European Consumer Price Indices since 1870

Ljungberg, Jonas

2023

Document Version:
Other version

Lund Papers in Economic History

No. 252, 2023

European Consumer Price Indices since 1870

Jonas Ljungberg

DEPARTMENT OF ECONOMIC HISTORY, LUND UNIVERSITY

European Consumer Price Indices since 1870

Jonas Ljungberg

Department of Economic History, Lund University

Abstract

This paper presents a database with the probably most up-to date and reliable consumer price indices for a large sample of European countries since 1870. The database is a compilation but a contribution by going back to original or ignored works. For some Eastern European countries, where CPIs have been missing, new provisional indices are constructed. It critically examines historical CPIs in oft-used online databases and uncover some alarming inaccuracies and even fallacies. Despite the importance of accurate CPIs in long-term analyses, previously little effort has been put in assessing the quality and comparability of data between countries. Realism of the CPIs is examined within a framework of economic integration, that qualifies received views. Lack of integration of Mediterranean countries before mid-twentieth century is validated, and contradictory patterns of integration in interwar and post-war Europe uncovered.

Keywords: consumer price indices; cost of living; source criticism; economic integration

JEL codes: E31; N13; N14

Acknowledgements: I am grateful for input, suggestions and comments from Olga Christodoulaki, Cristián Ducoing, Sakari Heikkinen, Clemens Jobst, Seán Kenny, Sofia Lazaretou, Carol Leonard, Jason Lennard, Leandro Prados de la Escosura, Solomos Solomou, Nuno Valério, Arthur van Riel, and the Lund Economic History Seminar. Remaining flaws and insufficiencies are mine. Financial support from the Bank of Sweden Tercentenary Foundation and Jan Wallanders and Tom Hedelius Stiftelse is gratefully acknowledged.

1. Introduction

Cost of living (COLI) and consumer price indices (CPI) have a multitude of uses in studies of economic history[1]. A modern CPI is composed by a basket of different goods and services, including housing, which should be representative for the average consumer (ILO, 2004). The historical CPIs, before the 1950s, are most often cost of living indices that should show the cost to sustain a working class family (e g *International Labour Review,* 1921: 116). Some but not all cost-of-living indices included clothes, miscellaneous products, housing, and income taxation, besides foodstuffs. For early periods, indices might merely comprise proxies constructed from a few price series, and baskets and index methods might vary considerably between countries or are not described at all. The aim of this article is not to make up for all these deficiencies, but to critically examine the state of the arts for a broad sample of European countries, and to suggest the probably best available CPI as unbroken series over the period 1870-2019, with 1929 as the reference year and presented in the online appendix to this paper. The varying quality of available CPI data motivates a particular emphasis on source criticism, and it will become clear to the reader that one should be careful when picking a CPI also from an authoritative website. The purpose to cover most of the European countries implies that within the space of a single paper it has not been possible to go into the same detail with all countries and the paper can be seen as a point of departure rather than completed research.

As a further check on the realism of the present CPIs, as well as a contribution on its own, the paper also examines the historical development of price levels in a framework of economic integration. On the one hand the extent to which individual countries were integrated in the international economy is analyzed, and on the other hand the extent of integration among the European economies as a whole.

While there were efforts to promote the construction of broadly standardized COLIs across countries in the aftermath of World War I (ILO 1925a, 1925b; see also NICB, 1927[2]), only recently have harmonization of CPIs been achieved within the EU and international organizations agreed on a CPI manual (ILO, 2004). The COLI had the aim to reflect the cost of sustaining a working- class household but it was neither universally nor uniformly adopted among measuring

[1] For simplicity, in the survey below I use "CPI" for both cost of living and consumer price indices. This is in line with the recent literature on CPIs extended back to Early Modern and Medieval times.
[2] I am grateful to Sakari Heikkinen for bringing my attention to this book.

agencies. After WWII the COLI was generally replaced by the CPI, with the aim to reflect the cost of the average consumer instead of a worker. [3] Traditionally, the weighing of the different price series to an index has been perceived a Laspeyres index. However, as pointed out in ILO (2004), in general COLI as well as CPI are Lowe indices. While both Laspeyres and Lowe have fixed weights, the former should strictly speaking have weights pertaining to the reference year, while the Lowe index may have the weight base in any year. In actual practice, and in particular retrospectively constructed indices have often weights derived from data in the middle of an index period (see for example Pedersen, 1930; Myrdal, 1933; Scholliers, 1995). Therefore, they as well as the modern chained indices fulfill the criteria of being of the Lowe type.

The present sample of countries as well as the start year 1870 were determined because the work began as part of a construction of a database on real as well as nominal effective exchange rates for Europe, and the classical gold standard seemed reasonable to begin with (Ljungberg, 2019). The gold standard might signify an overall integration of an international economy that, at least as a first step, motivates the start in 1870. For a few countries new estimates have been constructed for certain periods, either in order to improve the accuracy of existing series or as provisional new CPI where such are missing. All CPIs are available at:

https://www.lusem.lu.se/economic-history/databases/economic-history-data/ecpi

Unfortunately, to my knowledge no particular efforts have been made to standardize the way of constructing historical CPIs across countries. Ideally, the price quotations used should consider what the consumer pays for goods and services. These should be weighed together according to a typical household's budget, including housing. For historical COLIs, we often do not know how the weighing is done or what items are included, or even whether it simply is an unweighted average.

Moreover, the quality of historical CPI data that are available on various websites is rarely assessed. As shown in the present paper, inaccuracy of various degrees, from ignorance of up-to-

[3] The Second International Conference of Labour Statisticians in 1925 adopted a resolution on COLIs, much motivated by the aim to estimate real wages (ILO 1925a, 1925b). Broadly this aim remained the guideline for the calculations of COLIs until after WWII when CPIs became the standard. The change to CPI was motivated by misconceptions among the public about the meaning of COLI, yet also a shift of interest to macroeconomic issues and the purchasing power of the average consumer instead of a worker (ILO, 1947). However, ILO (2004, p. 10) disregards from the historical development and defines COLI as founded on a paper in Russian 1924 by Konüs, mostly unknown until WWII (Konüs, 1939; Schultz, 1939).

date research to outright distortion of the original series, characterizes much of the historical CPI data offered online. In some cases, CPI indices are not presented but inflation rates, which in turn often are derived from indices of cost of living or historical CPI. Most worrying are the series on inflation presented by the economic history hub *Clio Infra*, which uncritically, with reference to Carmen Reinhart's homepage, have been fetched from Reinhart and Rogoff (2010, 2011). As shown in the survey below, several of these series are remarkably fallacious.

Mitchell (2013)[4] provides comprehensive CPI data for most countries, though for some starting later than 1870. Mitchell's indices are critically compared with the literature dealing with national cases. For 13 of the European countries, along with four non-European, the Jordà-Schularick-Taylor *Macrohistory Database*[5] also offers CPI series back to 1870. For most countries their reference is to Taylor (2002) up to 1996 and then IMF. This leaves a gap 1948-1996, because Taylor (2002, p. 140 n) briefly states: "The principal pre-1948 price sources are the statistical volumes of Brian Mitchell." Where they give a specific reference for a European country, this is mentioned in the survey below, otherwise the comments to Mitchell pertain as well to the series in Jordà-Schularick-Taylor.

After this brief introduction follows a survey of CPIs for 23 European countries, in alphabetical order, which motivates the selection of the series in the online database. The discussion in the survey focuses on 1870-1950, because for this period data are less certain and available COLIs/CPIs of most varying quality. For some countries the discussion covers later periods, for example concerning the UK, where the treatment of CPI indices into recent time has become a bit confused. Even if some of the notes are just short, they might serve the aim to provide a starting point for further research. The third section provides a comparative discussion of the patterns of integration that are reflected in the CPI series. Apart from being of relevance on its own, such an exploration might indicate deviations that call for further research, whether the deviations reflect the actual development or shaky data. Section four concludes.

2. A survey of CPI for European countries

2.1 Austria

[4] Mitchell (2013) is an online edition in which CPI data are basically the same as in the latest printed edition (Mitchell, 2003).
[5] Jordà et al. (2017), although available online is Release 4 (May 2019) which has been consulted here.

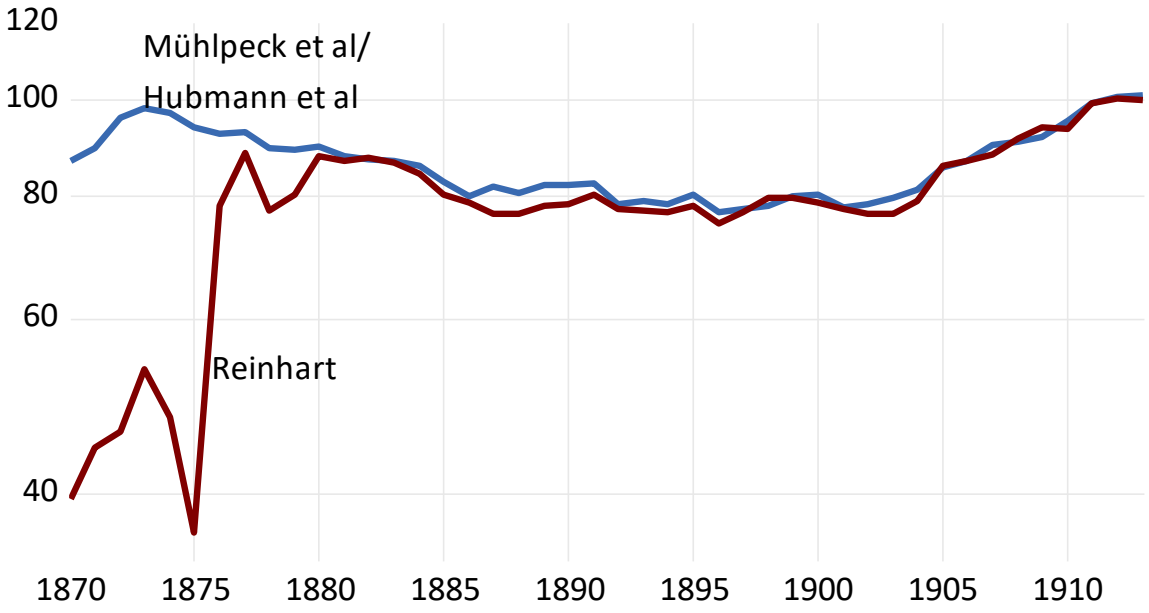
Mitchell has no CPI for Austria, or parts of the empire, before 1914. The *Clio Infra* series is from Reinhart, who uses wheat prices for the nineteenth century through the 1870s[6]. The series displays excessive volatility, with 114 per cent inflation in 1876, as illustrated in figure 1. An alarm would have rung for such jumps, in particular since nothing similar can be seen in neighbouring countries. For 1881-1913, Reinhart refers to a CPI in Flandreau and Zumer (2004), however, what these authors present are GDP deflators although labelled as "prices" (p. 103, 122)[7].

Nevertheless, there existed long-term CPIs for Austria and recently Hubmann *et al.* (2020a, 2020b) presented a CPI for Austria back to 1800. Since the new CPI is an adjustment and linking of previous work, it is motivated to shortly describe this. Austria had notably a long tradition of price quotations and by drawing on such data Mühlpeck *et al.* (1979) published a CPI for 1800-1914, which included five different commodity groups and housing weighted according to workers' household budgets in Vienna 1912-14. However, only prices of foodstuffs were from other cities than Vienna, and it would last until 1959 before the Austrian CPI had a broader geographical coverage (Mühlpeck *et al.,* 1979 p. 651; ÖStZ, 1997 p. 13). In the early 1920s began estimation of official indices, one showing the cost of a fixed caloric and protein intake and another for a worker household of four. A new consumption budget for 1926 provided the weight base for a conventional COLI, and Hubmann *et al.* have used this for the period 1914-1958, even though a new budget of 1935 was available and used by the Austrian statistics for the postwar years (ÖStZ, 1997 p.12). Hubmann *et al.* advocate the use of a constant weight basket as an advantage for long-term comparisons but have to comply with the more frequent change of weight bases in the Austrian CPI from 1959 onwards. Indeed, in comparison with the CPI in Mitchell[8], the new CPI shows more volatility in the 1910s and 1920s. The smoothing of price movements, which was a consequence of the substitutions implied by the definition of the basket in calories, is avoided by use of a fixed basket in the new CPI. From the late 1920s, however, the

[6] Citation is to Hoffman et al. (1992), but the data do not figure there.
[7] For Austria-Hungary, the reference source is a working paper by Schulze (1997), where however neither price series nor an implicit deflator can be derived.
[8] Closely followed by Reinhart/Clio Infra, except for the year 1923 when Mitchell, by valuing the currency in gold, has deep deflation and Reinhart displays 19 per cent inflation.

development of the old CPI (Mitchell) and the new by Hubmann *et al.* is similar.[9] In the present database, the Hubmann *et al.* index is used up to 2017, from then on IMF (2023).

Figure 1. Consumer price indices for Austria, 1870-1914 (1914=100)



Sources: See text.

2.2 Belgium

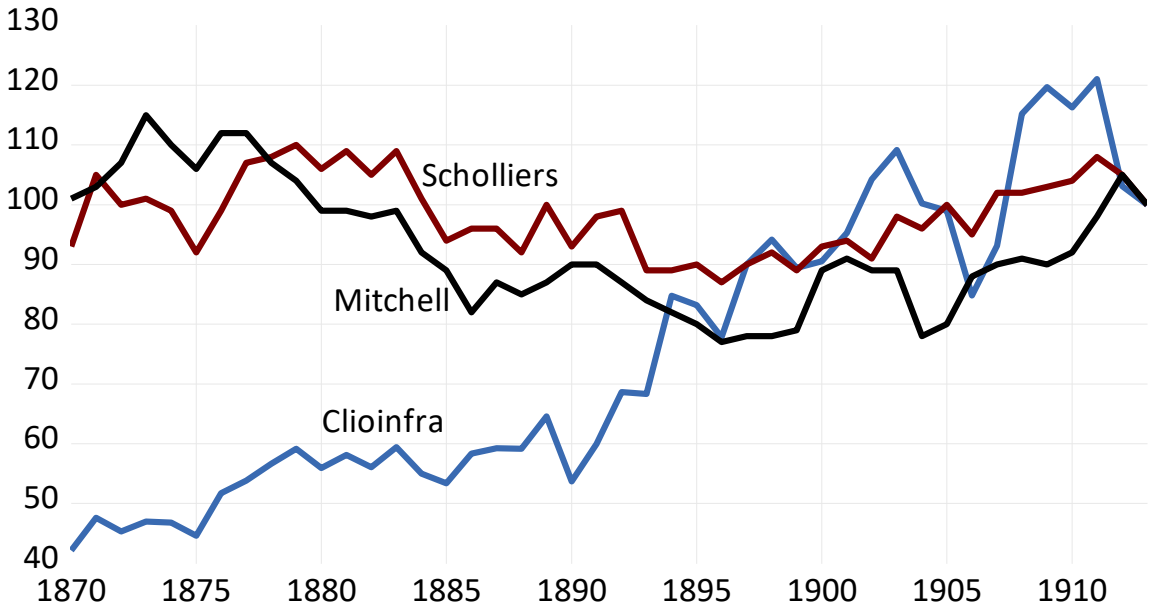
For Belgium, figure 2 shows different indices before World War I. The *Clio Infra* series stands out, rising at an annual rate of 2 per cent 1870-1896, while Mitchell falls at -1.3 and Scholliers at -0.5 per cent annually. Mitchell (2013) uses "Michelotte 1937" (should be Michotte) up to 1913. According to Scholliers (1995), the Michotte series was an unweighted average, of a relatively un-representative basket and not including housing. Scholliers (1995) presents a more elaborate cost of living index based on prices, including rent, in Ghent 1835-1914. It is weighted with one budget for 1835-1880 and another for 1880-1914. The price data are geographically limited, and with only 15 items, yet representing about 85 per cent of the budget of a working-class household.

[9] Before our period, 1800-1820, for which Mühlpeck *et al.* had deflated the CPI with prices of silver, Hubmann *et al.* also make a major revision, but then use the old series unchanged up to 1914.

Clio Infra uses Reinhart, who refers to Allen (n.d. – online at *iisg.nl*). In the paper connected with these data, Allen notes: "There is considerable disagreement between Michotte (1934) and Scholliers (1995, pp. 107-108) as to the rate of inflation in Belgium. Scholliers was preferred." (Allen, 2001, p. 437)[10]

Since Allen relies on Scholliers, one may wonder why Reinhart (and *Clio Infra*), when using Allen, can show 2.5 percentage points higher inflation rate 1870-1896 and 0.5 points higher 1896-1913? A check with Allen's data at *iisg.nl* confirms that he relies on Scholliers (1995), yet shows that he provides a "new CPI", which indeed is Scholliers but from 1873 adjusted for the declining price of silver.

Figure 2. CPIs for Belgium, 1870-1913 (1913=100)



Sources: See text.

This of course makes sense when it is used as a deflator for nominal wages denoted in "silver prices", as done by Allen (2001). But it is simply out of place to take it as an indicator of CPI or

[10] The devil has flung into the reference to Fritz Michotte's 1937 article. Scholliers and Allen have different though both wrong years, and Mitchell mis-spelt the name.

to use it for deriving the inflation rate. Also for the interwar period disparate CPIs are available. The differences are not very illustrative in a graph but table 1 summarizes the accumulated divergence. Three of the indices show a moderate inflation of half a per cent or less and they follow each other closely, while the ones by Scholliers and *Clio Infra* (Reinhart) show a somewhat higher inflation. The *Clio Infra* series can be discarded on the grounds that is not a CPI but a GDP deflator, according to Reinhart's references. Mitchell refers to "official publications", and Jordà et al. refer to Bank of Belgium for the same series (minor differences can be explained by rounding) with gaps 1915-1919 and 1940-1945, which in Jordá et al are interpolated with a stock market index. The "official" series, which contemporaneously was used for indexing of wages, is reported by Scholliers (1991, 1995) [11], who in the earlier article more in detail explains how both the official and his alternative index are calculated. He claims that the official index was an unweighted average of a large number of items but excluding rent. However, NICB (1927) and ILO (1925) provide another description: household surveys in 1921 were the basis for weights, including housing, related to earnings levels and reported in five different indices but no general index. The official indices were based on prices from all parts of Belgium, while Scholliers's price data are from Brussels only though the index calculation is quite up to-date with about five-year links with budgets modified according to changed consumption patterns. He erroneously contends, though, that the difference "can largely be explained by the non-inclusion of rent in the official index", and rent rose sharply in the depression after deregulation of controls in 1929 (Scholliers 1991, pp.425-6).[12]

However, due to its long-term consistency Scholliers is used for 1870-1939, Mitchell (2013) for 1940-1960, and AMECO from 1961 onwards. The gap in Mitchell 1941-1945 has been interpolated according to trend 1940-1946.[13]

Table 1. Average inflation rate (per cent) in Belgium, 1925-1939

[11] Scholliers refers to *Revue de Travail (1919-39).*

[12] Chris Schroeven and Peter Solar (1989) in a conference paper discussed Scholliers's index and mainly criticized that price data were from Brussels only and collected only in one month per year. Scholliers admitted the provisional character of the index but also defended the result, by pointing to minor regional differences. Notably rents in other major cities rose more to 1932 and fell less thereafter, why the difference to the official indices would not be exaggerated by the limitation to Brussels.

[13] Jordá et al interpolate the gap with a stock market index but this seems not representative for consumption. They show first excessive inflation, ending with three years of deflation of a sort no other country in the survey sample experienced. As an outcome, in 1946 Mitchell is revised downwards by more than 20 per cent. The present linear interpolation is of course a back door but its course is broadly in line with the French CPI during the war.

Official	Scholliers	Mitchell	Clio Infra	Jordá et al.
0.39	1.43	0.50	2.11	0.51

Source: See text.

2.3 Bulgaria

For Bulgaria, *South-Eastern European Monetary and Economic Statistics from the Nineteenth Century to World War II* (henceforth SEE, 2014) presents a retail price index 1890-1912, a "general price index" 1912-1932, and a CPI 1922-1941. The retail price index has been taken here as a CPI, and the "general price index" has been used to estimate a CPI for the missing years, 1913-1921.

Mitchell (2013) presents a series for the interwar period through to 1947, which for the overlapping years is very close to SEE (2014), and this is used here for 1942-47. For the following decades I have found no Bulgarian CPI until AMECO's, beginning in 1985. For the missing years I have dared an unruly guesstimate, achieved by regressing Bulgarian inflation 1925-43 on inflation in Hungary and Austria and then forecasting 1948-1984. Both countries had historical ties with Bulgaria and although the postwar period entailed a breakaway from Austria, in the postwar forecast this country might represent the influence of the still significant trade with the West. Other relevant macroeconomic variables are either missing or would seriously reduce the number of observations. Due to the postwar regulation of prices, it is furthermore questionable to derive a CPI without considering economic policy. This series can hence, of course, only be very provisional as a CPI.[14] Table A2 in appendix shows the fit 1925-1943. The cut in the regression in 1943 is motivated by the high volatility in the following years up to 1947.

2.4 Czechoslovakia/Czechia

Mitchell (2013) provides a CPI from 1923, which up to 1948 is a cost-of-living index for Prague and then there is the gap to 1953 before the country-wide CPI starts and runs up to 1992. Mitchell is used here with the gap 1948-1953 filled by help of Adam (1984, p. 110). While the IMF (2021) CPI for Czechia begins with 1995, AMECO offers a continuation with Czechia from 1993, and

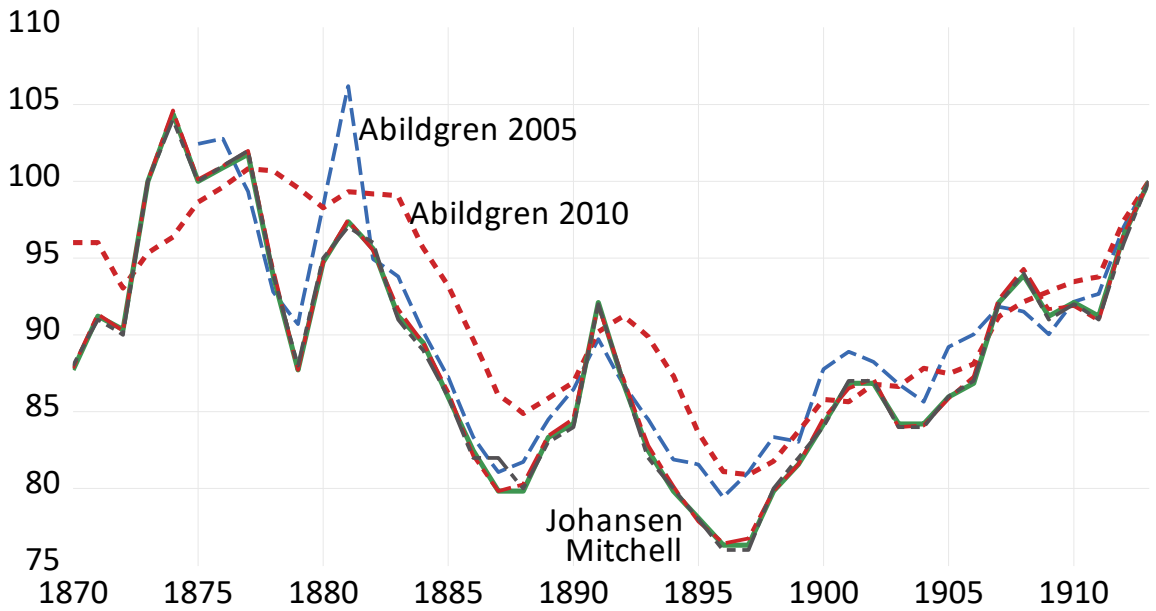
[14] See also comment below in the section *Consumer Price Indices and economic integration.*

this has been linked with the Mitchell series ending in 1992 by assuming that the inflation in 1993 was, as in Hungary, the same as 1992.

2.5 Denmark

For Denmark an official CPI is estimated since 1914, and its appearance in different publications differ not more than what might be caused by rounding (Johansen 1985; Abildgren 2004, 2005, 2010). Mitchell (2013) refers to Johansen(1985) for the years up to 1970, but unexplainedly deviates in the postwar period. Before 1914, the picture is more confused, even if trends are rather similar. Figure 3 shows available CPI series for 1870-1913, and clearly inflation rates differ significantly between Abildgren's different series, and the other series.

Figure 3. CPIs for Denmark, 1870-1913 (1913=100)



Sources: See text.

Abildgren (2005) can be left aside since it is not a CPI but a consumption deflator of historical national accounts. [15] Abildgren (2010), on the other hand, ambitiously provides a CPI back to

[15] For the source of Abildgren (2005) one has to see Abildgren (2004), who refers to the "private consumption deflator" and Kärgård (1991); Kärgård in turn refers to the historical national accounts by Hansen (1974).

1502, although for the years 1855-1913 arguably better data are available. For these years, namely, Pedersen (1930) constructed a cost-of-living series based on a comprehensive collection of retail prices as well as an investigation of housing rents, but this source is not considered by Abildgren, except for the years 1870-72. Instead, Abildgren uses the deflator for consumption in Hansen (1974) for 1815-1870, bridging with Pedersen (1930) for 1870-72 and for 1872-1914 he prefers Dalgaard (1926) "in order to be consistent with Statistics Denmark." The consistency is assumed due to "the almost identical" weights as applied in the official CPI from 1914. However, one should be aware that Dalgaard had limited price data, from only one hospital in Copenhagen and a poor-house in Odense, which moreover differed significantly from each other. Dalgaard himself characterized the data as wholesale prices, with more volatile movements than retail prices, and he therefore smoothened the price series to a lagged three-year moving average ($[t_{-2}+t_{-1}+t]/3$). Writing a few years after Dalgaard, Pedersen (1930) also used institutional price data, but the bulk of his prices was collected from shopkeepers' records. None of these were in Copenhagen, however, yet from the provincial cities Odense and Aarhus with surroundings as well as the municipality Varde in southwestern Denmark. It is clear that the data used by Pedersen are retail prices and superior to those used by Dalgaard. The smoothing, undertaken by Dalgaard, furthermore makes his series invalid as an indicator of inflation, and the standard deviation of annual changes is reduced to a half of that in Pedersen (1930), which also might be perceived from figure 3 with Abildgren (2010) slightly leveled compared to the other series. Concerning the weights, Pedersen considered the data of the official household surveys in 1897 and 1909 (the latter used by the early official CPI) but preferred a household budget constructed in 1879, because he wanted the base close to the middle of the period 1855-1913. Arguably this makes sense since the decades up to 1914 saw rapid changes in consumption, and to retrospectively use a basket representative for the end of the period would decrease the validity of the CPI for earlier years.[16]

H C Johansen (1985) used Pedersen's estimate. Pedersen (1930), however, did not present a CPI index, but the annual cost for specified household budgets. These were for unskilled and skilled

[16] In the interwar period direct taxes were included in some cost-of-living indices. Dalgaard (1926) followed this practice and Abildgren (2010) has washed out that part. Pederson (1930) did however not include direct taxes. The Swedish cost of living index 1914-1954 included direct taxes, but Myrdal (1933) motivated their exclusion in the Swedish cost of living index before 1914: "…it would be necessary to make the further assumption that the sum of commodities and services paid for by the taxes remains qualitatively and quantitatively the same year after year" (p.134-5).

workers and agricultural workers. Johansen's (1985) CPI is based on the budget for skilled workers which seems a reasonable choice – though the rounding of the index numbers creates a difference in the inflation rate, compared to a calculation directly on Pedersen's figures.[17] Hence, the present CPI for Denmark 1870-1913 is reconstructed on basis of Pedersen (1930) figures for skilled workers.

A particular problem is that Pedersen's series stops in 1913 and Johansen (1985) provides no link but has a new reference year in 1914. The official CPI, which retrospectively has been extended back to 1900, shows a stagnation of CPI inflation from 2.7 in 1913 to 2.6 per cent in 1914, despite a substantial acceleration in wholesale prices to over 12 per cent in 1914 (Johansen 1985). [18] The consumption deflator in Hansen (1974) increases 5 per cent in 1914, and this figure is applied here. In the following years up to the end of Johansen's series in 1980 there are only small differences, probably due to rounding, between his series, the official CPI, and Abildgren (2010), while Mitchell deviates more in some few years. Here Johansen (1985) is used 1915-1960 and AMECO from 1961.

2.6 Finland

In her volume with historical national accounts for Finland, Hjerppe (1989) presents a cost-of-living index, with reference to a collaborative work of Heikkinen in 1983, for the period before WWI. Later, Heikkinen (1997) presented cost of living indices 1850-1913 for rural and urban Finland, as well as one for Helsinki and one for all Finland, which is slightly revised compared to that in Hjerppe (1989). Heikkinen's indices are based on an extensive and geographically representative price material covering a broad set of commodities and housing. Weights are changed after six to at most 18 years, so as to reflect the development of consumption. While 1913 was the end year of those indices, Heikkinen (2017) and Heikkinen and Lundh (2020) have revised the official cost of living for Finland up to 1938. While the official index 1914-1919 only

[17] The standard deviation of the differences between the rounded index and an index closely following Pedersen (1930) 1871-1913 is 0.41 percentage points, and in five of the years Johansen's inflation rate is more than 0.5 percentage points lower, and in seven years it is more than so higher.
[18] The official CPI in its online version (www.statistikbanken.dk) is extended backwards to 1900, and the documentation (Danmarks statistik 2005, p. 99) refers to a CPI back to 1872 in *Nationalekonomisk Tidskrift (1926)* as the source, which should be Dalgaard, 1926. Strangely enough for 1900-1913, neither the official CPI, nor Abildgren (2010) do match well with Dalgaard (1926). For 1872-1899 Abildgren (2010) and Dalgaard (1926) however match.

covered Helsinki, and from 1921 included direct taxes, the revised index covers all Finland and excludes taxes.[19] The most significant changes are a reduction of inflation 1917-18 and of deflation 1929-32.

The series on inflation in Finland provided by *Clio Infra* is very close to the CPI in Hjerppe (1989) before WWI, but variations differ from Hjerppe's CPI and other available series thereafter. Reinhart refers for 1861-1960 to the GDP deflator in Finnish historical national accounts, however, it can be found in neither Hjerppe (1989), nor Hjerppe (1996).

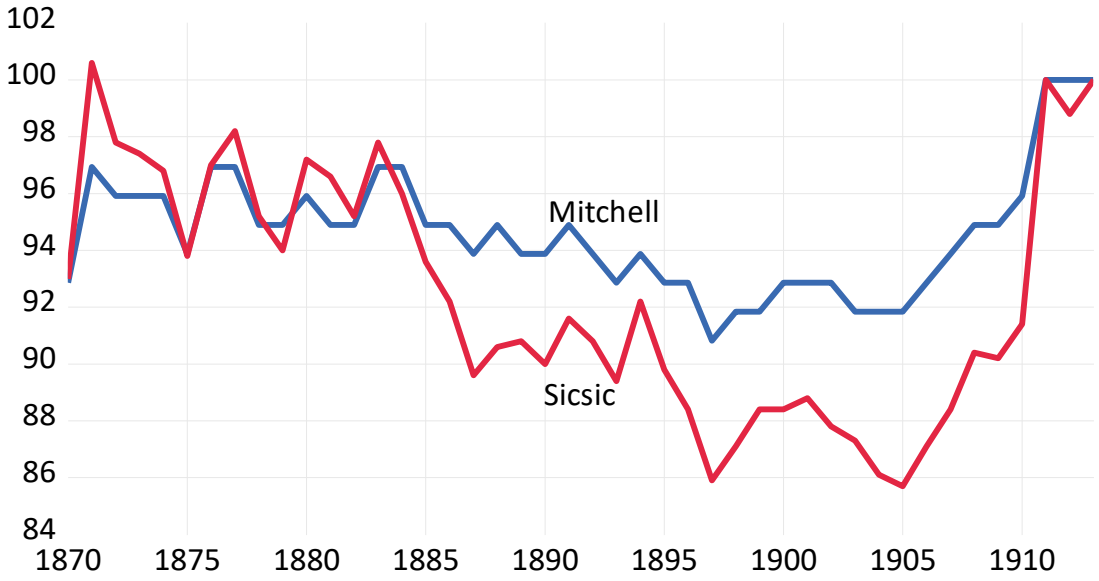
Mitchell (2013) has no CPI for Finland before 1914 and the index beginning that year differs somewhat from the rest. Used here are Heikkinen (1997, 2017; Heikkinen and Lundh, 2020) for all Finland 1870-1938, continued with Hjerppe (1989) to 1960, continued with Statistics Finland (2021).

2.7 France

For France *Clio Infra* is identical to Mitchell (2013). Mitchell refers to Singer-Kérel (1961) for the period up to 1914. However, Sicsic (1995) also refers to Singer-Kérel (1961), but presents a different series, as can be seen in figure 4. The matter is that Singer-Kérel constructed two cost of living indices, one composed of 214 items, which is very close to Mitchell (the difference might be due to rounding effects), and another with 213 items. With just a glance in the appendix table, the choice of the "214 articles" might look superior to the "213 articles". However, the 214th article is "gage", the word for remuneration of servants. And the 214 index is described as the "bourgeois" cost of living, while the 213 index is for a worker family. Apart from including the cost for servants, the 214 index has different weighting, for example just a fourth on food in the late nineteenth century as compared to two thirds for the 213 index.

[19] See Statistics Finland (1921) p. 283. Statistics Finland shows a COLI extending back to 1860. Before January 2021 it was identical with Hjerppe (1989) but was then revised with Heikkinen (1997) for 1860-1913. From 1958 onwards the COLI is extrapolated with the CPI.

Figure 4. Cost-of-living indices for France (Paris), 1870-1913 (1913=100)



Sources: See text.

The Singer-Kérel indices are indeed ambitious, composed by many commodities and reweighting the baskets with time. A drawback is that they do not consider all France but only Paris.[20] Mitchell and Singer-Kérel are similar in timing 1914-1940 but volatility is somewhat greater by Mitchell. Due to the careful and transparent construction, I have followed Sicsic (1995) and used the 213 articles index not only up to 1940, where Sicsic's study of real wages stops, but to 1954, when Singer-Kérel stops and the monetary turbulence of the late 1940s was behind. Mitchell (2013), for the period after 1913 referring to the *Annuaire Statistique de la France,* is used for 1955-1959 and AMECO from 1960 onwards.

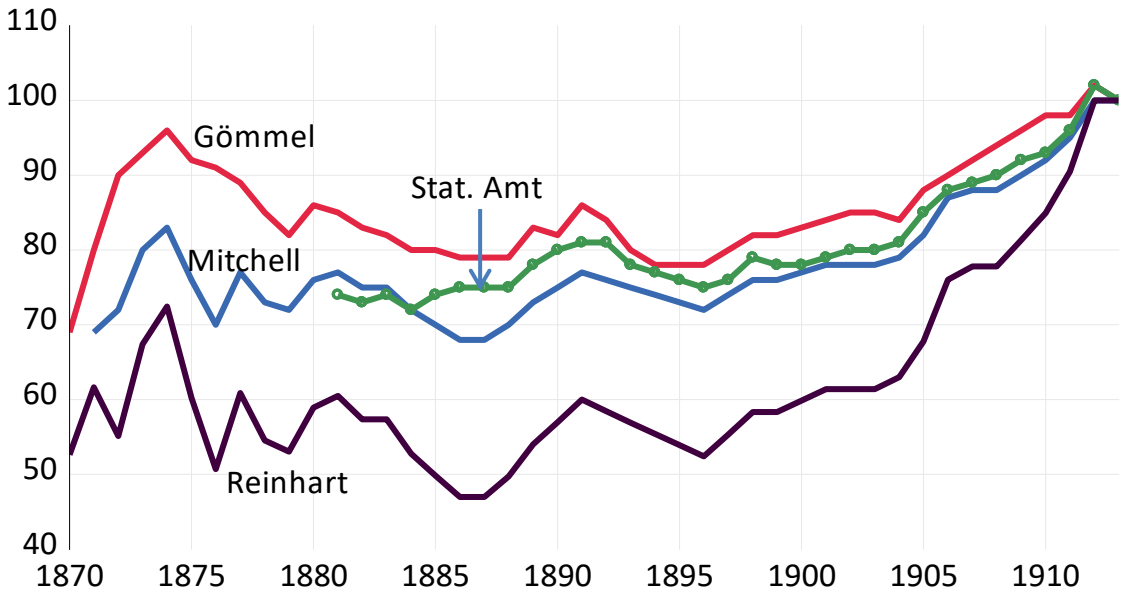
2.8 Germany

Compared to the original Mitchell CPI for Germany, it is puzzling that *Clio Infra*/Reinhart provide such a different series, despite Reinhart's reference to Mitchell (2003 – same in 2013). Something may have gone wrong in the handling of the material, since the inflation rate by

[20] Official collection of prices for cost of living began in 1911, down to local towns, but no COLI for all of France was calculated at least before the mid-1920s (NICB 1927).

Reinhart is exactly a multiple of 2, except for 1871 and 1872 where an extra quotation in 1871, for the months January-April, in Mitchell obviously caused trouble. The doubling of the inflation rate implied by Mitchell continues in *Clio Infra*/Reinhart through to 1979.

Figure 5. Different CPIs for Germany, 1870-1913 (1913=100)



Sources: See text.

It remains to choose between three other series in figure 5. Mitchell relies on real wage studies from the 1960s for the period before WWII. A more recent survey of the literature on real wages in Germany, by Hohls (1995), suggests alternatives. Only the cost-of-living index for Nürnberg, constructed by Gömmel (1979 – cited by Hohls, 1995) stretches back to 1870. Gömmel suggested it was representative for Germany, though Hohls also presents a series 1881-1985 which is compiled from different COLIs by Statistical Amts. From the late 1880s both series are similar but the higher inflation in the early Stat Amt series in the 1880s makes it less probable and Gömmel is used up to 1914. From 1914 to 1960 the Stat Amt series is preferred over Mitchell. Both series are rather similar but rounding (a consequence of low index figures) in Mitchell creates unnecessary noise in the inflation rate, as well as in the long, linked index series. From 1961, AMECO is used.

2.9 Germany (East)

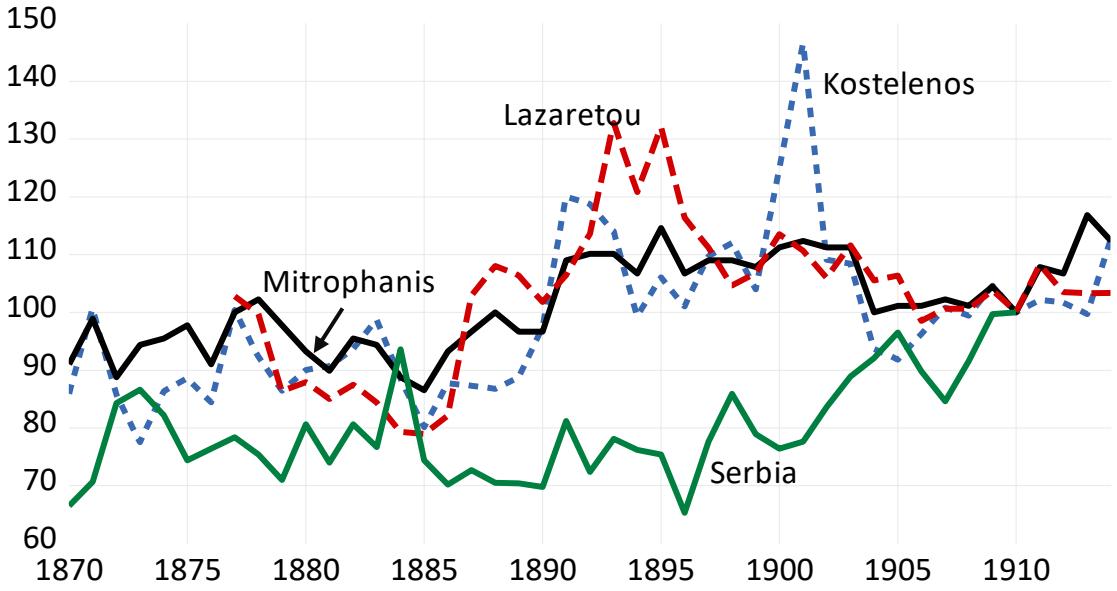
Mitchell (2013) presents a series for 1950-1989, though with a gap 1951-1954. This series has been used here, with the gap interpolated according to the trend between 1950 and 1955. From a glance at this CPI, with deflation in the 1950s and almost immovable thereafter, one can presume that this index more reflects what the government thought the prices *should be* than what they actually were.

2.10 Greece

The inflation rate in *Clio Infra* (Reinhart) is based, down to 1939, on the GDP deflator from Kostelenos et al. (2007 – same in SEE 2014). Besides not showing the cost of living, the series displays an excessive volatility, as illustrated by figure 6. In an earlier work Kostelenos (1995) used another deflator with slightly less volatility, though with other timing of troughs and peaks and with rising trend up to World War I. Why the differences occurred are not explained, except that the 1995 deflator is a Laspeyres while the later version is a Paasche index, but unless the underlying data are thin the differences in timing should not be caused by the methods. Lazaretou (1995) estimated an unweighted food price index on the basis of price quotations in larger cities of oil, butter, sugar, coffee and rice. It is indeed a narrow sample, but as for Kostelenos et al (2007 – same as *Clio Infra*) the long-term trends before and after the mid-1890s are different from the West European pattern. Volatility is somewhat less and different from that in Kostelenos et al (2007). The deviation from international trends may reflect a lack of integration, although a comparison with another country in the region might be telling. For Serbia, Palairet (1995) presented a food price index, based on five commodities (flour, black bread, beef, lard and soft cheese) and weighted to a household basket [21].

[21] Available data (SEE 2014) do not allow a comparison of openness, which could tell Serbia's international integration in this period: for Serbia there are trade data but no historical GDP. Dividing total trade (Mitchell 2013) with GDP for Greece (SEE 2014) suggests that openness was high but declining, from 55 per cent in 1870/72 to 36 per cent in 1911/13, further suggesting that growth was largely a domestic affair. Further, it is not unlikely that Serbia's commercial connections with the Austria-Hungary (Gnjatovic, 2006 p. 50) made it more influenced by international price trends.

Figure 6. Prices in Greece and Serbia (1910=100), 1870-1914



Sources: See text.

As can be seen in figure 6, this Serbian index shows both a lower volatility and the familiar long-term pattern, with decline down to the mid-1890s followed by moderate inflation. Yet, Mitrophanis and Riginos constructed a food or retail price index which is presented in Dertilis (2005), though with no information about its construction.[22] Given that the late Mitrophanis was a price historian, the co-author of a two-volume price history of a few Greek cities (Pizanias and Mitrophanis, 1991), I have assumed that their index is the best available approximation of a cost of living index to 1914. As can be seen from figure 6, the trends before 1914 are still deviating from the international pattern, including Serbia, but it may reflect an isolation of the domestic market – a similarity with the Iberian peninsula as will be seen below.

[22] I am indebted to Olga Christodoulaki for supplying the information about the Mitrophanis and Riginos index. Unfortunately the original index from 2002 was not published and seems only to have survived in Dertilis (2005). Yet, for 1914-1929 it is published in Christodoulaki (2015, p. 299), along with the official retail price index and the official COLI, as well as the 1995 and 2007 GDP deflators. Actually, a comparison of "Mitrofanis' index" with the official COLI for this period corroborates the former. For most years Mitrofanis is similar with the COLI, but while the latter has 2 per cent deflation in the middle of WWI (in 1917), Mitrofanis has 66 per cent inflation – yet in 1918 both arrive at about the same level, with 135 per cent inflation in 1918 for the COLI while it has receded to 31 per cent in Mitrofanis. The CPI for Greece in Mitchell (2013) starts in 1914 and mirrors the official COLI with a roughly constant differential factor, though it illustrates the effects of rounding: while the latter has a rise from 323 in 1919 to 351 in 1920, resulting in 8.7 per cent inflation, Mitchell's index increases from 17 to 18, displaying 5.9 per cent inflation.

Table 2. Inflation rates in Greece with different indices, 1915-1929

	Mitchell	Official CoL	Lazaretou	Mitrophanis
1915	20,00	17,00	25,93	21,00
1916	33,33	35,90	40,20	33,06
1917	0	-1,89	56,64	66,46
1918	137,5	134,62	45,54	30,60
1919	-10,53	-11,75	-12,58	-6,29
1920	5,88	8,67	14,39	9,15
1921	16,67	13,39	6,13	12,29
1922	57,14	59,80	94,22	61,19
1923	84,85	85,69	57,44	91,20
1924	4,92	4,57	8,79	5,00
1925	15,63	14,49	12,42	15,91
1926	14,86	15,49	20,71	12,07
1927	9,41	9,61	7,75	7,46
1928	4,30	4,36	1,01	4,02
1929	3,09	2,94	0,71	1,91

Note: Calculations on Mitchell (2013) for column 1, Christodoulaki (2015: 299) columns 2 and 4, SEE (2014) column 3.

Some support for a deviating Greek pattern is provided by the comparison of wheat prices in Piraeus with French and British prices. Pireaus prices were without trend over 1870-1912, while those in France and Britain declined (Pizanias and Mitrophanis 1991, vol 1 pp. 320-1)[23].

[23] A comparison of wheat prices in Piraeus (Pizanias and Mitrophanis 1991, vol. 1 p. 165 ff) with those in Serbia (SEE 2014) further support that Serbia was closer to the West European pattern than Greece, despite that most of the

For 1914-1941 a CPI is available in Lazaretou (2014; SEE, 2014). For 1914-1928 she refers to the official COLI calculated by the ministry of the economy, based on price quotations for food, cleaning, heating and electricity in larger cities. However, according to Christodoulaki (2015, p. 54) the official index in this period was an unweighted average. There are more indices, though, and table 2 displays inflation rates in Greece 1915-1929 according to available CPIs. First, one can note the similarity between Mitchell and the official cost of living, the differences most probably being due to the rounding in the former. Lazaretou (2014) unexplainedly differs from the official index, and both for consistency with the preceding period, and with consideration of Mitrophanis's expertize in Greek price history, his index has been used up to 1929. It is broadly similar with the official one, but without the unreasonable deflation in 1917 (which in the official index is "corrected" with higher inflation in 1918).

From 1929 Bank of Greece calculated a cost-of-living index based on a larger basket of commodities although with price data only from the Athens region (Lazaretou 2014, p. 132; SEE, 2014)[24]. During World War II inflation accelerated and in November 1943 and 1944 escalated to hyperinflation, that is, a monthly inflation rate of at least 50 per cent. In November 1944 stabilization occurred even if hyperinflation resurfaced some months in 1945 and 1946. Monetary reform hides the evaporation of the currency, so the increase in the CPI 1940-45 is about 1700 per cent although the accumulated inflation was 1700 billion per cent.

The index is in 1949/50 linked to Mitchell (2013), which up to 1958 is based on prices in Athens. To conclude, Mitrophanis is used for 1870-1929, Lazaretou (2014; SEE, 2014) for 1930-1949, Mitchell (2013) for 1950-1960, and AMECO from 1961 onwards.

2.11 Hungary

Hungary is implicitly subsumed in the Austrian CPI up to WWI although prices were only from Vienna. A CPI for Hungary is from Mitchell (2013) and starts in 1924, when the hyperinflation

wheat in the market of Piraeus was shipped from the Black Sea. While the Serbian wheat prices fell at a steady rate until the mid-1890s and then increased, the Greek prices had a weakly falling trend until the end of the series in 1909.

[24] Bank of Greece stopped calculations from December 1941 until January 1946, and the figure for 1941 in SEE (2014) is based on January-November. Lazaretou (2014) extends the CPI to 1949. From December 1941 a monthly cost of living index was calculated by the Government Economic Council, interestingly with a basket defined by its caloric content. The Joint Relief Committee took over the index after the hyperinflation in November 1944 until January 1946 (Delivanis and Cleveland 1949, p. 12f.). 1941 has been recalculated here on the basis of all months.

had stabilized. Mitchell states that the series pertain to Budapest but make not clear if this also applies to the postwar years and does not specify the source. The series is here extended backwards to 1921 and with a value for 1914, based on the index figures for December each year, reported by Sargent (2013). Until November 1923 it is a retail price index based on 60 commodities with a base in July 1914 and reported by the Budapest daily *Pester Lloyd*, and from December 1923 to 1924 it is a wholesale price index based on 52 commodities 1923-24, calculated by the Hungarian Central Statistical Office and with the base in 1913 (Young 1925). Presumably both indices are just unweighted averages of the indexed price quotations. The figures, at least before 1924, are of course only rough approximations. From 1973 the Mitchell CPI is replaced with AMECO.

2.12 Ireland

The *Central Statistics Office* of Ireland provides a CPI from 1922 onwards, which is used here (CSO, 2018). It is very close to the series in Mitchell (2013), although the latter has a gap, unfortunately in 1956 which was a year of crisis in Ireland (Kenny, 2016). *Clio Infra* (Reinhart) provides a series of the inflation rate, which up to 1960 relies on Mitchell (and consequently with a gap 1956-1957). However, Reinhart has without mention lagged one year, allegedly providing inflation rates for 1922-1947, and somehow filling the gap for 1948, and after that matching the source (Mitchell). Since occasionally there is a short-term volatility in the Irish inflation rate, the lag of one year conspicuously changes the macroeconomic pattern. From 1961 CSO, *Clio Infra*, and AMECO are almost indistinguishable, and the latter has been used here.

2.13 Italy

Published Italian CPIs are an illustrative case of effects of rounding and incautious replication of typos. *Clio Infra* (Reinhart) follows Mitchell (2013) who refers to *Sommario di Statistiche Storicho Italiane, 1861-1955.* However, calculations of inflation, while the same in Mitchell and *Clio Infra*, are randomly different compared with calculations on the Italian original, where more digits are given for each observation than in Mitchell. The differences may not be alarming, until a clear typo in both Mitchell and *Clio Infra* creates 33 per cent inflation in 1929, to be followed by 25 per cent deflation in 1930 (i.e., back to level), when the original *Sommario* provides

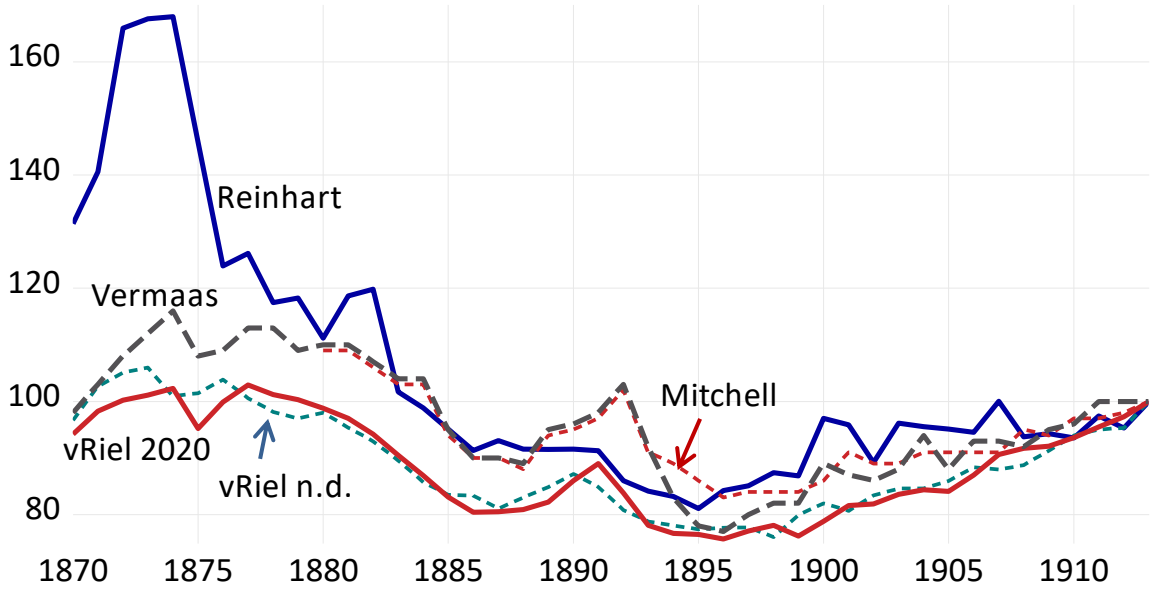
changes of 1.6 and -3.2 per cent respectively. Zamagni (1995) presents one urban cost of living index for 1890-1946 and one rural for 1913-1938, none of which displays a jump like Mitchell and *Clio Infra*, and broadly corroborate the official series. Here the latter (Istituto…, 1958, 1968) is used up to 1960, and then AMECO.

2.14 Netherlands

The Dutch projects on historical national accounts included a comprehensive collection of price data. Vermaas (1995) reported different preliminary cost of living series 1850-1913, the one favoured by Vermaas based on a budget of 1910. Later on, van Riel (n.d.) published a cost-of-living series spanning the nineteenth century based on budgets adapted to changing consumption patterns. As can be seen in figure 7, the Vermaas series is not very different from the one published by Mitchell (2013), which however begins only in 1880. The indices presented by van Riel are less volatile although not that different in the longer trends. In his dissertation 2018 Arthur van Riel has slightly adjusted the cost-of-living index (van Riel 2021). If previously there was some confusion whether it was a consumption deflator or a CPI, its label "Adaptive Manual Worker" and description make clear that it is a cost-of-living index. Confusion there remains, however, with the *Clio Infra* (Reinhart) series, which is highly volatile in the 1870s. Reinhart refers to van Riel (2009), however the website of *The International Institute of Social History* (iisg.nl) has for several years (and still in August 2021) shown a paper with the same title (van Riel, n.d.) and the concomitant cost of living index is shown together with other indices in figure 7. Reinhart's series distinctly stands out whereas the different versions of the Dutch project are fairly similar, as also shown by the trends (table 3).

For the Netherlands, van Riel (2021) has been used for 1870-1913, Mitchell (2013) for 1914-1960, and AMECO from 1961.

Figure 7. Cost-of-living indices for Netherlands, 1870-1913



Sources: See text.

Table 3. Average inflation rate (per cent) in the Netherlands, 1870-1913

	Mitchell	Vermaas	vRiel (n.d.)	Reinhart	vRiel (2021)
1870-1896	-1.29*	-1.09	-1.20	-2.66	-1.16
1896-1913	1.06	1.41	1.73	0.72	1.66
1870-1913	-0.24*	-0.49	-0.32	-1.06	-0.30

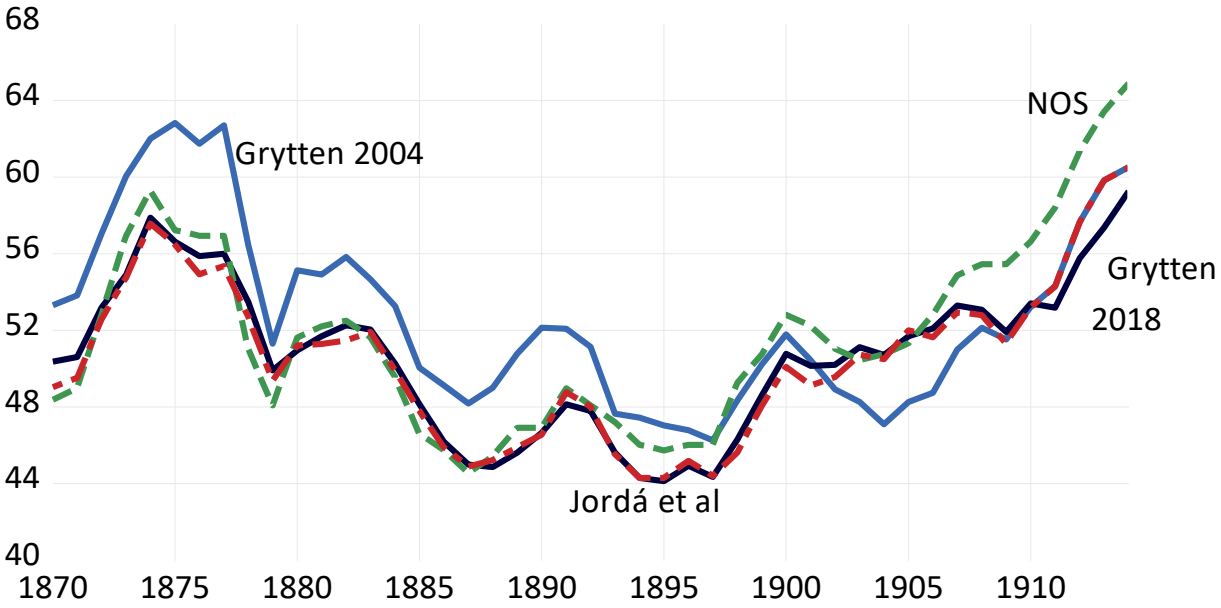
Note: * Mitchell begins 1880. Sources, see text.

2.15 Norway

A CPI for Norway was constructed by O. H. Grytten (2004a), within the project on historical monetary statistics for Norway, and it extends back to 1516 and up to 2003. The inflation rate in *Clio Infra* (Reinhart) is based on this index. However, Grytten (2018; 2020) revises the previous series, and besides extending it backwards to 1492, changes pertain notably to the period 1871-1920. For the years 1871-1901 the previous index was taken from Ramstad (1982), which had certain limitations, as is clear from Grytten (2004b), such as long interpolations, prices only from

the capital city, and with the weight base in 1910 which was beyond the end of the period. [25] For 1901-1916 Grytten (2004a) used an official cost of living index pertaining to the capital city only, and from then on the corresponding series covering larger parts of the country but right up to 1920 the geographical coverage was somewhat limited. The new index (Grytten 2018, same in 2020) make up for these weaknesses in the previous version. For 1871-1920 the number of included commodities and the geographical coverage is vastly increased and the weight base for the period 1871-1910 is in 1895 and for 1910-1920 in 1913. From 1920 the official cost of living index for the whole country is used in both the old and the new index.

Figure 8. Cost-of-living indices for Norway, 1870-1914



Sources: See text.

[25] Indeed Ramstad's index ended in 1910, but Grytten (2004a) used it down to 1901. Anyway, a weight base (budget) late in a period with rapid development might bias the index in the early period. Although of no importance for the results, a misconception about index method can be noticed in Grytten (2004b). He argues that the use of quantity weights and percentage weights in a Laspeyres price index will give different results. This might intuitively seem right but is nevertheless simply erroneous and remarkable to read in a journal. Given that prices are indexed when percentage weights are used, and that the base year is the same for prices and quantities, the resulting index series will be the same. Algebraically: A Laspeyres price index with prices p and quantities q is written (with o for base year and t for year of comparison) $L = \sum \frac{pt\ qo}{po\ qo}$. Let $\frac{pt}{po} = pxt$ and $\frac{po\ qo}{\sum po\ qo} = so$. Then $L = \sum pxt\ so$

Statistics Norway in the 1960s estimated a price index for private consumption since 1865 (NOS 1965) but it has "never been documented" and Grytten (2004a, 2004b) suspects it is derived from the older Swedish Jordà et al. (2019) refers to Statistics Norway though gives the address to Bank of Norway and Grytten's long CPI. However, although the reference there is Grytten (2004a), the series differs significantly from the original. [26] Yet, it is very close to Grytten (2018), as can be seen in figure 8, though significant differences remain for the 1910s. The consumption deflator by Statistics Norway (NOS), so criticized by Grytten (2004a, 2004b), is also shown and interestingly it comes very close to Grytten (2018) down to the early 1890s, whereas the largest differences over the whole period are between Grytten's two versions. There is no doubt, however, that Grytten (2018) best reflects reality, due to the impressive amount of data on which it is constructed.[27] For the present CPI, Grytten (2018, 2020) is used until 2018 and for 2019-2022 IMF is the source.

2.16 Poland

Clio Infra presents an inflation series for Poland back to 1559 (with gaps), but with origin not specified before 1995. It is however identical with Reinhart (2010), who refers to Allen (n.d.) up to 1914 and to Mitchell for 1922-1963 and to IMF from 1964. Most of the nineteenth century and in the early twentieth century Poland was divided, with Warsaw in Tsarist Russia, Krakow in Austria-Hungary, and a big part under German rule. Reinhart's series is based on Allen's CPI for Warsaw, however without noticing that it is a "silver CPI" (cf Belgium above). Allen (n.d.) also presents a CPI for Krakow up to 1910, which differs somewhat from the CPI for Warsaw. With the reservation that no independent Poland existed 1870-1914, a CPI has been constructed here as the chain linked average of Allen's two series. This CPI is further deflated by the silver/gold exchange rate, reported by Allen (n.d.) for Warsaw, to adjust for the deterioration of the value of silver. As a result this Polish CPI displays a deflation of -0.3 per cent annually over 1870-1896, while the unadjusted *Clio Infra* pretends inflation at a rate of 1.3 per cent.

[26] Latest access 1 September 2021: https://www.norges-bank.no/en/topics/Statistics/Historical-monetary-statistics/Consumer-price-indices/

[27] No comment is here given about the CPIs before 1870. Grytten (2018) shortly compares his new series with the CPIs for Denmark and Sweden back to 1492. The daunting difference before the nineteenth century between the Swedish and the other two indices calls for an explanation.

From 1922 onward Mitchell (2013) is used up to 1960, except for 1949-1955, years for which Adam (1984) is used. Adam's figures are similar with Mitchell's except for 1950 where inflation is reported as 7 per cent instead of three times higher. I have assumed that Adam's pertinent study is more appropriate. Mitchell (2013) has a gap 1940-45, which years have been interpolated according to trend 1939-1946. From 1961 AMECO is used.

2.17 Portugal

Nunes, Mata and Valério (1989) is the main source for the Portuguese historical CPI. Nunes et al. could rely on newly available price data for the nineteenth century, which were weighed in a basket and somehow continued into the twentieth century. In the early twentieth century there was one cost of living index constructed for Lisbon 1900-1916, according to Nunes et al. who used the same weights for the nineteenth century. Nunes et al. presents both the Lisbon index 1900-1916 and their own all-Portugal "surrogate index of the cost of living" 1833-1912. Nunes et al. then continue 1914-1985 with an all-Portugal cost of living index. However, the source and computation of the 1914-1985 index is not entirely clear. Bastien (2001) in the *Portuguese Historical Statistics* endorses Nunes et al. (1989) and present their index as the Portuguese cost of living, but without any explanation of why the Lisbon index instead of the all-Portugal index is used for 1900-1913, although differences are significant. Mitchell (2013) presents a Portuguese index from 1929 onwards, which is said to be the cost of living in Lisbon until 1976. However, the official cost of living for Lisbon should not begin until 1948 and was followed by a national series from 1977 (Bastien, 2001). Mitchell's series differs only due to rounding from the all-Portugal series in Nunes et al. during 1929-1947, but then deviates by order of magnitude. *Clio Infra* refers to Reinhart who refers to Bastien (2001), from which the inflation has been derived.[28] Here the all-Portugal index in Nunes et al. (1989) has been used for 1870-1960, and from 1961 onwards AMECO.

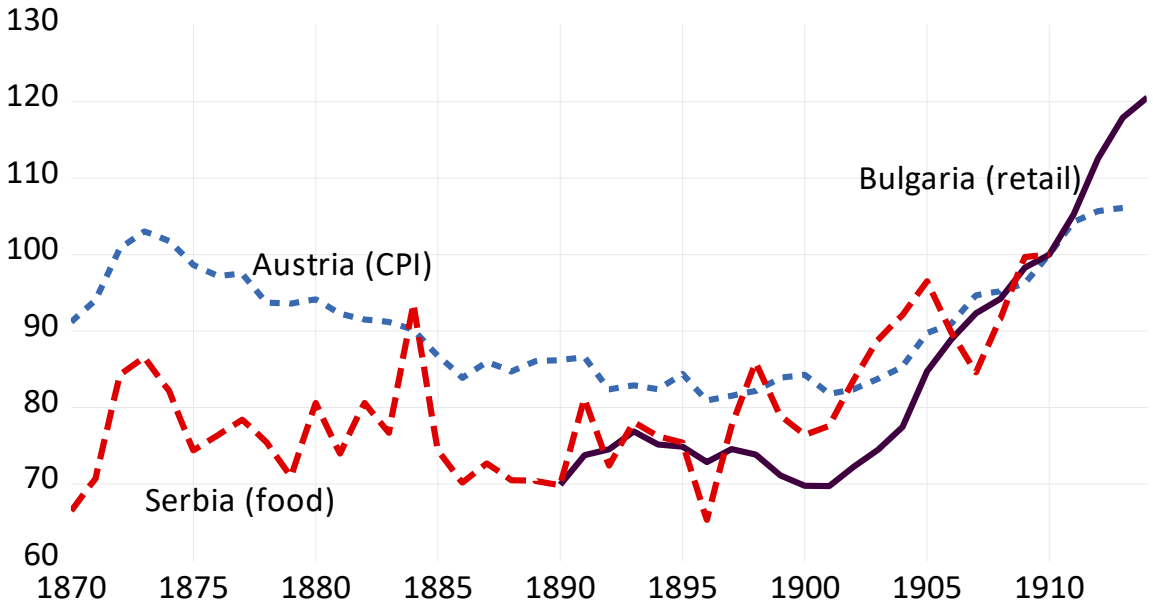
[28] Though *Clio Infra* (Reinhart) has deviating inflation rates for 1867 and 1868, obviously by typing "85" instead of "86" for 1867, before retrieving the inflation rates. Jordà et al. (2019) refer to "Valério (ed) (2001)" which is the *Portuguese Historical Statistics,* but the article with the table is Bastien (2001).

2.18 Romania

For Romania Mitchell (2013) reports a CPI for 1921-1947 but nothing thereafter. A retail price index 1921-1940 is presented by SEE (2014), and it is broadly similar to Mitchell. Reinhart presents inflation rates 1930-1941, with reference, but without similarity, to Mitchell (2003), and 1971-2010, with reference to IMF. [29] As a provisional continuous CPI, I have filled the gaps with estimates based on neighbouring countries and linked to available indices.

1878-1920 it is assumed that the inflation rate of Romania was the average of the annual changes in the CPI of Austria and, up to 1890, in the food prices of Serbia (Palairet 1995) – in this period all countries being parts of the same state. From 1891 the "CPI" of Bulgaria (see above for a description) is available and has been used instead of the Serbian prices. Of course, this is a conjectural estimate though one might infer from figure 9, showing price movements in the neighbouring countries, that it might not be without likelihood. However, the high volatility of the Serbian food prices is however questionable and motivates their exclusion when the

Figure 9. Prices in Bulgaria, Serbia and Austria (1910=100), 1870-1914



Sources: See text.

[29] CPI or inflation in Romania is however available first from 1990 on the IMF international financial statistics online database, and in the new monthly database first from 2000 (IMF 2021).

Bulgarian retail prices are available, instead of just adding the latter for the extrapolation.

1921-41 the cost-of-living index for Romania in SEE (2014) has been used, linked 1942-47 with Mitchell (2013). The gap 1948-70 has been estimated from a non-linear least squares ARMA regression of the actual inflation rate 1925-41[30], on inflation rates in Czechoslovakia and Poland and then forecasted for 1948-1970. The estimation output is reported in appendix table A2. 1971-1987 the source is *Clio Infra* (Reinhart), 1988-91 the European Bank for Reconstruction and Development (1991), and from 1992 AMECO. A disclaimer must be made for the reliability of the present Romanian CPI before 1921, for 1948-1970, and due to the unclear source also for 1971-87.

2.19 Russia

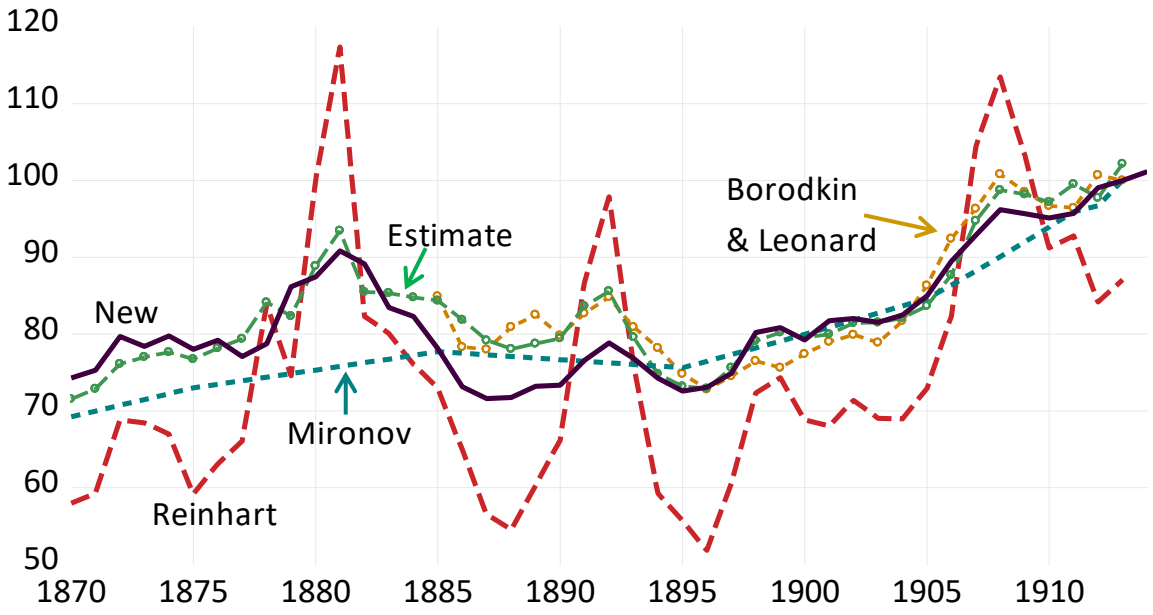
Gregory (1982) published different price and cost-of-living indices for Russia but only for 1885-1913. Borodkin and Leonard (2000) elaborated on the cost-of-living index but did not publish it – though they have kindly supplied it for this paper. However, it still only spans 1885-1913. Mironov (2010) presented a cost-of-living index for the period 1703-1913, but only with decadal averages. *Clio Infra* (Reinhart) has a series beginning in the 1850s based on prices for flour of wheat and rye, but it shows an excessive volatility as can be seen in figure 9. Furthermore, one would expect a CPI or cost of living index to be less volatile than the prices of sensitive goods, even if these are important in the basket, such as rye in 19th century Russia. However, the *Clio Infra* index is more volatile than the rye prices in the port of St Petersburg, which rose with almost 60 per cent from a low in 1878 to a high in 1881, whilst from a low in 1875 the *Clio Infra* index rises with 98 per cent to 1881[31].

Recently Allen and Khaustova (2019) have constructed various cost of living indices for cities in Russia, with series and underlying data available as online appendix. The cities are St Petersburg, Moscow, and Kursk. For the two first cities, 18 prices series for food and 10 for other commodities and rent are made available from the mid-nineteenth century up to WWI. For Kursk, four price series for food and four other series including rent are available. In

[30] Due to autocorrelation an OLS was avoided.
[31] Online data to Andersson and Ljungberg (2015).

the article, Allen and Khaustova (2019) only show a graph with the CPI for St Petersburg. Due to high volatility in the Moscow series they seem to despair about a Russian index, and the Kursk calculations are left uncompleted. Nevertheless, Allen and Khaustova (2019) claim that the price data are of good quality and, it can be added, clearly more comprehensive than used for several historical CPI. Yet, there are some flaws and the high volatility Allen and Khaustova found in the Moscow CPI can be traced to exorbitant jumps of the wheat bread prices. These are obviously unrealistic and would force consumers to switch to the more stable rye bread. Since the budget used assigns most weight of any single commodity to wheat bread, the result is a shaky CPI for Moscow. The weights are based on a survey pertaining to 1905 and it is of course not ideal to retrospectively use that budget several decades back into the nineteenth century. In the present elaboration on Allen and Khaustova's data, weights are changed between wheat bread (originally 15 per cent) and rye bread (originally 5 per cent) in St Petersburg, and wheat bread is fully substituted by rye bread in the Moscow CPI. For Kursk, wheat bread prices are among the missing data though prices of rye bread are available.

Figure 10. Cost-of-living indices for Russia, 1870-1913



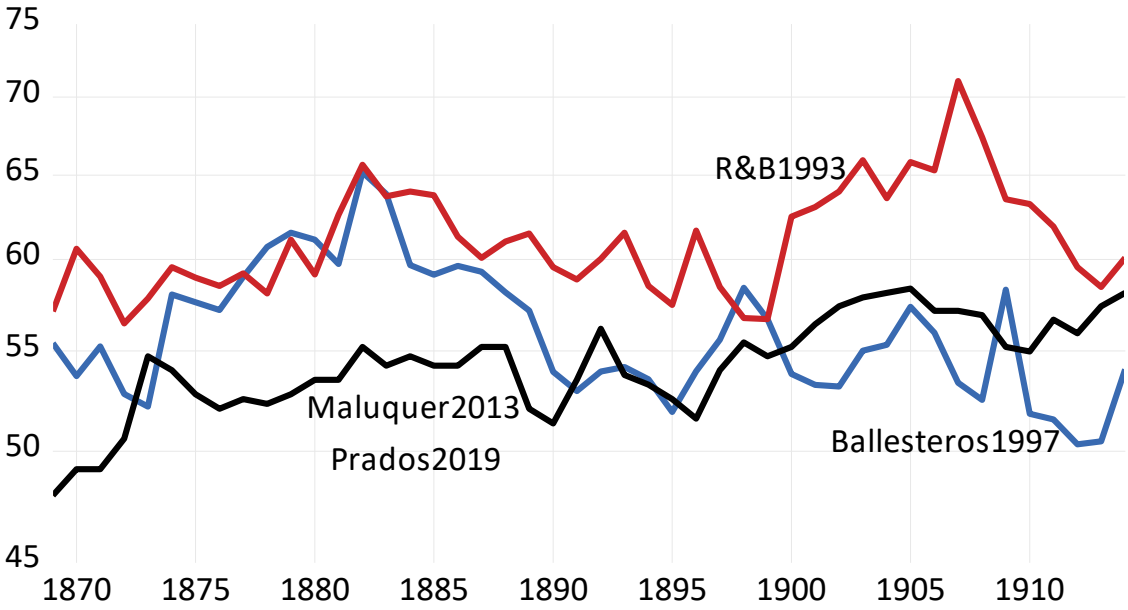
Sources: See text.

The available price series have been assigned weights in two steps, first depending on its relative weight in the commodity group, and then as belonging to food, personal utensils, fuel, vodka, or rent. The price of vodka is missing for Kursk, but since the same in St Petersburg and Moscow, it has been assumed the same in Kursk, with 5 per cent of the budget. Allen and Khaustova have inserted Moscow cloth prices in the Kursk data, but without the smoothing undertaken for Moscow. I have applied the Moscow adjustments also for Kursk. The proposed Russian CPI is the average of CPIs calculated for St Petersburg, Moscow, and Kursk. Judging from figure 10, the new CPI is reasonable when compared with the other series: close to Borodkin & Leonard from the early 1890s, with some similarity to Mironov's averages, and smoothing the extreme volatility in Reinhart. The new series is used in the database for 1870-1914. A continuation of the Russian CPI after 1914 is beyond the scope of this paper.

2.20 Spain

Simpson (1995, p. 252) asserts "The price index for Madrid is the best available for Spain at the moment, although the range of products is especially limited in the 19th century." The index Simpson considered was constructed by Reher and Ballasteros (1993) and spans the period 1501-1991. This is the series from which *Clio Infra* (Reinhart) derived inflation, while Mitchell (2013) has a different series. However, later Ballesteros (1997) constructed a CPI for all Spain 1861-1936, based on price data from all provinces. Maluquer de Motes (2013) presented a new one and criticized previous indices, the one by Ballesteros for using prices in the nineteenth century not truly valid for the purpose of a CPI and for having inconsistent construction between different periods. The Spanish CPI by Prados de la Escosura (2019), slightly differs from Maluquer de Motes only in the timing of inflation 1937-39, yet for 1940-1960 they become synchronized. From 1961 there are minor differences even if the trend is the same. However, given that Prados de la Escosura (2019) links previous series, Maluquer de Motes (2006) to 1936, de Ojeda (1988) for 1936-1961, and the official statistics from 1961 onwards, I find Maluquer de Motes (2013) as the most original update. Figure 11 compares the different Spanish CPIs over the period 1869-1914, when the differences between the earlier and later vintages are most significant. Intuitively Ballesteros 1997 seems most similar to countries in the west European core, but the decline after 1900 deviates from the international mild inflation.

Figure 11. CPIs for Spain, 1869-1914 (1929=100)



Sources: See text.

On the other hand, the trend of Maluquer and Prados are similar to the Portuguese CPI (Nunes et al), and the absence of any deflation 1873-1896 might be due to a still feeble integration of the Iberian peninsula in the new Atlantic economy of the late nineteenth century, as discussed in the next section. In the database Maluquer des Motes (2013) is used for 1870-1960, and from 1961 onwards AMECO.

2.21 Sweden

Statistics Sweden provides an official CPI back to 1830, up to 1913 based on Myrdal (1933) and from 1914 to 1954 based on the cost-of-living index calculated by the Social Welfare Board. The cost-of-living index 1914-1954 included direct taxes, which were excluded in the CPI from 1954 for which the calculation in 1962 was overtaken by Statistics Sweden (SOS 1962). Edvinsson and Söderberg (2010) present a Swedish CPI ranging 1290-2008, which from 1914 is identical with the currently official CPI. However, over the years the presentation of the official series has displayed small alterations. One reason was that up to 1954 observations were quarterly and annual averages included the last quarter of the preceding year. For many years a series figured as

the "long-term index" that did not show the annual averages but was calculated on the changes from December to December (see e.g. SOS 1993, p. 48). Due to the lack of clarity about the relation between the present official CPI and the original quarterly observations, a new annual series has been calculated for 1919-1954 based on four quarters and without direct taxes (the first years from 1914 observations were less than quarterly and the annual official series is used).[32] The reconstructed CPI is close to the currently official series, the one also used by Edvinsson and Söderberg (2010), although inflation rates differ in a few years notably during the Great Depression.

Before 1914, Edvinsson and Söderberg (2010) have calculated an alternative series to the official CPI. Their argument is that their index should primarily measure inflation and not the cost of living, which is a somewhat strained reasoning. Anyway, even though trends are very similar both the index of Edvinsson and Söderberg and the official index by Myrdal cannot be appropriate indicators of inflation since they differ not insignificantly in single years 1871-1913[33]. Differences are due to the different composition of the baskets of the two indices, and that of the former is barely representative, neither for a worker's household or the average consumer. For example, Edvinsson and Söderberg have substituted full grains for flour in Myrdal's budget, and included tanned cow hides, bar iron and pig iron in the basket, while having excluded the cost of housing.[34] Housing has 10 per cent of the weight in the later period of Myrdal's index and a larger share in the official CPI from 1914. Clearly the linking of Edvinsson and Söderberg's index before 1914 with the official CPI from 1914 results in an inconsistent match. So far there is no good reason to replace Myrdal (1933) in an historical CPI.

[32] Before 1944, quotations were reported for January, April, July, and October in *Sociala meddelanden*, but actually data were collected in the preceding month. Instead of calculating both the current and next "January", only the latter, that is December of the current year has been used here. From 1944 the months were reported as March, June, September, and December but the Social Welfare Board still calculated annual averages from five months (e.g. Sociala meddelanden, 1950, p.373). From 1935 a separate cost of living index without direct taxes was reported, but not before 1935. Such a series has been reconstructed here by help of the weight share for direct taxes, which was 7.95% to 1930 and 6.1% from 1931 (SOS 1933, 1961).

[33] Trends are similar because on average differences even out but counting on the absolute differences shows the size of the deviations between the inflation rates provided by the two indices: the average absolute difference is 1 percentage points over 1871-1913. Given that the magnitude of absolute annual price changes was about 3 per cent, that difference is not insignificant.

[34] Another reason to be careful with Edvinsson and Söderberg's index is the table on page 433, showing the weight shares "in per cent" for different periods, which in the bottom line are summed up to 100. However, only 1830-1870 the shares amount to 100, while to 127 in earlier periods and to 96 for 1870-1913.

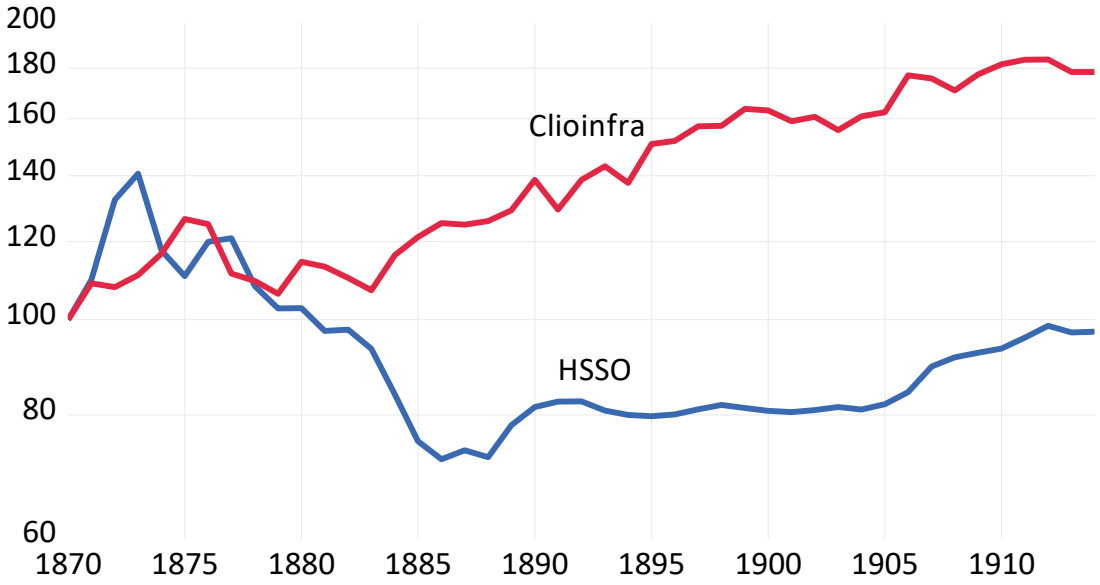
Used here is thus Myrdal (1933) for 1870-1913 and the official CPI 1914-1960 (though reconstructed from quarterly data 1918-1954), and AMECO from 1961 onwards.[35]

2.22 Switzerland

For Switzerland, Mitchell's CPI begins first in 1890. *Clio Infra* (Reinhart) uses a GDP deflator to 1913, and then onwards Reinhart refers to Mitchell until 1950 (although significantly deviating from Mitchell in 1949 and 1950) and IMF from 1951. However, the collaborative project *Historische Statistik der Schweiz* (HSSO, 2012) have published tables on nominal and real wages, from which a CPI can be derived.[36] The derived CPI and the *Clio Infra* series differ significantly, as can be seen in figure 12. Even if the fall of the CPI down to the late 1880s seems too steep, it is probably more valid and closer to the actual movement of consumer prices than the GDP deflator. After 1914 the *Clio Infra* series, Mitchell, and the HSSO series are practically the same, until 1949-1950 when *Clio Infra* makes a jump compared to the other two. Used here is the series constructed from HSSO data for 1870-1960, and from 1961-2018 AMECO is used and IMF for 2019-2022.

[35] The Social Welfare Board collected price data and made household surveys also in the years before 1914 which has made possible the linking 1913-1914.
[36] 1870-1890 from HSSO (2012) table G02; 1891-1921 from table G05ab; 1922-1960 from table G08a.

Figure 12. Switzerland, 1870-1914: CPI and GDP deflator as proxy CPI (1870=100)



Note: semi-logaritmic scale. Source: see text.

2.23 United Kingdom

For the UK several "CPIs" are available. In 2004 the Office for National Statistics authoritatively declared the one to trust:

> This article presents a composite price index covering the period since 1750, which allows long-run comparisons to be made of consumer price inflation and the purchasing power of the pound. It replaces similar indices that have been published in the past by the Office of National Statistics, the Bank of England and the House of Commons Library …. The price index presented in this article therefore reflects movements in the prices and services purchased by the private domestic consumer, that is, ordinary households, rather than those purchased by businesses or public authorities. (O'Donoghue et al., 2004, p. 38)

Although "official", there are reasons to treat this index with care. Before 1870, of less concern here, it is composed of the somewhat dated price indices by Phelps-Brown and Hopkins (1956), to 1850, and Layton and Crowther (1935) 1850-1870[37]. From 1870 to 1947 it is the deflator for

[37] Actually not their own: "The index for the year from 1850 to 1910 was compiled by Mr. G.H.Wood" (Layton and Crowther 1935, p 232). George Henry Wood contributed to *The Journal of the Royal Statistical Society* 1899-1910 on prices and wages. See also Feinstein (1995).

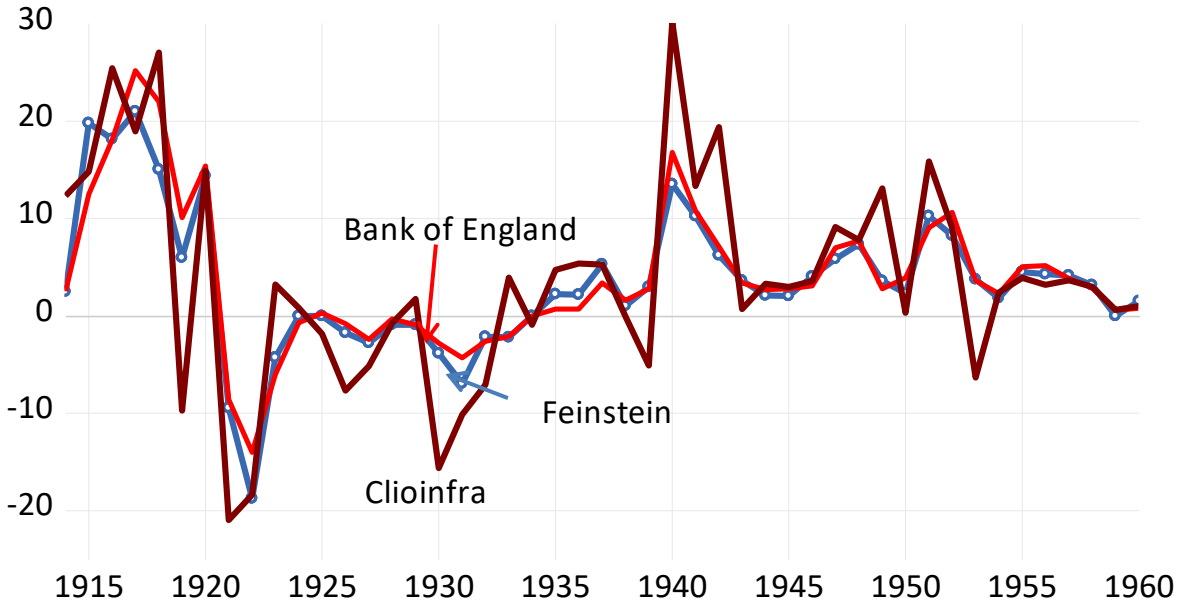
consumption expenditure in national accounts (from Feinstein 1972), and from 1947 and onwards it is the official retail price index (RPI)[38]. Strangely the ONS project passed over later work by Feinstein, precisely aimed to a cost-of-living index, with annual observations 1770-1990 (Feinstein 1991, 1995, 1998). Feinstein (1995) shortly describes the adjustments done to previous indices and it seems reasonable to judge his late work as the most valid, although weight bases (budgets) are not well matched before 1938. Thus for 1870-1914 the budget is from 1900, for 1914-1937 from 1904. In previous indices the budget of 1904 was used until 1947, while Feinstein added a weight base from an enquiry undertaken 1937-38 for the period 1938-1947, whereafter weights were regularly updated, from 1957 annually. Recently Bank of England published the impressive database by Thomas and Dimsdale (2018), *A millennium of macroeconomic data for the UK* (henceforth *BoE*), where Feinstein (1998) is used for 1770-1882 followed by Feinstein (1991) to 1914, but then by O'Donoghue et al. (2004), that is, Feinstein (1972) for 1914-1946 and the official RPI for 1947-49. One should recall that Feinstein (1972) is the consumption deflator and not a cost-of-living index. From 1949 onwards *BoE* somewhat mysteriously refers to "CPI (ONS)".[39] Figure 13 illustrates that for 1914-1960 the differences between Feinstein (1995) and the *BoE* series are minor, though not insignificant in certain years. Even in the early 1950s, when *BoE* refers to an official series, its inflation rate differs from Feinstein's (1995) by full percentage points. From the late 1940s, the series by O'Donoghue et al (2004), i.e., the RPI, has minor differences with both *BoE* and Feinstein, but from the early 1980s the RPI drifts upwards. Over 1980-2003 its inflation rate is 4.3 per cent, 0.5 and 0.6 per cent higher than AMECO and *BoE* respectively. The greater volatility of the RPI might be explained by a dated calculation method (Johnson, 2015), but the origins of the *BoE* and AMECO series are not clear.

The third series in figure 13 is the one presented by *Clio Infra* (Reinhart). For 1870-1913 it is identical with Feinstein (1995), but from 1914 to the 1950s the differences are striking. Reinhart refers to Diaz et al. (2005), a mimeo or draft of a historical statistics for Chile, which

[38] An RPI often not contains housing, but this RPI does (ONS 2021). While most countries changed from COLI to CPI, the UK changed to RPI (Johnson, 2015; cf ILO, 1947).
[39] The first CPI was the harmonized index starting in 1997, and due to its shortcomings the RPI was ended in 2013 (Johnson, 2015).

later has appeared as a book (Lüders et al., 2016). The book does not, however, contain any CPI or cost of

Figure 13. Inflation rates for the UK with different CPIs, 1914-1960



Sources: See text.

living index for the UK. Mitchell's CPI for the UK has so far not been mentioned. In some periods it is quite close to Feinstein (1995), but in other there are significant differences, such as over 1870-1896, in the Great Depression and in the 1940s and 1950s. The Jordá et al. database uses the 2018 version of *BoE* for the UK CPI, and the weaknesses discussed above applies.

A fifth series has not been mentioned, despite probably being consulted by many economic historians: Greg Clark's series on earnings and prices in the UK 1209-2017 on *Measuringworth* (Clark 2019). For prices over the years 1870-1946, he relies on Feinstein (1995), which is defined as a cost of living index, but from 1947 onwards he uses the ONS "composite price index". The inconsistency is pointed out above.

Mention should also be made of Gazeley (1989, 1994), who critically discuss the state of the arts concerning British cost of living indices and proposes new estimates for 1886-1912 and 1920-1938. Particular interest is devoted to weight bases and alternatives are applied. He also criticizes the official index for "overestimating the [WWI] wartime inflation by about 3%" (1994,

p. 208), a critique which still hits the BoE and ONS series. All in all Gazeley corroborates Feinstein (1991, 1995) who comes closer to Gazeley than any of the other indices. Here, Feinstein (1995) has been used 1870-1960, from 1961 to 2018 AMECO, and for 2019-2022 IMF.

3. Consumer Price Indices and economic integration

International comparisons of prices are often conducted as a measure of market integration for certain commodities (for example, Federico 2012; Andersson and Ljungberg 2015). However, in the present case we are dealing with price indices that aim to reflect the general price levels, which to varying degrees include non-tradables. Thus, CPIs in different countries are not, like prices of homogenous and tradable commodities, leveling as a direct effect of arbitrage in more or less integrated markets. The extent to which CPIs are co-moving and leveling are rather indirect effects of integration in a diversity of markets and the composition of the CPI baskets. Whereas co-movement and convergence of CPIs do not tell about integration of specific commodity markets, they provide a measure of the broader economic integration resulting from several markets. It is therefore not without interest to comparatively study the CPIs with the purpose to track countries' involvement in an international economy and the degree of integration among countries.

Since each CPI is constructed on basis of national data, their levels are not comparable without an adjustment for the purchasing power parities (PPP). In want of historical PPP benchmarks, one might adjust the whole series since 1870 with the PPP levels of some recent year. However, due to compositional or structural effects, the further away from the benchmark we move, the more uncertain will be the comparison (Prados de la Escosura 2000). Arguably, the co-movements of the CPIs are telling about the economic integration even without the consideration of price levels. Andersson and Ljungberg (2015) apply wavelets and principal component analysis in a dynamic factor model of nineteenth century grain prices around the Baltic Sea and the results suggest a graded measure of regional market integration. They used monthly price data and therefore could examine periods as short as a decade. With annual observations as in the present CPIs, it is dubious to make a wavelet decomposition of two-three decades, which arguably are the historical periods of interest for comparison. The same goes for

cointegration analysis, which furthermore yields results that are problematic to interpret. [40] Neither are the number of observations satisfactory for VAR-modelling of the interrelations, and since the causal relations rather are indirect via different commodity markets than lagged between the CPIs of different countries, it is probably the contemporaneous movements that are best reflecting the general economic integration. Instead of econometric tools, descriptive and more transparent methods are used here to historically explore the extent of economic integration in Europe. Three aspects are examined. First, did CPIs move similarly across countries as measured by average annual rates of change over certain historical periods? Second, under conditions of economic integration, it could be expected that inflation rates are inversely correlated with income levels, because both income and price levels of the poorer countries catch up with the richer ones. Of course, there are several factors influencing the trend of CPIs, however, it would go far beyond the scope of this paper to deal with diverging domestic conditions such as growth experiences, debt policies etc. Focusing economic integration, one could achieve a broad picture by looking for the ordinal instead of the cardinal relations. A non-parametric measure such as Spearman's rank correlation is used for an examination of the relations between CPI inflation rates and income levels at the start of the period in question. A strong negative rank correlation indicates ongoing integration with low barriers within the region for price levels to adjust to influences from abroad. A third aspect on economic integration is provided by the multiple correlations between changes of the CPIs in different countries, and their strength, as a measure of the co-movements of price levels. Close co-movements show that countries are not insulated, even if it does not necessarily indicate that price levels are converging within the larger regional economy. Thus, it can be seen as a weaker and more country-specific measure of international integration than the inverse rank correlation of income levels and inflation rates. An advantage with these approaches is that they account for the integration of the whole sample of countries and are not limited to pairwise comparisons of whether two markets are integrated.

[40] For example, from an oral inspection of a graph with the CPIs of four Nordic countries 1870-1914 (figure XX), it is not transparent why the only cointegrating relations (with Johansen tests) are between Sweden and Denmark, as well as between Sweden and Finland, but not between Denmark and Finland, or Norway and any of the other. Theoretically, a linear relation must hold, but this does not allow for some of the idiosyncrasies which may marginally disturb in the real world even if the basic patterns are the same.

3.1 Inflation trends

A comparative look at the trend of CPIs during certain periods is provided in Table 4. Before the WWI, almost general is the well-known pattern of deflation from the early 1870s switching to a moderate inflation from the mid-1890s. The Nordic countries were clearly included in this pattern, as well as eastern countries even though the deflation during the first period was rather moderate in Poland and Russia. An exception though, were the Mediterranean countries Greece, Portugal and Spain, with weak inflation over both periods or, as Greece, with weak deflation from the 1890s differently from the general pattern of moderate inflation. Noticeable is also the comparatively high inflation 1896-1913 in Austria, Germany, and the Netherlands. In particular the Netherlands stands out among the higher income countries with double the inflation rate of the UK. These pre-WWI developments are also captured by the rank correlations in Table 6, where the rank order of inflations rates is rather strongly inversely correlated against the rank order of income per capita levels. One could also note, that the negative correlation is slightly stronger when two eastern countries (Russia and Poland) are included, suggesting that these economies were integrating in the larger international economy. In the following period of moderate inflation 1896-1913, the rank correlation disappeared, which is primarily due to the noted deviation from the pattern of Mediterranean Greece, Portugal, Spain and, to a lower extent, Netherlands.

Table 4. Average annual rate of change of CPI, different periods 1870-2019

	Austria	Belgium	Bulgaria	Czecho-Slovakia[1]	Denmark	Finland	France	Germany (West)
1870-1896	-0.80	-0.46			-0.83	-0.67	-0.36	-0.34
1896-1913	1.75	1.09	3.12		1.33	1.53	0.69	1.55
1914-1925	171.6	11.7	38.7		6.26	27.1	14.2	37.1[2]
1925-1939	-0.15	1.43	-4.36	0.01	-0.31	-1.35	1.81	-1.56
1940-1949	22.0	15.0	36.9	12.7	2.32	26.1	37.3	5.22
1950-1969	3.39	2.02	4.25	0.04	4.07	5.10	4.38	2.07
1970-1989	5.18	6.58	9.96	1.41	8.81	9.67	9.18	4.00
1990-2019	1.94	1.96	23.8	3.95	1.91	1.55	1.50	1.59

	Germany (East)	Greece	Hungary	Ireland	Italy	Nether-lands	Norway	Poland
1870-1896		0.58			-0.29	-1.16	-0.87	-0.26
1896-1913		-0.18			0.83	1.66	1.18	3.07
1914-1925		28.7			16.4	2.66	7.14	
1925-1939		2.97	-1.02	-0.71	-1.81	-2.13	-1.77	-5.75
1940-1949		42.8	152.6	4.61	64.7	7.25	2.58	62.5
1950-1969	-3.01	3.65	1.18	3.48	3.50	3.17	3.56	2.85
1970-1989	0.00	17.8	6.27	12.4	13.7	5.29	8.67	18.7
1990-2019		3.60	8.00	2.15	2.26	2.01	2.06	6.89

Table 4 continued

	Portugal	Romania	Russia	Spain	Sweden	Switzer-land	UK	Serbia
1870-1896	0.17	-0.73[3]	-0.30	0.16	-0.71	-2.04	-0.98	-0.32[4]
1896-1913	0.34	1.89	1.81	0.28	1.42	1.30	0.81	
1914-1925	38.6	45.4		5.35	4.28	4.65	3.75	
1925-1939	-1.30	-3.11		2.15	-0.49	-1.86	-0.96	
1940-1949	7.31	179.7		11.2	2.32	3.63	4.47	
1950-1969	2.48	1.71		6.01	3.67	2.16	3.41	
1970-1989	19.4	2.31		14.0	8.91	3.93	10.8	
1990-2019	2.57	25.4		2.61	1.34	0.74	2.15	

Note: 1) From 1994 Czech Republic/Czechia; 2) The period 1914-1925 ends with 1920 for Germany; 3) the period 1870-1896 begins with 1882 for Romania; 4) Serbia not included in the database, source for Serbia is Palairet (1995).

Over the war, all countries without exception had at least double-digit inflation and in table 5, 1914-1925 appears as a period of high inflation. However, after the war, the UK and countries not involved in the war switched to deflation, while Germany and some central and eastern European countries faced hyperinflation. Despite the turbulent times, both these extraordinary circumstances contribute to the rather strong inverse rank correlation, as seen in Table 5. The richer countries, now including Scandinavia, prone and able to deflate for a return to the gold standard, had as a result less pronounced rises of price levels compared to other countries. Hyperinflations were ultimately consequences of the war and the dissolution of the Austro-Hungarian empire, and the inverse rank correlations in this period are accidental more than indications of integration.

Table 5. Spearman's rank correlation between initial income levels and average annual rates of change in CPIs

	Only western Europe		Including eastern countries	
	Rank correlation ρ	Number of countries	Rank correlation ρ	Number of countries
1870-1896	-0,718**	15	-0,765***	17
1896-1913	-0,425	15	-0,156	19
1914-1925	-0,657*	14	-0,724**	16
1925-1939	-0,265	16	0,209	21
1940-1949	-0,559*	16	-0,653**	21
1950-1969	-0,141	16	0,006	21
1970-1989	-0,785***	16	-0,371	21
1990-2019	-0,707**	16	-0,862***	21
1990-2008	-0,697**	16	-0,855***	21
2009-2020	0,226	16	-0,169	21

Note: * denotes statistical significance at 5 % level, ** at 1 % level, and *** at 0,1 % level (Zar, 1972). Income levels as PPP-adjusted GDP per capita, until 1950 from Maddison (2001), from 1970 from AMECO.

Over 1925-1939 deflation had spread and included even the countries that had gone through hyperinflations. Actually, in this period Poland and other eastern countries had the most severe deflations and since these countries also were in the bottom end of incomes, as a result the rank correlation including eastern countries shows a positive sign. As will be seen below, Mediterranean Greece and Spain, however, began to integrate in western Europe during the interwar period, although their inflation over this period with universal deflation is probably much influenced by domestic conditions; yet it would make them fit into an integration pattern of inverse relation between income levels and price changes. Prices were volatile, though, and in the midst of the Great Depression also Greece and Spain experienced deflation. The same applies to the richer outliers France and Belgium, who had high inflation in the late 1920s and late 1930s,

outweighing deflation during the worst years of the Depression. Being outliers were arguably the result of their monetary policy with the late return to the gold standard and the late break up from gold (see for example, Mouré, 2002). Their case nevertheless draws attention to the question of the quality of cost-of-living indices in the interwar period, which in the survey above was illustrated by not the least the Belgian case. Not unexpectedly, the rank correlations across Europe do not suggest progress of economic integration in this period.

The 1940s, with WWII and the early postwar years, were inflationary though the spread was wide, as seen in table 5. The Nordic countries, except Finland, as well as the UK and Switzerland had moderate inflation with only a few years in double digits. On the other hand, some eastern countries together with Greece had episodes with hyperinflation[41]. Domestic conditions or national responses to military coercion formed the background to the diversity of CPI developments in the 1940s.

Historically during peace time conditions, inflation rates in the 1950s and 60s were rather high, on average 3.5 per cent among the western countries, and the spread was small. Hence, there is no statistically significant inverse rank correlation even if adjusted for the outliers of Denmark, a high-income country with relatively high inflation, and Portugal, in the other end of incomes though with a low inflation rate. Correlation does not improve even if the period is shortened to 1958-1969, when postwar reconstruction had been completed. The 1960s were otherwise a decade of progressing European integration with the realization of the customs union among the Six. A tentative explanation for the lack of relation of inflation rates to income levels, is that the progress of integration was still limited to a small number of countries and the capital controls of the Bretton Woods system allowed for a relative independence of monetary policies. As seen in Table 5, the more regulated eastern economies reported[42] lower inflation rates, which emphasizes the East/West division during the Cold War.

In the 1970s inflation rates increased despite economic recession and over 1970-89 inflation averaged 9.9 per cent across western Europe. The combination of high unemployment and inflation gave birth to the notion “stagflation.” Nevertheless, politically integration took big strides ahead, with new members in the European Community and the Single Act in 1986. This

[41] The conventional treshold of hyperinflation is 50 per cent rise per month, if lasting over a year approaching an inflation rate of 13 000 per cent.
[42] Except Bulgaria, for which the somewhat higher inflation is a conjectural estimate, see the survey above.

can be seen as reflected in the CPIs, fitting the pattern with the lower the income level, the higher the inflation, shown by the strong inverse rank correlation in table 6. This pattern included not, however the eastern countries which officially had lower inflation, except Poland (see table 5). Poland furthermore had hyperinflation in the winter 1989-1990, with 50 per cent inflation rate in November and 79 per cent in February. Despite the Polish high inflation, the inverse rank correlation is only weak when also the east is contained. This completely changes after the Fall of the Wall, and for the period 1990-2019 the inverse rank correlation is stronger when the east is included. In particular high inflations in the eastern transition countries during the 1990s contribute to this effect. Bulgaria was most extreme with 242 per cent hyperinflation in February 1997 and the annual inflation rate amounting to 548 per cent.[43] Inflation in the eastern countries stayed higher and for the whole period 1990-2019 the inverse rank correlation persisted, especially when the east is included. However, also reported in Table 6, after the Great Recession from 2009 onward, the pattern with the lower the income level the higher the inflation rate disappears. Top-income Norway with the highest, and low-level Greece with the second-lowest inflation rate contributed the most to this disappearance. Not surprisingly, this suggests that the Great Recession entailed a blow to the integration that had advanced during the preceding decades.

3.2 Inflation co-movements

Now turning to the co-movements of CPIs, that provides another angle on the historical integration of countries and regions. Correlations of annual changes of CPIs between all countries are estimated over broadly the same periods as examined above. However, the world wars with the immediate reconstruction years are omitted and periods are adjusted to similar lengths to make the correlation coefficients comparable. Table 6 illustrates the results, showing the average of the statistically significant (at 5 per cent level) correlation coefficients between the country in question and the rest of countries. In parentheses are the number of countries for which these correlations applied. The inference is that the higher the correlation coefficients and the more

[43] Calculated as December 1997 over December 1996. However, taking the annual average of 1997 over the annual average of 1996 would provide an inflation rate of 1058 per cent, illustrating the problem of transforming the one to the other, as discussed in the Introduction.

countries that the CPI changes of a country correlated with, the more integrated in the international economy was the country in question.

Table 6. Pearson's correlation between annual changes of CPIs between countries

	1871-1896	1891-1914	1920-1940	1950-1975	1975-2000	1994-2019
Austria	0.5155 (8)	0.5254 (5)	0.9150 (2)	0.6269 (12)	0.8058 (15)	0.6295 (13)
Belgium	0.5762 (2)	0.4569 (6)	0.5455 (7)	0.7326 (14)	0.8063 (15)	0.6314 (12)
Bulgaria	n.a.	0.5960 (3)	0.5341 (9)	0.6132 (11)	0.4806 (1)	0.5205 (3)
Czechoslovakia /Czechia	n.a	n.a.	0.7089 (13)	0.5745 (7)	0.6292 (2)	0.6039 (11)
Denmark	0.6011 (8)	0.6027 (8)	0.7098 (11)	0.5891 (15)	0.8061 (15)	0.5748 (16)
Finland	0.6256 (7)	0.5596 (8)	0.7194 (4)	0.5884 (14)	0.8324 (15)	0.5647 (12)
France	0.4800 (6)	0.0000 (0)	0.5510 (9)	0.5690 (14)	0.8386 (15)	0.6597 (14)
Germany (BRD)	0.5845 (11)	0.5216 (9)	0.8433 (4)	0.6217 (12)	0.7082 (15)	0.6122 (16)
East Germany (DDR)	n.a.	n.a.	n.a.	0.3832 (1)	n.a.	n.a.
Greece	0.0000 (0)	0.0000 (0)	0.7310 (4)	0.0000 (0)	0.5864 (14)	0.6598 (13)
Hungary	n.a.	n.a.	0.7544 (4)	0.5904 (6)	0.5864 (3)	0.6541 (10)
Ireland	n.a.	n.a.	0.7422 (13)	0.6934 (13)	0.8168 (15)	0.5936 (12)
Italy	0.5046 (9)	0.4823 (7)	0.4976 (6)	0.7093 (13)	0.8429 (15)	0.6484 (17)
Netherlands	0.5107 (11)	0.5207 (8)	0.7055 (12)	0.6248 (15)	0.7877 (14)	0.5182 (11)
Norway	0.5918 (9)	0.5769 (6)	0.7335 (9)	0.6255 (17)	0.7295 (15)	0.0000 (0)
Poland	0.4165 (5)	0.0000 (0)	0.5764 (13)	0.5989 (2)	0.4445 (1)	0.7047 (8)
Portugal	0.4450 (1)	0.4283 (2)	0.5740 (5)	0.6164 (13)	0.7167 (15)	0.6285 (17)
Romania	n.a.	0.6452 (4)	0.5830 (11)	0.6172 (5)	0.5460 (3)	0.6225 (7)
Russia	0.4947 (1)	0.5556 (6)	n.a.	n.a.	n.a.	n.a.

Spain	0.0000 (0)	0.4674 (3)	0.6015 (9)	0.5377 (13)	0.7839 (14)	0.6751 (17)
Sweden	0.6247 (9)	0.5517 (10)	0.7503 (10)	0.6368 (17	0.7573 (15)	0.5791 (13)
Switzerland	0.5520 (9)	0.4781 (13)	0.7151 (11)	0.6671 (13)	0.6173 (14)	0.5466 (15)
United Kingdom	0.5548 (10)	0.5155 (8)	0.7348 (12)	0.6514 (15)	0.7719 (15)	0.5138 (11)

Note: The numbers indicate the average of the statistically significant (at 5 per cent level) correlation coefficients between the country in question and the rest of countries, and in the parentheses are the number of countries for which this applied.

Searching for regional patterns, the observations made above about Greece, Spain and Portugal, are further strengthened. Thus, it can be concluded that first in the interwar period became Spain somewhat integrated with the European economy, while Greece and Portugal were even later. By contrast, both Italy and the four Nordic countries were highly integrated with the European economy at least from the 1870s although Italy from the 1890s through the interwar period. Among the core countries, Belgium and France are a bit puzzling with weak correlations before WWI. The French CPI is even uncorrelated with all the other countries 1891-1914. The comprehensive underlying data in its CPI, which pertain to metropolitan Paris, would suggest that the deviation probably not is due to a weakness of the CPI but reflects a relative insulation of the domestic market. However, this cannot be taken for granted and there is reason for new research on prices in late nineteenth century France.[44] Another core country with rich underlying data but with slightly arresting price trends before WWI is the Netherlands. Yet, the co-movements with other countries are comparable with Germany and the UK and give no reason for concern.

It is noticeable that Russia, in the first period only correlated with Finland, from the 1890s became correlated also with other Nordic as well as continental countries. Other eastern countries such as Bulgaria and Romania also look fairly integrated from their inclusion in the 1890s, while Poland loses its earlier correlations. However, as described in the survey, the

[44] The Méline tariff was introduced 1892 but it remains to investigate its impact on the domestic market (Smith 1992). Even if average French tariffs rose about 40 per cent in a couple of years (Clemens and Williamson 2004, appendix), Italy's tariffs were still higher. Rather than the average tariff level, one has to look at its distribution and effect on consumerables.

Romanian CPI before 1921 is estimated from the Austrian and Bulgarian indices, why its alleged integration is constructed rather than actual.

It is a stylized fact that the international economy disintegrated in the interwar period, and as noted above about the rank correlations, the levels of income and CPI trends became uncorrelated. This notwithstanding, in aggregate co-movements of the CPIs were more synchronized than in the quarter century before WWI. For example, the eastern countries and in particular Czechoslovakia and Poland were correlated with several others in both east and west. Thus, the successor countries of the former Austro-Hungarian empire seem to have been integrated in the international economy, even though Austria itself was only correlated, though strongly so, with Germany and Greece. Under the aggregate surface of correlations one can thus discern a disintegration within Europe, with Austria and Germany breaking up from its former correlations with the north and west. Apart from this breakup however, co-movements of CPIs were generally strengthened in the interwar period.

In the postwar period 1950-1975 co-movements in the west were further strengthened and the CPIs of both Austria and Germany were widely correlated. Except Greece, the Mediterranean countries were neither insulated from, nor different from the rest of western Europe. The eastern countries, however, were less correlated with western countries than in the interwar period. Bulgaria being an exception, but as described in the survey, its CPI 1948-1984 is an estimate, why this outcome is conjectural.[45] Although CPIs were co-moving in the west, a broader regional integration was still constrained as suggested by the insignificant rank correlation between income levels and inflation rates in the 1950s and 60s. This changed in the last quarter of the century when integration progressed according to both measures. As can be seen in table 6, the average of the statistically significant correlation coefficients increased among all countries in the west, except for Switzerland, and for most countries also the number of countries with which they were correlated increased in the period 1975-2000. In the east, on the other hand, co-movements were further reduced until the Fall of the Wall. The change in the 1990s is suggested by the strikingly stronger co-movements in the east during the overlapping

[45] And certainly biased, with eight correlation connections among western countries compared to three each for Czechoslovakia and Hungary. All eastern countries except Poland and East Germany were however correlated with Austria, arguably suggesting that the Bulgarian CPI is at least an approximation.

period 1994-2019. By contrast, in the west the co-movements were slightly weaker 1994-2019, except for Greece, and for most countries, correlations included fewer countries.

Table 7. Summary of co-movements in annual changes of CPIs

	All			West			East		
	% share stat.sign.	n	Mean r	% share stat.sign.	n	Mean r	% share stat.sign.	n	Mean R
1871-1896	39.0	17	0.5385	41.7	15	0.5513	18.8	2	0.4556
1891-1914	31.0	19	0.5303	34.4	15	0.2978	18.1	4	0.4234
1920-1940	42.4	21	0.6774	40.0	16	0.6918	50.0	5	0.6314
1950-1975	52.4	22	0.5849	62.5	16	0.5931	25.4	6	0.5629
1975-2000	58.6	21	0.7091	69.4	16	0.7630	24.0	5	0.5367
1994-2019	59.0	21	0.5782	65.3	16	0.5647	39.0	5	0.6212

Note: columns with percentage shares show the percentage of pairwise correlations that achieve statistical significance at the 5 per cent level among the total number of countries, that is indicated in the n column; the third column in each section shows the average of the coefficients in these correlations.

Most strikingly the CPI changes in Norway were not correlated with those in any other country, and its higher inflation was probably a symptom of "Dutch Disease" as a consequence of the oil economy. Apart from Norway, a conjecture is that the change was largely an effect of the Great Recession, as the pattern with the inverse rank correlation between income levels and inflation rates dissipated 2009-2020. It is near at hand to presume that the weaker co-movements 1994-2019 were also an effect of the Great Recession.

A summary of the aggregate of co-movements of CPI changes during the different periods is provided by table 7. The columns with percentages show the share of possible correlations that were statistically significant at the 5 per cent level. *n*-columns show the number of countries in each category and the columns with means show the average correlation coefficients that are statistically significant at the 5 per cent level. Striking is the decline of co-movements, in the west, in 1891-1914 compared to the preceding period. It highlights the backlash that occurred in the first globalization wave during the half-century before WWI. However, despite the following de-globalization, co-movements were strengthened in both west and east during the interwar period. Yet, this does not indicate a broader regional integration as was suggested by the lack of any inverse rank correlation between income levels and CPI

changes. In the first quarter century after WWII, correlations of co-movements were again weaker even though more countries in the west were involved. Moreover, the lack of inverse rank correlation implies that barriers to a broader regional integration remained. This changed in the west during the last quarter of the twentieth century, when both the rank correlation and correlation of co-movements were strong. Both measures suggest that the east came along in the integration process in the 1990s. This process was weakened in the twenty first century, as it seems as an effect of the Great Recession.

4. Concluding discussion

The survey of CPIs demonstrated the risk of picking easily available data from the shelf, that is, from online databases without scrutinizing their origin. Most alarming are the historical CPI inflation rates provided by *Clio Infra*/Reinhart and Rogoff (2010) though also other common and authoritative sources sometimes display surprising inaccuracy.

This said, it must be admitted that here compiled indices are of varying quality as indicators of the cost of living or price levels, both as regards reliability and validity. Validity differs due to the calculation methods and composition of baskets, that is, the sample of price series. Price data also differ as regards representativity, whether covering the whole country and the whole year, as well as regards homogeneity over time, which subsume to varying reliability. Some of the indices pretend to a high precision and have been successively improved, while others are sketchy outlines that only can be taken as provisional. As recurrently noticed in the survey, lack of precision or differences between series of the same origin is often due to the effect of rounding when low index numbers are used.

In lack of knowledge about how an index is constructed, inspection of its behavior gives an impression of its realism. Presence of excessive jumps should be a warning, and if alternative indices are available a comparison with consideration of the historical context is usually instructive. Another check on the realism of a CPI is provided by a comparison with those of other countries which also might inform about economic integration. Thus, the somewhat deviating patterns of Mediterranean countries before WWI suggest lack of integration rather than erroneous data. For France, the lack of integrated co-movements 1891-1914 raises concerns about the CPI despite it is based on comprehensive data. In the interwar period, the comparative

analysis confirmed the received picture of international disintegration, but nonetheless showed an increased integration between individual countries across Europe. It might be expected that economic integration was strong in the postwar period, however, again this was only the case as shown by co-movements of price levels between individual countries, while the overall pattern still indicated disintegration. The final decades of the twentieth century, not surprisingly exposed strong integration in several respects. However, in the twenty-first century trends changed, whether temporarily so due to the Great Recession or more long-term, remains to be seen.

References

Abildgren, K (2004) Nominal and real effective krone rate indices for Denmark 1875-2002. *Danmarks Nationalbank Working Papers,* 13

Abildgren, K (2005) Real effective exchange rates and purchasing-power-parity convergence: Empirical evidence for Denmark, 1875-2002. *Scandinavian Economic History Review,* 53: 58-70

Abildgren, K (2010) Consumer Prices in Denmark, 1502-2007. *Scandinavian Economic History Review,* 58: 2-24

Adam, J (1984) *Employment and Wage Policies in Poland, Czechoslovakia and Hungary since 1950.* London: Macmillan

Allen, RC (n.d.) *Consumer price indices, nominal / real wages and welfare ratios of building craftsmen and labourers, 1260-1913.* Data files at http://wwwiisgnl/hpw/dataphp#netherlands

Allen, RC and Khaustova, E (2019) Russian real wages before and after 1917, *Explorations in Economic History,* 72: 23-37. Online data appendix at https://wwwopenicpsrorg/openicpsr/project/107509/version/V1/view

Andersson, FNG and Ljungberg, J (2015) Grain market integration in the Baltic Sea Region in the nineteenth century. *Journal of Economic History,* 75:749-90

Ballesteros Doncel, E (1997) Una estimacíon del coste de la vidaen España, 1861-1936. *Revista de Historia Económica,* 15: 363-95

Bastien, C, Prices and wages, in Valério, N (2001) (ed) *Portuguese Historical Statistics.* Instituto Nacional de Estatística, 2001

Bayoumi, T, Lee, J and Jayanthi, S (2005) New rates from new weights. *IMF Working Paper 05/99*

Borodkin, L and Leonard, CS (2000) The rural urban wage gap in the industrialization of Russia, 1885-1913. *University of Oxford: Department of Economics Working Paper Series, N*o 14

Christodoulaki, O (2015) *The origins of central banking in Greece.* PhD thesis, The London School of Economics and Political Science (LSE)

Clark, G (2019) What Were the British Earnings and Prices Then? (New Series), *MeasuringWorth*, https://wwwmeasuringworthcom/datasets/ukearncpi/#

Clemens, MA and Williamson, JG (2004) Why did the tariff-growth correlation change after 1950? *Journal of Economic Growth*, 9: 5-46

CSO (2018) Central Statistics Office [of Ireland]. https://wwwcsoie/multiquicktables/quickTablesaspx?id=cpm02_cpa04_10

Dalgaard, K (1926) Arbejderklassens ökonomiske kaar I Danmark I de sidste 50 aar, *Nationalökonomisk Tidskrift,* LXIV: 105-216

Danmarks statistik (2005) *Forbruger- og nettoprisindekset Dokumentation*. Köpenhamn

de Ojeda Eiseley, A (1988) Índice de precios en España en el período 1913-1987. *Estudios de Historia Económica*, no 17 (Bank of Spain)

Dertilis, G B (2005) *History of the Greek State, 1830–1920* Athens: Hestia

Edvinsson, R and Söderberg, J (2010) The evolution of Swedish consumer prices, 1290-2008. In Edvinsson, Jacobson and Waldenström (eds) *Exchange Rates, Prices, and Wages, 1277-2008.* Sveriges Riksbank: Ekerlids förlag

European Bank for Reconstruction and Settlement (1991) *Annual Report.* London

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

Feinstein, C (1991) A new look at the cost of living, 1870-1914. In J Foreman-Peck (ed) *New perspectives on the late Victorian economy.* Cambridge: Cambridge University Press

Feinstein, C (1995) Changes in nominal wages, the cost of living and real wages in the United Kingdom over two centuries, 1780-1990. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe.* Aldershot: Edward Elgar

Feinstein, CH (1998) Pessimism Perpetuated: Real Wages and the Standard of Living in Britain during and after the Industrial Revolution. *Journal of Economic History,* 58: 625-58

Flandreau, M and Zumer, F (2004) *The making of global finance 1880-1913.* OECD

Gazeley, I (1989) The Cost of Living and Real Wages for Urban Workers in Late Victorian and Edwardian Britain. *Economic History Review,* 42:207-21

Gazeley, I (1994) Prices in Interwar Britain. *Explorations in Economic History,* 31: 195-209

Gnjatovic, D (2006) Introduction of Limping Gold Standard in Principality of Serbia. In Avramov and Pamuk (eds) *Monetary and Fiscal Policies in South-East Europe Historical and Comparative Perspective.* National Bank of Bulgaria

Gömmel, R (1979) Realeinkommen in Deutschland Ein internationaler Vergleich (1810-1914). *Vorträge zur Wirtschaftsgeschichte,* vol 4

Gregory, P R (1982) *Russian National Income, 1885-1913.* Cambridge: Cambridge University Press

Grytten, O H (2004a) A Consumer Price Index for Norway 1516-2003. In Eitrheim, Klovland & Qvigstad (eds) *Historical Monetary Statistics for Norway 1516-2003*. Norges Bank, Occasional Papers no 35

Grytten, OH (2004b) A Norwegian consumer price index 1819-1913 in a Scandinavian perspective. *European Review of Economic History,* 8: 61-79

Grytten, OH (2018) A continuous consumer price index for Norway 1492-2017. *NHH Discussion Paper,* SAM 26

Grytten, OH (2020) Revising price history: consumer price index for Norway 1492-2018. *Scandinavian Economic History Review,* 68: 129-44

Heikkinen, S (1997) *Labour and the market Workers, wages and living standards in Finland, 1850-1913*. Helsinki: Commentationes Scientarium Socialium

Heikkinen, S (2017) War, Inflation, and Wages: The Labor Market in Finland, 1910-1925. *Essays in Economic and Business History,* 35: 63-96

Heikkinen, S and Lundh, C (2020) Sticky Swedes and flexible Finns: manufacturing labour markets in Finland and Sweden during the Great Depression. *Scandinavian Economic History Review,* 68, pp 145-69

HSSO (2012) Historische Statistik der Schweiz. https://hssoch/de/2012/g/2 ; https://hssoch/2012/g/5a ; https://hssoch/de/2012/g/10b

Hjerppe, R (1989) *The Finnish Economy, 1860-1985 Growth and structural change.* Helsinki: Bank of Finland

Hjerppe, R (1996) *Finland's historical national accounts 1860-1994: calculation methods and statistical tables.* University of Jyväskylä: Historian laitos

Hohls, R (1995) The sectoral structure of earnings in Germany, 1885-1985. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe.* Aldershot: Edward Elgar

Hubmann, G, Jobst, C and Maier, M (2020) A new long-run consumer price index for Austria (1800 – 2018). *Monetary Policy & the Economy*, (Q3/20), 61-88

Hubmann, G, Jobst, C, and Maier, M (2020b) Ein neuer langer Verbraucherpreisindex für Österreich, 1800–2018. *Vierteljahrschrift für Sozial-und Wirtschaftsgeschichte*, *107*(1), 47-85

ILO (1925a) *Methods of compiling Cost of Living index numbers*. Geneva

ILO (1925b) *The second International Conference of Labour Statisticians*. Geneva

ILO (1947) *Cost-of-Living statistics Methods and Techniques fort he Post-War Period*. Geneva

ILO (2004) *Consumer Price Index Manual Theory and Practice.* (with IMF, OECD, UNECE, Eurostat, World Bank) Geneva: International Labour Office

IMF (2023) *International Financial Statistics.* https://data.imf.org

International Labour Review, 1920-1940

Istituto Centrale de Statistica (1958) *Sommario di Statistiche Storico Italiane, 1861-1955*. Roma

Istituto Centrale de Statistica (1968) *Sommario di Statistiche Storico dell'Italia, 1861-1965*. Roma

Johansen, HC (1985) Dansk ökonomisk statistik. In *ibid Danmarks historie,* bd *9,* Köbenhavn: Gyldendal

Johnson, P (2015) *UK Consumer Price Statistics: A Review.* London: UK Statistics Authority

Jordà, O, Schularick, M and Taylor, AM (2017) Macrofinancial history and the new business cycle facts. In *NBER Macroeconomics Annual 2016,* vol 31

Konüs, AA (1939), The problem of the true index of the cost of living. *Econometrica,* 7 (1): 10-29

Kostelenos, G (1995) Money and Output in Modern Greece; 1858-1938. Athens: Center of Planning and Economic Research

Kostelenos, G, Vasiliou, D, Kounaris, E, Petmezas, S and Sfakianakis, M (2007) *Sources of the economic history of modern Greece: quantitative data and statistical series: Greek domestic product, 1830–1939*. Athens: Centre for Planning and Economic Research and the National Bank of Greece

Layton, WT and Crowther, G (1935) *An Introduction to the Study of Prices.* London: Macmillan

Lazaretou, S (1995) Inflation and Real Exchange Rate Behaviour Under Alternative Nominal Exchange Rate Regimes: the Greek Experience of 1877-1936. *Greek Economic Review*, 17: 1-21

Lazaretou, S (2014) Greece: from 1833 to 1949. In *South-Eastern European Monetary and Economic Statistics from the Nineteenth Century to World War II.* Published by the Bank of Greece, Bulgarian National Bank, National Bank of Romania, Oesterreichische Nationalbank Athens, Sofia, Bucharest, Vienna

Ljungberg, J (2019) Nominal and real effective exchange rates for Europe, 1870-2016. Some methodological issues. *Lund Papers in Economic History,* 200

Lüders, R, Diaz, J and Wagner, G (2016) *La república en cifras Chile 1810-2010 Historical Statistics.* Santiago: Ediciones Universidad Católica de Chile

Maluquer de Motes, J (2006) 'la paradisíaca estabilidad de la anteguerra' Elaboración de un índice de precios de consumo en España, 1830-1936. Revista de Historia Económica 24 (2): 333-382

Maluquer de Motes, J (2013) La inflaciòn de Espana Un ín dice de precios de consumo, 1830-2012. *Estudios de Historia Económica,* No 64 Bank of Spain

Michotte, F (1937) L'évolution des prix de detail en Belgique de 1830 à 1913. *Bulletin de l'Institut de recherches économiques,* 8: 345-57

Mironov, BN (2010) Wages and prices in imperial Russia. *Russian Review,* 69: 47-72

Mitchell, BR (2013) *International Historical Statistics, 1750-2010*. Basingstoke: Palgrave Macmillan, online resource

Mouré, K (2002) *The Gold Standard Illusion France, the Bank of France, and the International Gold Standard, 1914-1939.* Oxford: Oxford University Press

Mühlpeck, V, Sandgruber, R and Woitek, H (1979) Index der Verbraucherpreise 1800-1914. In *Geschichte und Ergebnisse der zentralen amtlichen Statitstik in Österrreich 1829-1979.* Österreichischen Statistischen Zentralamt, pp 649-86, Wien

Myrdal, G (1933) *The Cost of Living in Sweden 1830-1930.* London: PS King

NICB (1927) *The Cost of Living in Foreign Countries.* New York: National Industrial Conference Board

NOS (1965) *National Accounts 1865-1960*. Oslo: Norges Offisielle Statistikk XII 163

Nunes, AB, Mata, E and Valério, N (1989) Portuguese Economic Growth, 1833-1985. *Journal of European Economic History,* 18: 291-330

O'Donoghue, J, Goulding, L and Allen, G (2004) Consumer price inflation since 1750. *Economic Trends,* no 604: 38-46

ONS (2021) Consumer Prices Index (CPI) and Retail Prices Index (RPI) basket of goods and services. https://www.on.sgov.uk/economy/inflationandpriceindices/methodologies/consumerpricesindexcpiandretailpricesindexrpibasketofgoodsandservices

ÖStZ (1997) Die Entwicklung der Verbraucherpreise von 1900 bis 1996. *Beiträge zur österreichischen Statistik,* heft 1240, Wien

Palairet, M (1995) Real wages and earnings in long-run decline: Serbia and Yugoslavia since 1862. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe.* Aldershot: Edward Elgar

Pedersen, J (1930) *Arbejdslönnen i Danmark – under skiftende konjunkturer i perioden ca 1850-1913.* Köbenhavn: Nordisk forlag

Phelps Brown, EH and Hopkins, SV (1956) Seven centuries of building wages. *Economica,* 22:195-206

Pizanias, P and Mitrophanis, GN (1991), *Mouvement des prix en Grece XIXe – début du XXe s,* Athenes: Fondation culturelle de la banque nationale de Grece, 2 vols

Prados del la Escosura, L (2000) International Comparisons of Real Product, 1820-1990: An Alternative Data Set. *Explorations in Economic History*, 37: 1-41

Prados de la Escosura , L (2019) What Was Spain's GDP Then? *MeasuringWorth* https://wwwmeasuringworthcom/datasets/spaingdp/

Reher, D S, & Ballesteros, E (1993) Precios y salarios en Castilla la Nueva: La construccion de un indice de salarios reales, 1501–1991. *Revista de Historia Económica-Journal of Iberian and Latin American Economic History*, *11*(1), 101-151

Reinhart, C M and Rogoff (2010) From Financial Crash to Debt Crisis. *NBER Working Paper 15795*

Reinhart, C M and Rogoff (2011) From Financial Crash to Debt Crisis. *American Economic Review,* 101: 1676-1706. Data: http://wwwcarmenreinhartcom/data/browse-by-topic/topics/2/

Sargent, TJ (2013) The ends of four big inflations. In ibid *Rational expectations and inflation.* Princeton and Oxford: Princeton University Press

Scholliers, P (ed) (1989) *Real Wages in Nineteenth and Twentieth Century Europe Historical and Comparative Perspectives.* New York: Berg

Scholliers, P (1991) Index-linked wages, purchasing power and social conflict between the wars: the Belgian approach (internationally compared). *Journal of European Economic History,* 20: 407-39

Scholliers, P (1995) A century of real industrial wages in Belgium, 1840-1939. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe.* Aldershot: Edward Elgar

Schroeven, C and Solar, P (1989) The construction of historical price indices, with an illustration from interwar Belgium. In Scholliers (ed), p 149-75

Schultz, H (1939) A misunderstanding in index-number theory: the true Konüs condition on cost-of-living index numbers and its limitations. *Econometrica,* 7 (1): 1-9

SEE (2014) *South-Eastern European Monetary and Economic Statistics from the Nineteenth Century to World War II*. Athens, Sofia, Bucharest, Vienna: Bank of Greece, Bulgarian National Bank, National Bank of Romania, Oesterreichische Nationalbank

Sicsic, P (1995) Wage dispersion in France, 1850-1930. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe,* Aldershot: Edward Elgar

Simpson, J (1995) Real wages and labour mobility in Spain, 1860-1936. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe.* Aldershot: Edward Elgar

Singer-Kérel, J (1961) *Le coût de la vie à Paris de 1840 à 1954*. Paris: Libraire Armand Colin

Sociala Meddelanden (various issues) Stockholm: Kungl Socialstyrelsen

Smith, MS (1992) The Méline tariff as social protection: rhetoric or reality? *International Review of Social History,* 37: 230-43

SOS (1933) *Detaljpriser och indexberäkningar 1913-1930.* Stockholm: K Socialstyrelsen

SOS (1961) *Konsumentpriser och indexberäkningar 1931-1959.* Stockholm: Kungl Socialstyrelsen

SOS (1963) *Konsumentpriser och indexberäkningar år 1962.* Stockholm: Kungl Statistiska Centralbyrån

SOS (1993) *Konsumentpriser och indexberäkningar 1993.* Stockholm: Statistiska Centralbyrån

Statistics Finland (1921) *Annuaire Statistique de Finlande.* Helsinki

Statistics Finland (2021) https://pxnet2statfi/PXWeb/pxweb/en/StatFin/StatFin__hin__khi__vv/

Taylor, AM (2002) A century of Purchasing Power Parity. *Review of Economics and Statistics,* 84: 139-50

Thomas, R and Dimsdale, N (2018) A millennium of macroeconomic data for the UK. The Bank of England's collection of historical macroeconomic and financial statistics, Bank of England

van Riel, A (n.d.) Constructing the nineteenth-century cost of living deflator (1800-1913). Working document project on the reconstruction of the national accounts of the Netherlands http://iisgnl/hpw/brannexphp

van Riel, A (2021) *Trials of Convergence Prices, Markets and Industrialization in the Netherlands, 1800-1913.* Leiden: Brill

Young, JP (1925) *European Currency and Finance.* Washington: Commission of Gold and Silver Inquiry, United States Senate, serial 9

Zamagni, V (1995) Appendix, Table A6. In P Scholliers and V Zamagni (eds), *Labour's Reward Real wages and economic change in 19th and 20th century Europe.* Aldershot: Edward Elgar

Zar, JH (1972) Significance testing of the Spearman rank correlation coefficient. *Journal of the American Statistical Association,* 67: 578-80

Appendix

Table A1. Bulgarian inflation regressed on inflation in Hungary and Austria, 1925-1943

Dependent variable: Bulgarian inflation		Probability
Constant	-0.837	0.675
Hungarian inflation	1.046	0.000
Austrian inflation	1.479	0.048
Adjusted r2	0.62	
F-stat	15.83	0.000
Durbin-Watson	1.77	

Sources: See text.

Table A2. Romanian inflation regressed on inflation in Hungary, Czechoslovakia, and Poland, 1925-1943

Dependent variable: Romanian inflation		Probability
Constant	2.242	0.605
Czechoslovak inflation	0.786	0.070
Polish inflation	0.253	0.001
AR(1)	0.600	0.021
Adjusted r2	0.88	
F-stat	32.53	0.000
Durbin-Watson	1.70	

Sources: See text.

Lund Papers in Economic History
ISRN LUSADG-SAEH-P--23/252--SE+56

Orders of printed single back issues (no. 1-65)
Department of Economic History, Lund University
Postal address: P.O. Box 7083, S-220 07 Lund, Sweden
Telephone: +46 46 2227475
Telefax: +46 46 131585

Full-text electronic issues (no. 58, 60, 61, 66--)
www.ekh.lu.se

Lund Papers in Economic History are published by the Department of Economic History, Lund University, Sweden. This series replaces the former series under the title *Meddelande från ekonomisk-historiska institutionen, Lunds universitet*. The change of name reflects the orientation of the series towards an international readership. The series is multilingual, but the majority of the working papers appear in English.

Lund Papers in Economic History are published as occasion arises, not at fixed intervals. Printed issues are distributed to libraries. From 1999 and onwards, full-text electronic issues are also available on *www.ekh.lu.se.* Those who would be interested in receiving information by email on new issues of **Lund Papers in Economic History** are requested to send an email message to *Lund.Papers@ekh.lu.se.*

LUND
UNIVERSITY