in the Twentieth Century* (Oxford: Oxford University Press, 2000). The figures relate to Undivided India, comprising the territory of the future Indian Union, plus Pakistan and Bangladesh. It excludes Birma.

Special remarks concerning the pre-1900 data: Livestock corresponds to animal husbandry; services are included under small-scale and cottage industries; Current prices were obtained by inflating the figures from Heston (1983) using price series from M. McAlpin (1983), 'Price Movements and Economic Fluctuations' In: Dharma Kumar and Meghnad Desai (eds.), *The Cambridge Economic History of India. Volume 2: c.1757-c.1970* (Cambridge: Cambridge University Press, 1983): chapter XI. For Agriculture, a 'weighted agricultural index' was used (p. 903, series 2) whereas for the other series a weighted price index was constructed using a 'weighted index of agricultural prices' (p. 903, series 2) and a 'weighted index of non-agricultural price' (p. 903, series 3), both weighted by their contribution to GDP that was, in turn, computed from constant price GDP from Heston (1983) and from Sivasubramonian (2000). These recalculations were made by Debin Ma, Tirthankar Roy and Felip Fernandes (all from LSE).

-Method: VOP, 10 industries, 1873/74-1899/1900; VOP, 23 industries, 1900-1946/47.

Japan

-Source: K. Ohkawa, N. Takamatsu, and Y. Yamamoto. 'Vol 1 National Income' in K. Ohkawa, M. Shinohara, and M. Umemura (eds). *Estimates of Long-Term Economic Statistics of Japan Since 1868* (Tokyo: Toyo Keizai Shinposha, 1974).

-Method: VAVOP, timeperiod, number of industrial branches: 1885-1940, 15 sectors.

(South) Korea

-Source: T. Mizoguchi and M. Umemura *Basic Economic Statistics of Former Japanese Colonies, 1885-1938: Estimates and Findings* (Tokyo: Tokyo Keizai Shinposha, 1988), pp. 2336-37; Myung Soo Cha and Kim Nak Nyeon *Korea's First Industrial Revolution, 1911-1940*, Naksungdae Institute of Economic Research Working Paper 2006-3 (Table 1).

-Method: VAVOP, timeperiod, number of industrial branches: 1911-1940, 15 sectors.

Taiwan

-Source: T. Mizoguchi and M. Umemura (eds.) *Basic Economic Statistics of Former Japanese Colonies, 1885-1938: Estimates and Findings* (Tokyo: Tokyo Keizai Shinposha, 1988).

-Method: VAVOP, timeperiod, number of industrial branches: 1902-1938, 3 sectors.

Lastly we provide an overview file containing the indices on agricultural, mining, manufacturing and industrial constant value added for the whole period ca. 1870-present. As mentioned above, problems arise in long-term series of output partly because of revisions in the System of National Accounts, therefore we chose to present these figures solely in the form of indices.

4. Research agenda

This version of the datahub presents the first generation of disaggregated Historical National Accounts for a number of European and East Asian countries as well as the United States. Contrary to existing datasets, estimates are given in national currencies and –where possible- at current and constant prices. At this moment, estimates are still limited to research that has been done using a value added (output) approach. It is our aim to expand on this selection of countries as well as to supplement the currently

available data with new or revised figures. We will try and incorporate any additions, revision or suggestions made by our users - either based on already published country studies or as of yet unpublished research - and we will provide regular updates accordingly. In the near future we will mainly focus on the following five areas to extend this dataset:

- 1) *Addition of employment data and productivity measures*: In addition to the value added series, data on employment and hours worked is required for the research into the comparative trends in labour productivity. A second release of the database should be complemented with data on labour input, standardised across countries.
- 2) *Making benchmark comparisons of labour productivity*: The relative price structures, available in the widely used PPP benchmarks for the late 20th century, may not be representative for earlier periods in time and are thus less suited for country comparison across the long time-span covered in this datahub (for more details see appendix 2). Recently, attempts have been made to develop expenditure PPPs for benchmark years before WWII, as well as new industry-of-origin estimates.⁶ In addition to the research into price differences between countries for a particular benchmark year, attention needs to be paid to price changes *within* countries as well.
- 3) *Addition of more countries to the website and/or extending time series for those countries which are already included*: In the following version of the datahub more attention will be paid to Latin America, sub Saharan Africa as well as Southern and South Eastern Asia.
- 4) *The treatment of the service sector*: During the last two decades new estimation procedures have been developed in order to measure output and productivity in services. However, in many of the first generations of historical national accounts (such as those of the United Kingdom, France and Germany) many different estimation procedures have been applied. The measurement of service output needs to be standardised (for more details see appendix 3).
- 5) *Long-run economic growth and sustainability - a capital perspective*: Even though GDP is used as an important indicator for economic growth, criticism has been levelled against conventional accounting. Therefore, we plan to include issues concerning welfare and sustainability in due time. Following recommendations from the *Working Group on the Statistics on Sustainable Development (WGSSD)*, sustainability will be charted on the basis of a capital approach. According to the Brundtland definition, a society is supposed to be on a sustainable path in case enough means of production (i.e. different forms of capital) are left to

⁶ See e.g. M. Ward and J. Devereux, 'Measuring British decline: Direct versus long-span income measures', *Journal of Economic History* 63, no. 3 (2003): 826-851; R. Fremdling, H. de Jong and M.P. Timmer, 'British and German Manufacturing Productivity Compared: A New Benchmark for 1935/36 Based on Double Deflated Value Added.' *Journal of Economic History* 67, no. 2 (2007): 350-78; H. de Jong and P. Woltjer, 'A Comparison of Real Output and Productivity for British and American Manufacturing in 1935', *GGDC Research Memorandum*, no. 108, Groningen: Groningen Growth and Development Centre (2009).

future generations in order for them to be able to generate welfare. Here capital is defined in a broader sense as is often done in the conventional national accounts, by also including natural and social capital.

Appendix 1: Industry Classification Historical National Accounts Dataset (NACE rev 1.1)

- A Agriculture, hunting and forestry
 - 1 Agriculture, hunting and related service activities
 - 2 Forestry, logging and related service activities
- B Fishing
- C Mining and quarrying
 - 10 Mining of coal and lignite; extraction of peat
 - 11 Extraction of crude petroleum and natural gas; service activities incidental to oil and gas extraction, excluding surveying
 - 12 Mining of uranium and thorium ores
 - 13 Mining of metal ores
 - 14 Other mining and quarrying
- D Manufacturing
 - 15 Manufacture of food products and beverages
 - 16 Manufacture of tobacco products
 - 17 Manufacture of textiles
 - 18 Manufacture of wearing apparel; dressing and dyeing of fur
 - 19 Tanning and dressing of leather; manufacture of luggage, handbags, saddlery, harness and footwear
 - 20 Manufacture of wood and of products of wood and cork, except furniture; manufacture of articles of straw and plaiting materials
 - 21 Manufacture of pulp, paper and paper products
 - 22 Publishing, printing and reproduction of recorded media
 - 23 Manufacture of coke, refined petroleum products and nuclear fuel
 - 24 Manufacture of chemicals and chemical products
 - 25 Manufacture of rubber and plastic products
 - 26 Manufacture of other non-metallic mineral products
 - 27 Manufacture of basic metals
 - 28 Manufacture of fabricated metal products, except machinery and equipment
 - 29 Manufacture of machinery and equipment n.e.c.
 - 30 Manufacture of office machinery and computers
 - 31 Manufacture of electrical machinery and apparatus n.e.c.
 - 32 Manufacture of radio, television and communication equipment and apparatus
 - 33 Manufacture of medical, precision and optical instruments, watches and clocks
 - 34 Manufacture of motor vehicles, trailers and semi-trailers
 - 35 Manufacture of other transport equipment
 - 36 Manufacture of furniture; manufacturing n.e.c.
 - 37 Recycling
- E Electricity, gas and water supply
 - 40 Electricity, gas, steam and hot water supply
 - 41 Collection, purification and distribution of water
- F Construction
- G Wholesale and retail trade; repair of motor vehicles, motorcycles and personal and household goods
 - 50 Sale, maintenance and repair of motor vehicles and motorcycles; retail sale of automotive fuel
 - 51 Wholesale trade and commission trade, except of motor vehicles and motorcycles
 - 52 Retail trade, except of motor vehicles and motorcycles; repair of personal and household goods
- H Hotels and restaurants
- I Transport, storage and communication
 - 60 Land transport; transport via pipelines
 - 61 Water transport
 - 62 Air transport
 - 63 Supporting and auxiliary transport activities; activities of travel agencies
 - 64 Post and telecommunications
- J Financial intermediation
 - 65 Financial intermediation, except insurance and pension funding
 - 66 Insurance and pension funding, except compulsory social security
 - 67 Activities auxiliary to financial intermediation

- K Real estate, renting and business activities
 - 70 Real estate activities
 - 71 Renting of machinery and equipment without operator and of personal and household goods
 - 72 Computer and related activities
 - 73 Research and development
 - 74 Other business activities
- L Public administration and defence; compulsory social security
- M Education
- N Health and social work
- O Other community, social and personal service activities
 - 90 Sewage and refuse disposal, sanitation and similar activities
 - 91 Activities of membership organizations n.e.c.
 - 92 Recreational, cultural and sporting activities
 - 93 Other service activities
- P Activities of households
- Q Extra-territorial organizations and bodies

Appendix 2: The importance of PPPs in historical national accounting

One of the key issues in economic history concerns the question which countries are at the technological frontier in a certain period, and to what extent other countries are able to catch-up. In order to assess the relative economic strength of nations over long periods of time, we need to have reliable information about productivity differentials. Unfortunately, one of the main problems with the international comparison of GDP levels concerns prices. Well-known datasets such as the Penn World tables or Maddison's dataset work with one set of relative prices (dollars of 1990). The use of such a recent set of prices might distort our view on the comparative productivity performance of countries in earlier time periods. It is necessary to make proper comparisons of purchasing power parities (PPPs) for earlier benchmark years, as relative prices have changed over time.

In recent years a substantial body of literature has appeared on this subject. First of all the work of Ward and Devereux should be mentioned.⁷ Their new estimates of PPPs appear to have significant analytical implications concerning the relative strength of the British versus the United States economy in the nineteenth century. Also the re-estimation of East Asian PPPs by Fukao, Ma and Yuan opens new perspectives on the comparative economic performance of nations.⁸ Both these studies construct historical PPPs from an expenditure perspective. Consumer prices are being selected and weighted on the share of the relating products in total consumption. This approach has its main attraction in that with a relatively small sample of circa 20-30 products, reliable PPP estimates can be made. This method is aimed at measuring differences in *living standards*, as only final consumer goods are taken into account and consumer prices (including distribution costs and taxes) are being used.

The research group of the Groningen Growth and Development Centre follows an alternative route and estimates PPPs using the industry-of-origin method, which also provides the framework of the 'International Comparison of Output and Productivity' (ICOP) framework. This method is particularly well suited to study the *productivity* differentials between countries, and therefore not only includes final consumer goods, but also capital goods and intermediate products. A key characteristic of ICOP is the use of industry-specific purchasing power parities (or unit value ratios) to convert output in national currencies to a common currency, thus taking differences in the relative price levels between industries into account. In most cases countries are compared on a binary basis with either the US or Germany as the numéraire country. ICOP has mostly focussed on comparisons of value added per person employed or per hour worked. For some countries, the ICOP data base not only provides labour productivity, but also estimates of total factor productivity and unit labour cost. The ICOP

⁷ See note 6.

⁸ K. Fukao, D. Ma and T. Yuan, 'International Comparison in Historical Perspective: Reconstructing the 1934-36 Benchmark Purchasing Power Parity for Japan, Korea and Taiwan', *Explorations in Economic History*, Vol. 43, No. 2 (2006), pp. 280-308.

project has put out over 80 research reports, in which methods, procedures and basic data are given, so that methods can be replicated and revised.

ICOP data for manufacturing, transport and communication and wholesale and retail trade are now also included in a regular publication of the International Labour Office (ILO), called 'Key Indicators of the Labour Market, 2001-2002'. These estimates make use of ICOP's unit value ratios, but - in contrast to the estimates presented here - output and employment are directly taken from national accounts of individual countries instead of from industrial surveys and manufacturing censuses.

The Groningen Growth and Development Centre aims to extend the work on industry-of-origin PPPs and to construct benchmark estimates for earlier time periods. In more recent publications by GGDC-members, the industry-of-origin method is extended to the prewar period and relies on producer prices to get a clear view of the efficiency of production processes. The comparative productivity of economies can be analysed at quite a detailed level, as the PPPs are estimated at branch level.⁹ The industry-of-origin estimates should be seen as complements and not as substitutes of the expenditure-PPP's. At later stages, a detailed comparison of both types of PPPs should be made. This might reveal important information regarding international differences in price structure (such as the share of distribution costs and taxes). Besides, new benchmark PPP's will be important for the analysis of European economic performance in an international comparative framework, which will be carried out in the research project *Modern Times. European Capitalism in the Second Industrial Revolution 1900-1950*, sponsored by the Dutch Science Foundation and led by Herman de Jong.

⁹ See note 6.

Appendix 3: The treatment of services in historical national accounts¹⁰

Historical estimates of service output often face considerable data problems, as the required information is not often readily available in the published sources. Apart from the issues concerning data, there are several different measurement techniques of service output in historical national accounting, as well as contemporary national accounting, which can provide vastly different outcomes.¹¹ Output measurement for agriculture and manufacturing is often less difficult, as it basically consists of summing the quantities times the prices of goods. This procedure is impossible to follow for many service industries. Only for branches such as transport and communications, such a ‘commodity’ approach is applicable. Output in many other service industries is arrived at by means of input valuation, i.e. adding the value of inputs, mostly wages. Of course, this procedure has a major shortcoming. Output is not estimated independently of inputs and, as a consequence, cannot be used for the purpose of productivity measurement.

Transport

Output volume in transports is ideally estimated by multiplying the number of passengers and the tonnage of goods transported with the distance of transportation. In this way the output volume of the transport sector is expressed as the number of passenger kilometres and the number of ton kilometres. Next these output figures are linked to freight rates, that is the weighted price of transportation per passenger kilometre or per ton kilometre. This results in the value of output. Finally, the value of inputs are deducted in order to arrive at the estimates of value added.

In most countries such estimates have not been made, but rough indicators were used to chart the development of output in transport services. For example, in many of the first generation estimates no attention is paid to possible changes in the average distance. Furthermore, changes in input/output relations were disregarded. Thus, the effect of technological and organisational changes in transport is not measured. Moreover, it should be noted that by using a fixed set of prices, changes in relative prices are not reflected in the production estimates for earlier years.

Trade

Value added in trade was primarily calculated for a single benchmark year around 1910 on the basis of data on employment and average income (see the United Kingdom, Germany and the United States). As far as the construction of time-series is concerned, the growth of distribution is often calculated on the basis of agricultural and industrial output figures as well as the value of imports. In the first

¹⁰ This section is taken from: A. Burger and J.P. Smits, ‘A Benchmark Comparison of Service Productivity between Europe and the United States for 1910’, *Economic and Social History in the Netherlands* vol 7 (1996) 133-160.

¹¹ Cf. Z. Griliches (ed.), *Output measurement in the service sectors* (Chicago, 1993); O. Krantz, ‘Service production in historical national accounts’, *Review of Income and Wealth* vol 40, no. 1 (1994) 19-41.

generation of historical national accounts it is assumed that no elimination of intermediate trade took place. This means that trade margins (i.e. the difference between sales and purchases values) are supposed to be constant throughout the period 1850-1913; a rather coarse assumption which may not be applicable to all countries in our current sample.

In order to arrive at more reliable estimates for value added in trade it is important to establish trade margins for wholesale and retail trade. On the basis of records of trading companies and by comparing levels of different types of prices (producer prices, wholesale prices and retail prices) trade margins can be established.

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