



European consumer price indices since 1870

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Abstract

This article 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 countries, where CPIs have been missing, new provisional indices are constructed, and some are reconstructed for critical periods. The article 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-20th century is validated, and contradictory patterns of integration in interwar and postwar Europe uncovered.

Keywords Consumer price indices · Cost of living · Source criticism · Economic integration

JEL Classification E31 · N13 · N14

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. Inflation during WWI raised public and government interests in measuring the cost

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.

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of living and construction of indices was taken up in several countries (*International Labour Review* 1921; NICB 1927²). The COLI should besides foodstuffs include clothes, miscellaneous products, housing, and did in a few cases even include income taxation. However, in several countries, simpler indices were published before a full-fledged COLI was implemented. For the time before 1914, indices might merely comprise proxies constructed from a few price series, and baskets and index methods varied 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 1870–2022, with 1929 as the reference year and presented as online supplementary material to this article. 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 article 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 article also examines the historical development of price levels in a framework of economic integration. The extent to which individual countries were integrated in the international economy is analysed as well as the extent of integration of the European economy 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), only recently have harmonization of CPIs been achieved within the EU and international organizations have 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 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 The content of the consumption baskets thus measured has of course changed a lot over time, as well as between countries, but this arguably validates the index as an indicator of the general price level because it takes account of the actual habits. 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

² I am grateful to Sakari Heikkinen for bringing my attention to this book.

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).

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 fulfil the criteria of being of the Lowe type.

The present sample of countries as well as the start year 1870 was 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 as online supplementary material as well as on this website:

<https://www.lusem.lu.se/organisation/departement-economic-history/research-department-economic-history/databases-department-economic-history/economic-history-data/european-consumer-price-indices-1870>

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 article, inaccuracy of various degrees, from ignorance of up-to-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* (2015), 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. An oddity in Mitchell is that although his CPIs are running up to 2009, the possibility for long-term comparisons ends with 1993, since reference year is shifted in 1994 and again 2001 without providing links to the preceding year. For 13 of the European countries, along with four non-European, the Jordà-Schularick-Taylor (2017) *Macrohistory Database*⁵ also offers CPI series back to 1870. For most countries, their reference is to Taylor (2002) up to 1996 and then

⁴ Mitchell (2013) is an online edition in which CPI data are basically the same as in the latest printed edition (Mitchell 2003).

⁵ Used here is Release 4, from 2019.

IMF. Taylor (2002 p. 140 n) briefly states that “The principal pre-1948 price sources are the statistical volumes of Brian Mitchell” and refers to IMF for later years. 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 24 European countries distributed onto four regions. Besides a general remark to more recent CPI statistics, in the end of the survey, the discussion 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 in the survey are just short, they might serve the aim to provide a starting point for further research. The sources of the selected CPIs are listed in Appendix C. 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 unreliable data. Section 4 concludes.

2 A survey of CPI for European countries

2.1 Western Europe

2.1.1 Belgium

For Belgium, Fig. 1 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 “Mich-elotte 1937” (should be Michotte) up to 1913. According to Scholliers (1995), the Michotte series was an unweighted average, of a relatively unrepresentative basket 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.

Clio Infra uses Reinhart, who refers to Allen (n.d.—online at iisg.nl). In the article 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)⁶

⁶ 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.

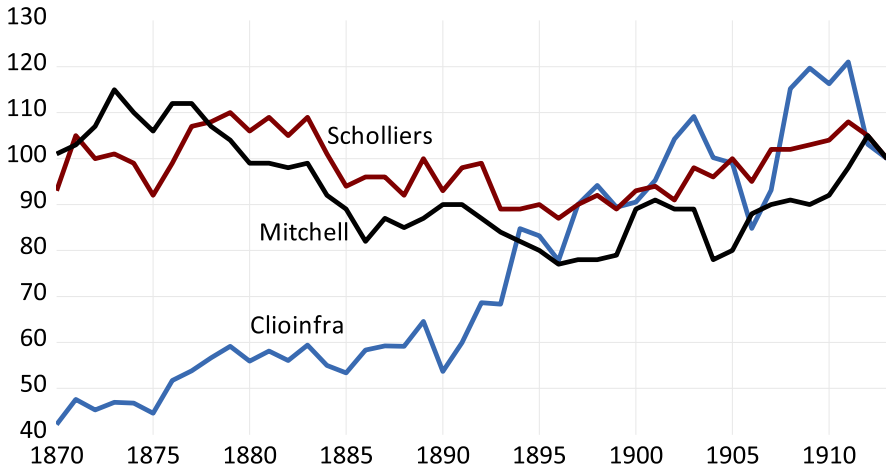


Fig. 1 CPIs for Belgium (1913 = 100), 1870–1913. Source: See text

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. 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 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 shows that significant differences develop during the 1930s. The only series that does not show deflation is *Clio Infra*, which however can be discarded on the grounds that it 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). The “COLI” series is reported by Scholliers (1991, 1995) as the price measurements used for indexing of wages which were published in *Revue du Travail*, organ of the Ministry of Industry and Labour. However, detail price indices were presented for five different income groups and six product groups but no comprehensive cost of living index was calculated (Bank Nationale de Belgique 1929; Ministère de l’industrie... 1920). Actually, it lasted until 1976 before housing was included and an elaborate weighting was performed. This goes also for the “CPI” in Table 1, which is currently presented by Statistics Belgium as the CPI back to 1920 (Statbel 2023a).⁷ Scholliers (1995) combined, however, his pre-1914 cost of living index with an index based on prices and housing in Brussels, 1914–1939.

⁷ Confirmed by retrospective weight schemes provided in personal communication with Statbel (Statbel 2023b, 2023c). The confounding intricacies are neither clarified by ILO (1925a, b) nor NICB (1927) which contend the existence of full-fledged cost of living indices, including housing.

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

	Clio Infra/ Reinhart	Mitchell	Jordá et al	“COLI”	“CPI”	Scholliers
1920–30	9.43	9.67	9.71	9.88	9.69	10.05
1930–39	0.02	−0.89	−0.89	−0.35	−0.89	−0.17

Note: sources see text

Scholliers admitted that this was provisional, due to the limitation to Brussels and price quotations in only 1 month of the year.⁸ Scholliers’s index contains however 118 products, including rent, compared to 56 in the “CPI”, and it is modern in the sense that the basket of weights is adjusted every 5th year.

Here, Scholliers is used for 1870–1939, the official (Statbel 2023a) index from 1940 onwards. The gap from May 1940 to 1946 has been interpolated according to trend.⁹

2.1.2 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 than Mitchell, as can be seen in Fig. 2. The matter is that Singer-Kérel constructed more than one cost of living index, one composed of 214 items, which is very close to Mitchell (the differences might be due to rounding effects), and another with 213 items. With just a glance Singer-Kérel (1961), 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 about a fourth on food as compared to 58 per cent in the 213 index.

A problem with the 213 index is that its main components have fixed weights over more than a century. This reflects the old idea in index theory that the object of comparison should be fixed. And the 213 index is patterned on the official cost of living index, based on 213 items, that was launched in 1949. Back in the 19th century, the same basket, with 20 per cent weight for manufactures of which clothing were just a third and with 15 per cent for diverse services of which rent was only a tenth, is indeed anachronistic. However, as in passing, Singer-Kérel (1961)

⁸ 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 1 month per year. Scholliers (1989) admitted the provisional character of the index but also defended the result, by pointing to minor regional differences.

⁹ Jordá et al. interpolate the gap with a stock market index, but this would not be representative for consumption. They show first excessive inflation, ending with 3 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.

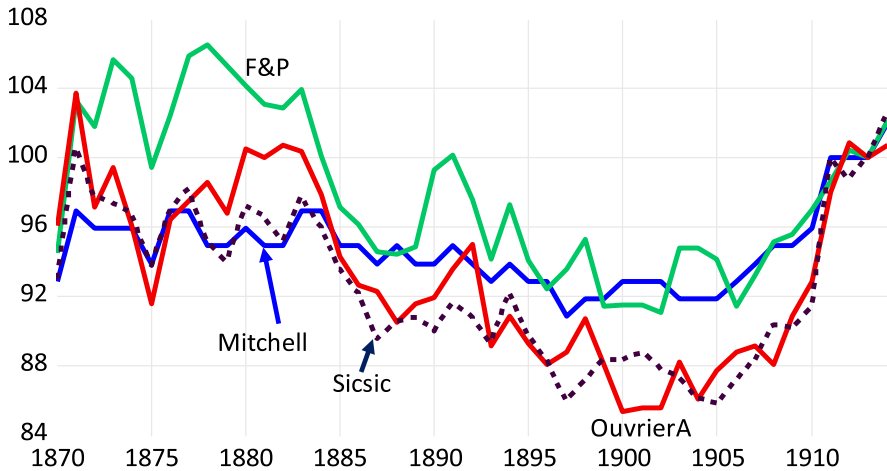


Fig. 2 Cost of living indices for France (1913 = 100), 1870–1914. Note: All indices are actually for Paris. Sources: see text

also constructs another two indices, one representative for a worker household and a second for an employee household.¹⁰ However, the first French COLI was construed by Lucien March¹¹ (1911, as cited in Jany-Catrice 2019 p. 30), stretched back to 1815 but with only decadal observations until 1905. Froment and de Portzamparc (1942) transform this to an annual series but mainly based on a limited set of wholesale prices. During WWI and through the interwar period, many local indices were construed but none covering the whole country and with a limited set of price data (NICB 1927; Singer-Kérel 1961; Jany-Catrice 2019). Singer-Kérel's index for a worker household is therefore judged the most appropriate for a COLI/CPI. It is used here until 1954, the gap during WWII is interpolated with Singer-Kérel's 213 article-index. 1954–55 Mitchell (2013) provides the link to IMF (2023) which begins 1955 and is used until 2022. It should be noted that a broader geographical coverage than the Paris region came first with the CPI from 1957 (Jany-Catrice 2019).

2.1.3 Germany

A long series back to 1881 was published by Statistisches Bundesamt Wiesbaden (2008). However, only from 1924, it is said to be a CPI whereas it should be an index of retail prices for the earlier years. The series is identical until 1913 with the COLI by “Stat. Bureau” published by Hohls (1995), they differ during WWI but

¹⁰ Budgets based on a household survey in 1905 (p. 19), weighting scheme presented on p.427–8, and the series on p. 534–5. Weights are changed over four different periods, for example, the share of food declining from 71 to 60 per cent. Weights apply until 1939, but the indices continue until 1954 though with a gap 1941–48.

¹¹ March was director of Statistique générale de la France (SGF), predecessor of INSEE.

from 1920 are very similar. Notably these both are the same for 1920 and the years up to the hyperinflation¹² as the complete COLI for Germany in NICB (1927).¹³ Thus, it is reasonable to infer that the Bundesamt series is a COLI from 1920 and not only from 1924, while before 1920, it shows a retail price index. The series in Hohls (1995) shows wholesale prices of food during WWI and differs somewhat from the Bundesamt index. For the second half of the 19th century, Hohls (1995) shows older indices that are dated, but also one by Gömmel (1979) who however from 1871 builds on Desai (1968) and from 1883 is identical with Orsagh (1969), who also modified Desai's original work. Desai (1968) covers 1871–1913 but for the 1870s and 80s lack some price data which neither are satisfactorily contained by Gömmel nor by Orsagh. The better, Pfister (2018) presents a complete COLI 1850–1889, based on a comprehensive collection of price data. The question is how to cover the period 1890–1913? Orsagh (1969) expressed old orthodoxy in blaming Desai for changing weights between periods, though himself only keeping the weight of housing constant in his modification. And instead of interpolating rent between the 5-year observations, Orsagh assumes that changes in rent did not influence the year-to-year changes in the cost of living.¹⁴ All in all, Orsagh (1969) demonstrates problems but does not offer clear empirical evidence. Fortunately, the supplementary material to Pfister (2018) provides a weight system for main commodity groups and, besides annual weights to 1889, a benchmark for 1899 which here has been further completed with a benchmark for 1907, based on a budgetary survey (Kaiserliches Statistisches Amt 1909).¹⁵ Together with price data and weights of single commodities in Desai (1968), it makes possible a construction of a CPI reasonably consistent with Pfister's index before 1890. Hence, it is a Fisher index from one Laspeyres and one Paasche, the latter two of the chained type (Fig. 3).

Table 2 summarizes the differences between the discussed indices. Pfister's index has been linked in 1889 to the present reconstruction. Its more moderate decline in the 1870s is explained by Pfister (2018) as due to a geographically broader coverage of prices, reaching to inland where the effects of globalization and the decline of grain prices were weaker. In the period from the mid-1890s to 1913, the present reconstruction displays a slightly steeper rise, closer to Desai than Orsagh. What stands out in Table 2 is *Clio Infra*/Reinhart, who refers to Mitchell (2003—same in 2013) but nevertheless shows quite different trajectories. Something has gone wrong in the handling of the material, since the annual inflation rate by 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 in *Clio Infra*/Reinhart continues through to 1979.

¹² The conventional threshold of hyperinflation is 50 per cent rise per month, if lasting over a year approaching an inflation rate of 13,000 per cent.

¹³ Although Hohls (1995) has a gap 1923 and Bundesamt a gap 1922–23, this is filled by data from NICB (1927). Another gap in Bundesamt (2008) is the inflationary year 1948, but this is filled with the observation in Hohls (1995).

¹⁴ Orsagh is right in suspicions about Desai's handling of rent data since the latter suggests (1968 p. 33) an insolvable equation with two unknowns for the interpolation.

¹⁵ I am indebted to Ulrich Pfister for supplying data from this survey which covered 852 households in 15 towns.

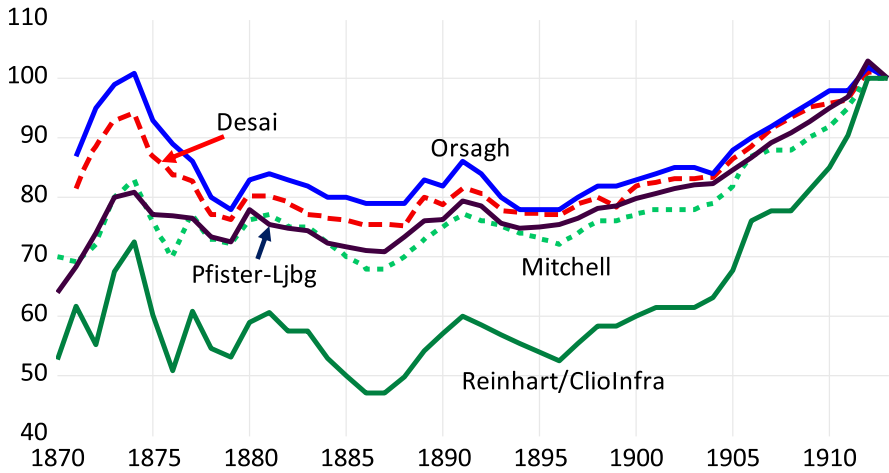


Fig. 3 Different CPIs for Germany (1913 = 100), 1870–1913. Sources: see text

Table 2 Average inflation rate (per cent) Germany, 1870–1913

	Mitchell	Clio Infra /Reinhart	Bundes-Amt	Desai	Orsagh	Pfister-Ljungberg
1870–1896	−0.05	−0.44	..	−0.51*	−0.68*	0.19
1896–1913	1.91	3.79	1.76	1.64	1.55	1.65
1870–1913	0.54	0.91	..	0.30*	0.16*	0.62

*Desai and Orsagh begin with 1871. Sources, see text

In the database, Pfister-Ljungberg is used to 1913 and from then onwards the Statistisches Bundesamt (2008, 2023) CPI.

2.1.4 Ireland

The *Central Statistics Office* of Ireland provides a CPI from 1922 onwards with reference base in July 1914 (CSO 2023). Mitchell (2013) also begins with 1922 and is similar to CSO, although with a gap, unfortunately in 1956 which was a year of crisis in Ireland (Kenny 2016). Moreover, in 1975, when CSO shows a spike in inflation of 20.9 per cent, Mitchell has only 2.6 per cent. The inflation rate shown by *Clio Infra* (Reinhart) relies on Mitchell up to 1960 (and consequently has a gap 1956–1957). However, Reinhart has without mention lagged 1 year 1922–47, and somehow fills the gap for 1948. Since occasionally there is a short-term volatility in the Irish inflation rate, the lag of 1 year conspicuously changes the macroeconomic pattern. From 1961, Reinhart refers to IMF and the series is close to the CSO although significant differences occur in single years. The CSO CPI is used here 1922–2022.

2.1.5 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 19th century based on budgets adapted to changing consumption patterns. As can be seen in Fig. 4, 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, p 701). If previously there was some confusion whether it was a consumption deflator or a COLI, 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 (2019); 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 Fig. 4. 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).

The current CPI of Statistics Netherlands is traced back to 1900. It is said to represent “goods and services purchased by an average Dutch household” (CBS 2023). Details about the computations are not reported but in the 1920s, full-fledged cost of living indices were calculated in the cities of Amsterdam and the Hague and drawn back to 1911 (NICB 1927). Mitchell (2013) is close to or identical with the CBS CPI until the 1950s when Mitchell begins to drift upwards. In the year 1980, Mitchell displays 20 per cent inflation when CBS (2023) shows 6.5 per cent, as does IMF (2023) while AMECO (2023) has 6.7. Here, van Riel (2021) has been used for 1870–1913 and CBS (2023) 1914–2022.

2.1.6 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 and to IMF from 1951. However, the collaborative project *Historische Statistik der Schweiz* (HSSO 2012) has published a CPI for 1821–1890 and tables on nominal and real wages for later periods, from which a CPI can be derived.¹⁶ The HSSO series and *Clio Infra* differ significantly, as can be seen in Fig. 5. The fall of the CPI down to the late 1880s is steeper than for other countries, and it would be desirable to know about its construction. In particular, the rapid growth of Switzerland in this period, double that of Germany and Austria (Maddison Project Database 2020), would imply a more moderate deflation. After 1914, the *Clio Infra* series, Mitchell,

¹⁶ CPI in HSSO (2012) table G02; 1891–1921 from table G05ab; 1913–1968 table G08a. References are to unpublished manuscripts, for the CPI to Hildegard Muff (1990) “Konsumentenpreisindex und Konsumdeflator 1851–1913”.

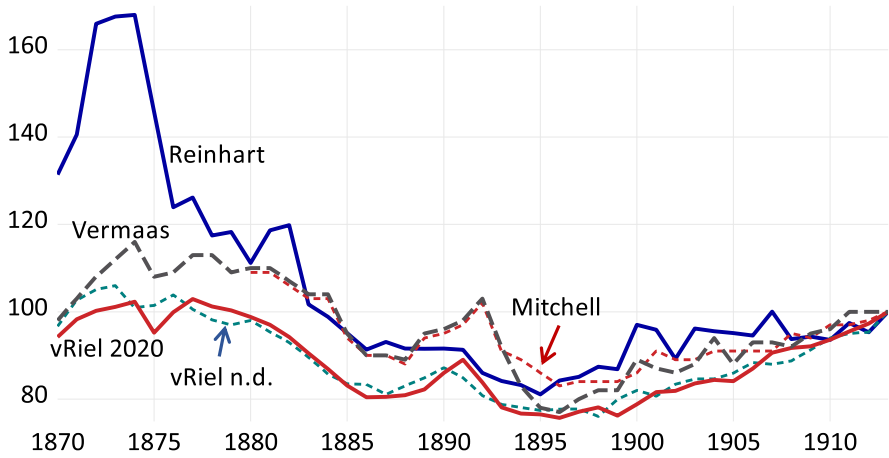


Fig. 4 Cost of Living indices for Netherlands (1913=100), 1870–1913. Source: see text

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

*Mitchell begins 1880. Sources, see text

and the HSSO series are practically the same, until 1949–1950 when *Clio Infra* makes a jump compared to the other two. The Federal Statistical Office of Switzerland publishes a CPI which goes back to 1921 (FSO 2023). The first years it did not include housing, but the methodology was revised in 1926 and housing was retrospectively added from 1921 (NICB 1927; FSO 2022). The FSO index is very close to the HSSO and first in the 1950s do the derived inflation rates differ as much as in the first decimal.

Even if the steep deflation in the 1870s and 80s is questioned cannot a GDP deflator substitute for a CPI. Therefore, used here are the HSSO series for 1870–1920, and from 1921 onwards FSO (2023).

2.1.7 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

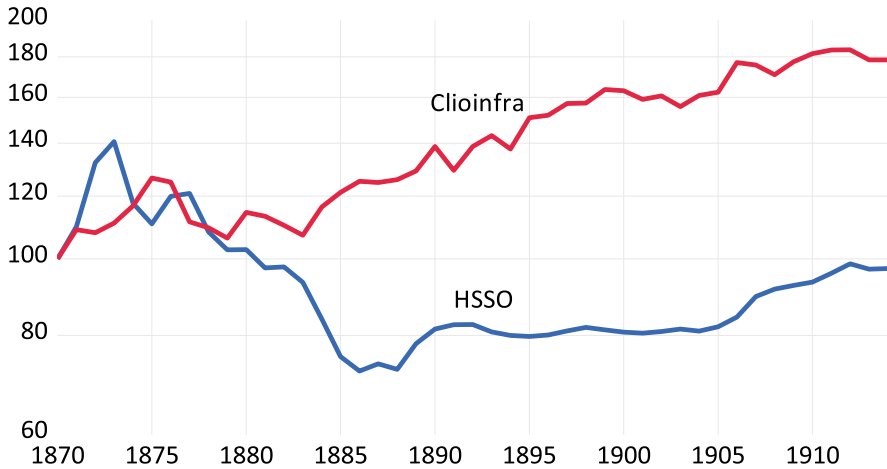


Fig. 5 Different CPI (1870=100) for Switzerland, 1870–1914. Source: see text

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) 1850–1870.¹⁷ From 1870 to 1947, it is the deflator for consumption expenditure in national accounts (from Feinstein 1972), and from 1947 and onwards, it is the official retail price index (RPI).¹⁸ 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

¹⁷ 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).

¹⁸ 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).

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)”.¹⁹ Figure 6 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 percentage points 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 Fig. 6 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 later has appeared as a book (Lüders et al. 2016). The book does not, however, contain any CPI or cost of 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) is used 1870–1960, and from 1961 onwards IMF (2023).

¹⁹ The first CPI was the harmonized index starting in 1997, and due to its shortcomings, the RPI was ended in 2013 (Johnson 2015).

2.2 Central and Eastern Europe

2.2.1 Austria

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 19th century through the 1870s.²⁰ The series displays excessive volatility, with 114 per cent inflation in 1876, as illustrated in Fig. 7. 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).²¹

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,²² 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 development of the old CPI (Mitchell) and the new by Hubmann et al. is similar.²³

In the present database, the Hubmann et al. index is used up to 2017, from then on IMF (2023).

²⁰ Citation is to Hoffman et al. (2002), but the data do not figure there.

²¹ For Austria-Hungary, the reference source in Flandreau and Zumer (2004) is a working paper by Schulze (1997), where however neither price series nor an implicit deflator can be derived.

²² Closely followed by Reinhart/Clio Infra, except for the year 1923 when Mitchell, by valuing the currency in gold, has deep deflation, Reinhart has 19 per cent inflation, and Hubmann et al. have 133 per cent. The year before, 1922, Austria faced hyperinflation.

²³ 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.

2.2.2 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 it is used here for 1942–47. For the following decades, I have found no Bulgarian CPI until AMECO (2017), beginning in 1985 and used here until 1995, from then onwards IMF (2023). For the missing years 1948–1984, I have dared an unruly guesstimate, achieved by regressing Bulgarian inflation 1925–43 on inflation in Hungary and Austria and then forecasting the missing years.²⁴ Both Hungary and Austria had historical ties with Bulgaria and the trade with Austria was still significant in the postwar period. Other relevant macroeconomic variables that might be used for an estimation 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.²⁵

2.2.3 Czechoslovakia/Czech Republic

The statistical office of Czechoslovakia began in the mid-1920s to compute two cost of living indices, one for wage earners and one for public officials, with households of five. Food prices were collected all over the country, but prices of other articles and rent were only collected in Prague. The indices were extended back to 1923 (NICB 1927). Mitchell (2013) reports the wage-earner index, unfortunately losing detail by rounding. Mitchell is used here 1923–91 except for 1949–53, when there is a gap in his series.²⁶ The gap is filled by help of Adam (1984, p. 110). IMF (2021) reported a CPI from 1991, and this has been used together with IMF (2023) for 1992–2022.

2.2.4 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.

²⁴ Table 9 in Appendix shows the fit 1925–1943.

²⁵ See also comment below in the section *Consumer Price Indices and economic integration*.

²⁶ According to Mitchell the index 1923–1948 pertains only to Prague while the 1953–1992 is country wide. Clio Infra has no series for Czechoslovakia.

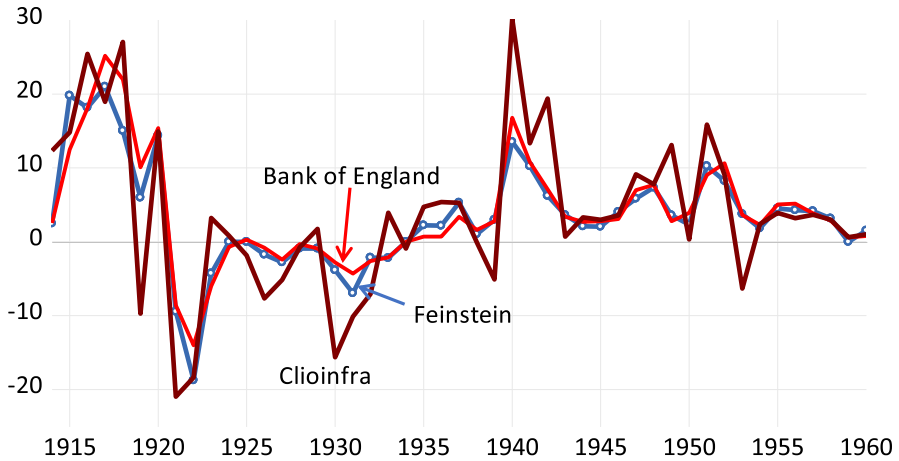


Fig. 6 Inflation rates for the UK with different CPIs, 1914–1960. Source: See text

2.2.5 Hungary

Hungary is implicitly subsumed in the Austrian CPI up to WWI although prices, except for food were only from Vienna. Mitchell (2013) has a CPI for Hungary from 1924, when the hyperinflation had stabilized. Mitchell states that the series pertain to Budapest but make not clear if this also applies to the postwar years. Sargent (2013) has an index for 1921–24, with base in July 1914, but it is partly a retail price index and partly a wholesale price index (Young 1925). Before the official COLI, trade unions calculated an index based on the collection of prices in Budapest twice a week. It was based on a theoretical budget that should provide the necessities for a wage-earner household of five, food making out 39, housing 24, and clothing 16 per cent of the costs with the prices in July 1914. Publication began in late 1920 but was extended back to 1914. NICB (1927) reports values by 31 December 1914–24 and 30 June 1924. The average of consecutive observations has here been used to extend Mitchell’s CPI back to 1914. From 1973, Mitchell is replaced with AMECO (2017) and continued 1981–2022 with IMF (2023).

2.2.6 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 19th century and in the early 20th 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

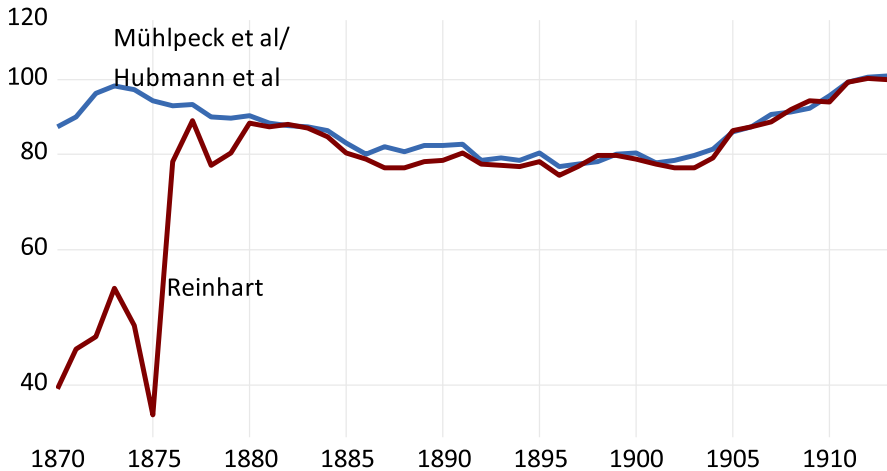


Fig. 7 Consumer price indices for Austria, 1870–1914 (1914 = 100). Sources: see text

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.

From 1922 onwards, 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, IMF (2023) is used.

2.2.7 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.²⁷

As a provisional continuous CPI, I have filled the gaps with estimates based on neighbouring countries and linked to available indices. In 1878–1920, it is assumed that the inflation rate of Romania was the average of the annual changes in the CPI of Austria, Serbia until 1910 (see below), and Bulgaria (see above) from 1891. Romania shared with Bulgaria and Serbia having the Austro-Hungarian empire as a major trade partner. Of course, this is a conjectural estimate though one might infer

²⁷ 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).

from Fig. 8 that it could be an approximation. The graph suggests that a convergence took place with lower price levels in poorer regions that approached the level of richer Austria, even if the seemingly complete levelling in 1910 is a visual effect of the indices = 100 in this year.

In 1921–1941, the cost of living index for Romania in SEE (2014) has been used, and it is linked with the preceding series by help of NICB (1927).²⁸ It is further linked 1942–1947 with Mitchell (2013). The gap 1948–1970 has been estimated from a non-linear least squares ARMA regression of the actual inflation rate 1925–41,²⁹ on inflation rates in Czechoslovakia and Poland and then forecasted for 1948–1970. The estimation output is reported in Appendix Table 10. In 1971–1987, the source is *Clio Infra* (Reinhart), and in 1988–1991, the European Bank for Reconstruction and Development (1991), and from 1992 IMF (2023). 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 1971–1987.

2.2.8 Russia

Gregory (1982) published different price and cost of living indices for Russia but only for 1885–1913. Borodkin and Leonard (2000) elaborated on a 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 Fig. 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, while from a low in 1875, the *Clio Infra* index rises with 98 per cent to 1881.³⁰

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-19th century up to WWI. For Kursk, four price series for food and four other series including rent are available. In 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

²⁸ NICB reports a COLI for 1925–26 with the reference year 1916=100, calculated by the Romanian newspaper *Argus*.

²⁹ Due to autocorrelation, an OLS was avoided.

³⁰ Online data to Andersson and Ljungberg (2015).

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 an invalid 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 19th 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. 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 Fig. 9, the new CPI is reasonable when compared with the other series: close to Borodkin and 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 article.

3 Nordic countries

3.1 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 10 shows available CPI series for 1870–1913, and clearly inflation rates differ significantly between Abildgren's different series, and the other series.

Abildgren (2005) can be left aside since it is not a CPI but a consumption deflator in historical national accounts.³¹ Abildgren (2010), on the other hand, ambitiously provides a CPI back to 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

³¹ For the source of Abildgren (2005), one has to see Abildgren (2004), who refers to the “private consumption deflator” and Kårgård (1991); Kårgård in turn refers to the historical national accounts by Hansen (1974).

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 a hospital in Copenhagen and a poorhouse 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 3-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 South-west 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 Fig. 10 with Abildgren (2010) slightly levelled 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.³²

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.³³ These were for unskilled and skilled 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.³⁴ Hence, the present CPI for Denmark 1870–1913 is reconstructed on basis of Pedersen (1930) figures for skilled workers.

³² 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).

³³ Typical at the time and in NICB (1927) called “the aggregate expenditure method.”

³⁴ 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 5 years, Johansen’s inflation rate is more than 0.5 percentage points lower, and in 7 years, it is more than so higher.

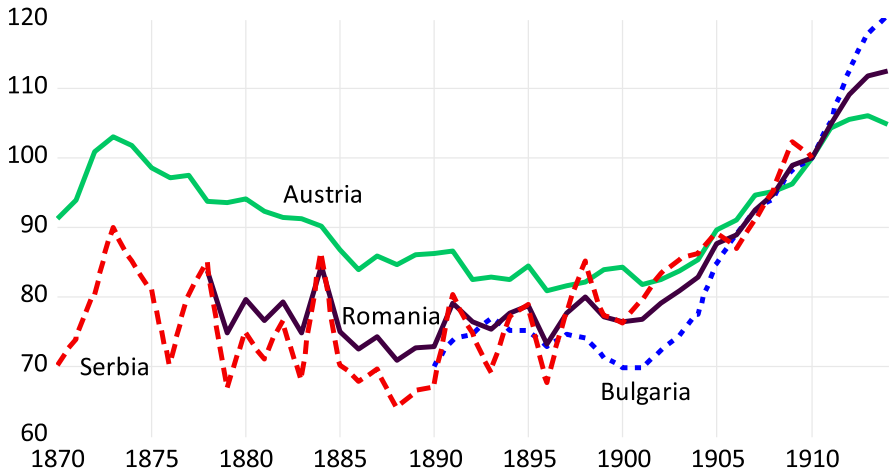


Fig. 8 Prices in Austria, Serbia, and Bulgaria with an estimate for Romania (1910=100), 1870–1914. Source: See text

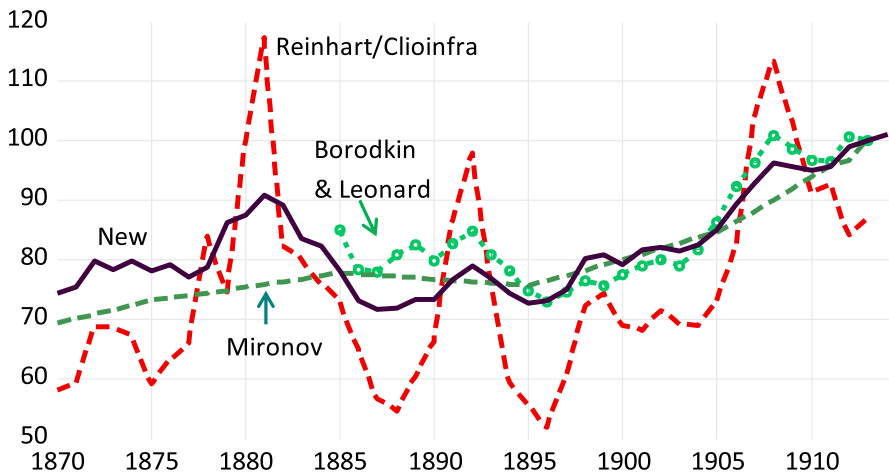


Fig. 9 Estimates of cost of living in Russia, 1870–1913. Source: see text

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).³⁵ 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 Pedersen (1930) is used for 1870–1913, Johansen (1985) for 1914–1967, and IMF (2023) from 1968.

3.1.1 Finland

In her volume with historical national accounts for Finland, Riitta 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 covered Helsinki, and from 1921 included direct taxes, the revised index covers all Finland and excludes taxes.³⁶ The most significant changes are a reduction of inflation 1917–1918 and of deflation 1929–1932. 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) and Heikkinen and Lundh (2020) for all Finland 1870–1938,³⁷ continued with Hjerppe (1989) to 1960, continued with Statistics Finland (2023).

³⁵ 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 Tidsskrift* (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.

³⁶ 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.

³⁷ A problem though is the linking of the new indices, since Heikkinen (2017) has reference year 1913 and ends in 1925, while Heikkinen and Lundh (2020) have reference year 1929 and begin with 1926. Hjerppe (1989) is used for the link between 1925 and 1926.

3.1.2 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 ends in 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.³⁸ 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. 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 that it is derived from the older Swedish historical national accounts and deemed it as “not reliable” (Fig. 11).

Jordà et al. (2017) 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. Yet, it is very close to Grytten (2018), as can be seen in Fig. 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) 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.³⁹ For the present CPI, Grytten (2018, 2020) is used 1870–2018 and thereafter IMF (2023)

³⁸ Indeed Ramstad’s index ended in 1910, but Grytten (2004a) used it only 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 erroneous given that the percentage weights pertain to the base year.

³⁹ 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 19th century between the Swedish and the other two indices calls for an explanation.

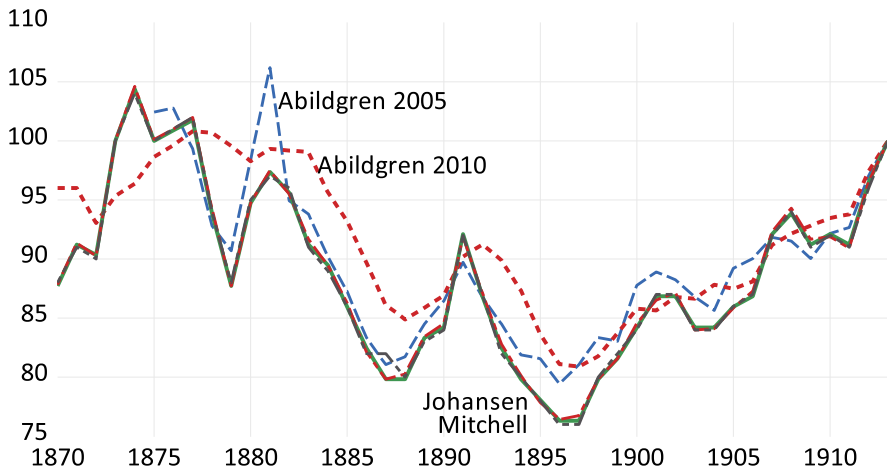


Fig. 10 CPIs for Denmark, 1870–1913 (1913 = 100). *Sources:* See text

3.1.3 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 1963). 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 was less than quarterly, and the annual official series is used).⁴⁰ 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 way that slightly changes the time pattern.

⁴⁰ 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 5 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).

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 1871–1913.⁴¹ Differences are due to the different compositions 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.⁴² 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. Used here is Myrdal (1933) for 1870–1913 and the official CPI 1914–1960 (though reconstructed from quarterly data 1918–1954), and IMF (2023) from 1961 onwards.⁴³

3.2 Southern Europe

3.2.1 Greece

The inflation rate in *Clio Infra* (Reinhart) is based, down to 1939, on the GDP deflator from Kostelenos et al. (2007—also in SEE 2014). Besides not showing the cost of living, the series displays an excessive volatility, as illustrated by Fig. 12. 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 is 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), 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 should reflect a lack of integration, although a comparison with another country

⁴¹ 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.

⁴² 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.

⁴³ 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.

in the region might be telling.⁴⁴ As can be seen in Fig. 12, prices in neighbouring Serbia show both a lower volatility and the familiar long-term pattern, with decline down to the late 1880s 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.⁴⁵ 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 in Fig. 12, 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. Some support for a deviating Greek pattern is provided by the comparison of wheat prices in Piraeus with French and British prices. Piraeus prices were without trend over 1870–1912, while those in France and Britain declined (Pizanias and Mitrophanis 1991, vol 1 pp. 320–1).⁴⁶

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 4 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 a rounding effect due to low numbers 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 expertise in Greek price history, his index has been used up to 1929. It is broadly

⁴⁴ 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 Austria-Hungary (Gnjatovic 2006 p. 50) made it more influenced by international price trends.

⁴⁵ 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 "Mitrophanis' index" with the official COLI for this period corroborates the former. For most years, Mitrophanis is similar with the COLI, but while the latter has 2 per cent deflation in the middle of WWI (in 1917), Mitrophanis 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 Mitrophanis. The CPI for Greece in Mitchell (2013) starts in 1914 and mirrors the official COLI with a roughly constant differential factor, and 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.

⁴⁶ 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 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.

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 (SEE 2014)⁴⁷ based on a larger basket of commodities although with price data only from the Athens region (Lazaretou 2014 p. 132). 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.

To conclude, Mitrophanis is used for 1870–1929, Lazaretou (2014; SEE2014) for 1930–1949, Mitchell (2013) for 1950–1960, and IMF (2023) from 1961 onwards.

3.2.2 Italy

The statistical institute of Italy (ISTAT) publishes a CPI extending back to 1861, originally in ISTAT (1958a). However, the construction of the index before 1926, with the founding of ISTAT, is not clear except that it is based on a diversity of retail prices that were collected by municipalities at least since 1861. However, according to NICB (1927), the city of Milan calculated a full-fledged COLI both for the city and for Italy from 1918, with base in the first half of 1914. Other cities also calculated local indices before ISTAT took over in 1926. The retrospective ISTAT index for the years 1918–26 is broadly similar with the Milan index, why it arguably is as good as an actual cost of living index even if it might be an unweighted retail price index.⁴⁸

For the period before 1914, Fenoaltea (2002) suggested an alternative CPI, although he saw the ISTAT series acceptable after 1885 and added the reservation that his alternative “is of course only an interim measure”. The reason was, first, that it largely builds upon the ISTAT index and, second, that it seemed “excessively volatile.” The latter weakness Fenoaltea nevertheless smoothed with a 3-year centred moving average. The explicit aim with Fenoaltea’s revision is to make real wages coherent with an optimistic view on the 1880s, and this is indeed achieved through a more drastic deflation in the early 1880s, moreover prolonged by the application of the moving average. As a desired result, real wages rise faster in the 1880s. The suggested index is still, to one-third, based on the ISTAT CPI, to which one-third is added for flour and bread of wheat, and one-third for flour of maize. The effect is an imbalanced composition of the basket with an exorbitant influence of a few

⁴⁷ 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. 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.

⁴⁸ The recent historical statistics (ISTAT 2010) refers to ISTAT (1958b) for details about “the first 100 years”, but that publication states that there is “no information” about the price statistics 1861–1926. In another ISTAT publication, D’Acunto (2006) contends that the COLI in the earlier 1920s was just an unweighted retail price index on 21 commodities.

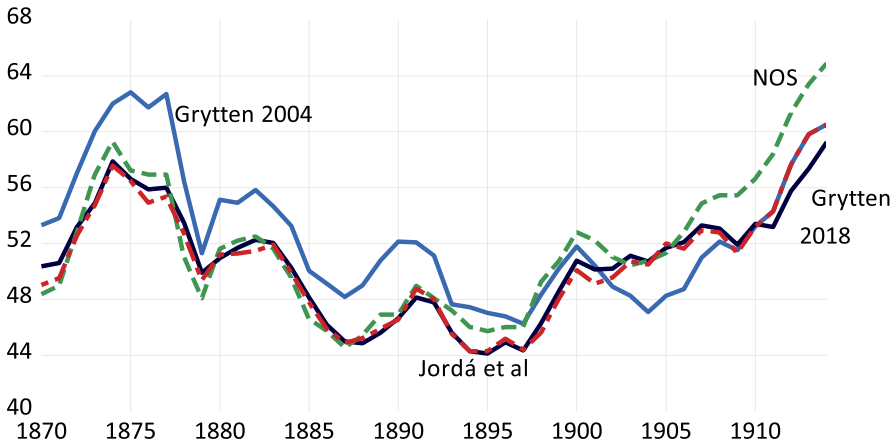


Fig. 11 Cost of living indices for Norway, 1870–1914. Sources: see text

foodstuffs and volatile wholesale prices. Figure 13 compares Fenoaltea's index with ISTAT, and two indices calculated on retail prices of food and textiles, one unweighted and one weighted according to an assumed basket (see Appendix B for details). Over the critical years 1879–1887, the reconstructed weighted index falls 13 per cent, compared to 24 per cent for the Fenoaltea index, 8.5 per cent for ISTAT, and 8.7 per cent for the unweighted index. The divergence between ISTAT and the two reconstructed indices appears mostly from 1884 to the early 1890s and after the crisis year 1907. Probably, more price data have been included in the ISTAT CPI, and only if this assumption can be rejected would it be advisable to replace it with the present reconstruct.⁴⁹

The usual secondary sources offer, when it comes to the Italian CPI, an illustrative case of effects of rounding, incautious referencing and replication of typos. *Clio Infra* (Reinhart) follows Mitchell (2013) who refers to ISTAT (1958a). According to documentation, Jordà et al. allegedly also rely on Mitchell, but in fact do so only to 1879 whereafter they exactly follow ISTAT until 1948 after which year their reference is to IMF. Inflation rates are the same in *Clio Infra* (Reinhart) as with Mitchell, although randomly different compared to 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, when the original ISTAT provides changes of 1.6 and -3.2 per cent, respectively. Although differences may not be alarming in other years, they could be significant for econometric analyses. It is further worth noting that despite both Jordà et al. and Reinhart refer to IMF, from 1949 and 1951, respectively, their inflation rates differ

⁴⁹ Vera Zamagni (1995) provides one urban cost of living index 1890–1946 and one rural index 1913–1938; however, these are largely derived from the ISTAT CPI (personal communication), and Zamagni (1989), dealing with the period 1890–1913, endorses the ISTAT index.

in most years before 1998. Here, the ISTAT (2010) CPI is used 1870–2010 and IMF (2023) 2011–2022.

3.2.3 Portugal

Nunes et al. (1989) is the main source for the Portuguese historical CPI. Nunes et al. could rely on newly available price data for the 19th century, which were weighed in a basket and somehow continued into the 20th century. In the early 20th 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 19th 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 are not entirely clear. Bastien (2001) in the *Portuguese Historical Statistics* endorses Nunes et al. (1989) and presents 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.⁵⁰ Here, the all-Portugal index in Nunes et al. (1989) has been used for 1870–1960 and from 1961 onwards IMF (2023).

3.2.4 Serbia

Mitchell has a CPI for Yugoslavia 1928–1990, with a gap 1942–1950. However, before WWI and after April 1992, Yugoslavia did not exist as a state. Serbia may represent the long-term continuity of Western Balkan, and Palairret (1995) provides a food price index 1862–1939, though with a gap 1911–1925. Recently, Mijatovic and Milanovic (2021) have constructed a CPI for Serbia 1862–1910 including not only food but also other necessities except housing.⁵¹ An obvious problem with the basket is that wine makes out a constant quantity, and when the price triples 1887–93 its share in the budget peaks at 36 per cent! Assuming that the demand for wine was not inelastic, I have adjusted the CPI by setting its percentage share of the budget to its average share before the phylloxera.⁵² As shown in Table 5, the adjustment brings

⁵⁰ 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).

⁵¹ Primarily, it is not a CPI but “a respectability basket” of a worker household of four along the approach of Allen (2001). Housing is added by 5 per cent to the basket but that does not influence the index. Necessities besides food are wine, soap, linen for clothing, candles, tallow, and charcoal.

⁵² That is, 13.8 per cent over 1870–1882. The price of wine is approximately noted from a graph (p. 432).

the CPI closer to Palairé's index, and the change from deflation to mild inflation is more in line with the international developments.

In the database, the adjusted index of Mijatovic and Milanovic (2021) is used 1870–1910, continued from 1926 to 1939 with Palairé's (1995) index. For 1911–1925, data are missing; yet, Palairé's index has its base in 1910 so there is a continuity over WWI. Palairé is rather similar with Mitchell's index for Yugoslavia, and the latter has been used to extrapolate the CPI 1940–41. Then, there is a gap to 1953, from when the Statistical Office of the Republic of Serbia (1989) provides annual changes in the cost of living until 1988. I have assumed that the change 1939–53 was of the same magnitude as in Bulgaria and used Mitchell's Yugoslavian CPI to extend the series back to 1951. For 1989–1991, it is again extrapolated with the Yugoslavian CPI (SFRY 1991)⁵³ and Palairé (1995), who provides monthly data 1990–1993. In 1994, a currency reform was implemented with 1.2×10^{23} old dinars for one new “superdinar” (Palairé 1995: 85). From 1994, IMF (2023) is used.

3.2.5 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 Ballesteros (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 19th 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, they have 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 14 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. On the other hand, the trend of Maluquer and Prados is 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 19th century, as discussed in the next section. In the database, Maluquer des Motes (2013) is used for 1870–1960, and from 1961 onwards IMF (2023).

⁵³ I am grateful to Luka Miladinovic and Branko Milanovic for providing excerpts from the Serbian and Yugoslavian yearbooks, respectively.

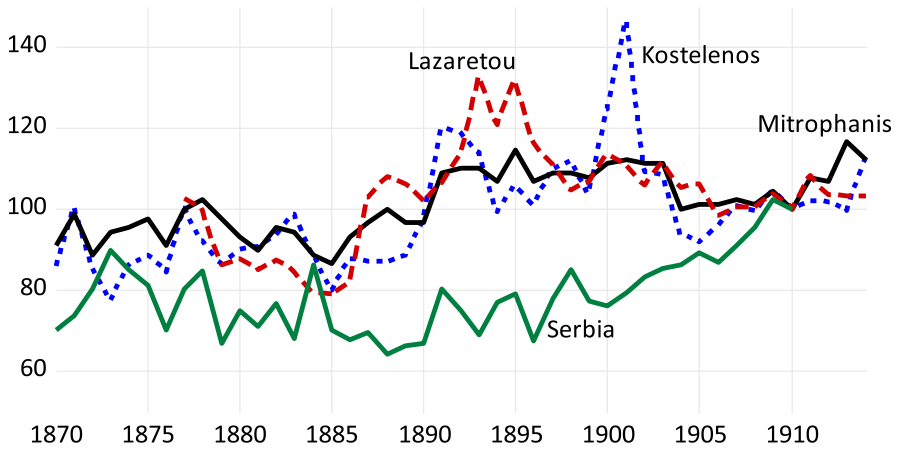


Fig. 12 Prices in Greece and Serbia (1910=100), 1870–1914. Sources: see text

3.3 Post-1960 consumer price indices

Finally, a remark should be made to the CPI statistics from 1960 onwards published by IMF and AMECO. One should be aware that there are unexplained differences between series published in different years. Mostly these are insignificant and probably occur for technical reasons. However, an example where differences in derived inflation rates are not insignificant is AMECO (2023) which, in particular for the 1960s and 1970s, differ both from AMECO (2017) and from the IMF (2021, 2023) statistics. This is much due to low numbers and rounding to only one decimal. However, a previous version (AMECO 2017) showed a strikingly different behaviours of Irish consumer prices in the critical years 2010–12, with 1.6 per cent inflation in 2010 when others show deflation of 1 per cent. Noteworthy is also the Belgian CPI (Statbel 2023a) that differs from both AMECO and IMF in 2001 and 2002, reporting inflation rates of 3 and 1.1 per cent compared to 2.5 and 1.7 per cent. Similarly, the CPI of Statistics Finland (2023) differs significantly from AMECO (2023) and IMF (2023) in 1973 and 1977. A take home of these observations is that econometric analyses might be sensitive to different versions of the CPI statistics.

4 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 homogeneous and tradable commodities, levelling as a direct effect of arbitrage in more or less integrated markets. The extent to which CPIs are co-moving and levelling

Table 4 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

is 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.⁵⁴ 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 19th 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,

⁵⁴ In a rare study, in order to compare real wages across countries Zamagni (1989) estimates the PPP-adjusted cost of living around 1905 for seven industrialized countries, based on a Milanese household food basket.

which furthermore yields results that are problematic to interpret.⁵⁵ 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 and debt policies. 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.

4.1 Inflation trends

A comparative look at the trend of CPIs during certain periods is provided in Table 6. 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 even though recent research suggests that Germany had no long period of deflation (Pfister 2018). Yet, the Nordic countries were clearly included in the pattern, as well as eastern countries, which can be seen as indications of a regional economy centred on the Austro-Hungarian empire and of the involvement of

⁵⁵ For example, from an oral inspection of a graph with the CPIs of four Nordic countries 1870–1914 (Appendix Figure 15), it is not transparent why the only cointegrating relations (with Johansen tests) are between Sweden and Denmark and between Sweden and Finland, but not between Denmark and Finland, or Norway and any of the other. Theoretically, a linear relation must hold, and 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.

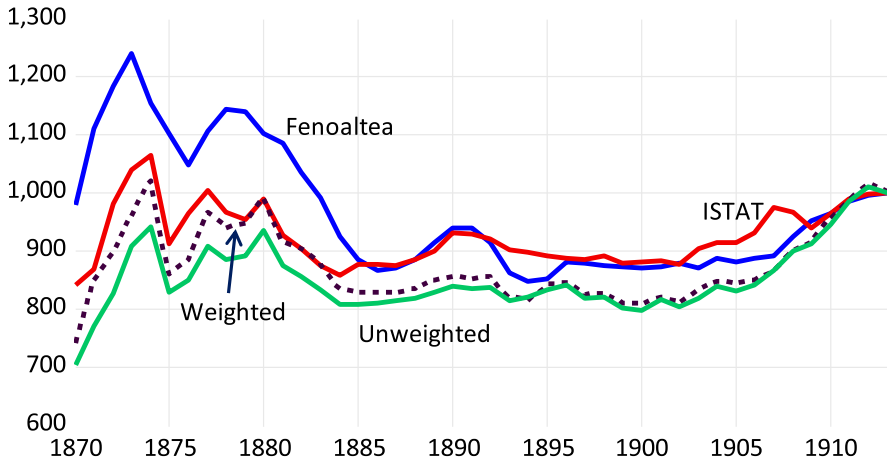


Fig. 13 Different CPIs for Italy (1913 = 1000), 1870–1913. Sources: see text for Fenoaltea and ISTAT and Appendix B for calculation of Weighted and Unweighted

Russia and Poland in globalization via the Baltic grain trade.⁵⁶ Not involved though, were the Mediterranean countries Greece, Portugal, and Spain, while other Southern countries, notably Italy and Serbia, were more synchronized with the international pattern. These pre-WWI developments are also captured by the rank correlations in Table 7, where the price changes 1870–96 are inversely correlated against the income per capita levels in 1870. One could also note that the statistical significance of the negative correlation increases 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 1896–1914, the rank correlation disappeared, which is primarily due to the noted deviation from the pattern of Mediterranean Greece, Portugal, and Spain. In the period of international deflation 1870–96, their less deflationary performance fitted with the expectation that the price level in poorer countries should adapt to the higher prices in richer countries. But the lower inflation, even deflation in Greece, in the subsequent period of international mild inflation, was contrary to expectation. The comparatively high inflation in the higher income countries Austria, Germany, and the Netherlands also contributed to the weaker negative correlation 1896–1913. However, inflation in these countries was sustained by rapid industrialization and catching-up on the UK.

Over the war, all countries without exception had at least double-digit inflation and in Table 6, 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.

⁵⁶ While Danzig had for centuries shipped large volumes of grain to Western Europe and is shown to have been well integrated with the Western markets for rye and wheat at least since the mid-19th century, St. Petersburg became integrated first somewhat later in the century (Andersson and Ljungberg 2015).

Despite the turbulent times, both these extraordinary circumstances contribute to the rather strong inverse rank correlation, as shown in Table 7. 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.

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. Inflation in Mediterranean Greece and Spain, however, made 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 even 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 the 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 in the 1920s (see for example, Mouré 2002). 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 shown in Table 6. 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 of hyperinflation. 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 shown in Table 6, the eastern plan economies reported⁵⁷ lower inflation rates, which emphasizes the East/West division during the Cold War.

In 1970s, inflation rates increased despite economic recession and over 1970–1989 inflation averaged 9.9 per cent across Western Europe. The combination of high unemployment and inflation gave birth to the notion “stagflation.”

⁵⁷ Except Bulgaria, for which the somewhat higher inflation is a conjectural estimate, see the survey above.

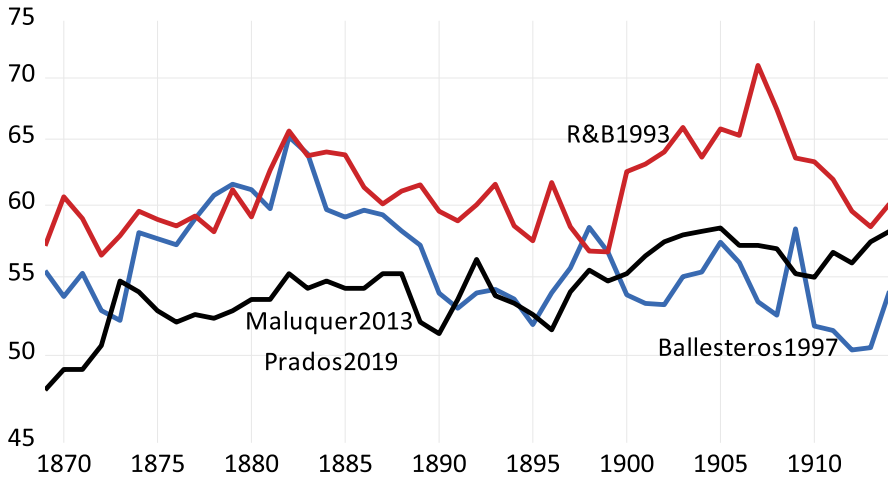


Fig. 14 CPIs for Spain, 1869–1914 (1929=100). Sources: See text

Nevertheless, politically integration took big strides ahead, with new members in the European Community and the Single Act in 1986. This 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 7. This pattern included not, however, the eastern countries which officially had lower inflation, except Poland (see Table 6). 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 1990–2009, 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. Serbia was the most extreme with hyperinflation in both 1992 and 1993 and climaxing in October with 1 898 per cent. Bulgaria came next with 242 per cent hyperinflation in February 1997 and the annual inflation rate amounting to 548 per cent.⁵⁸ However, also reported in Table 7, after the Great Recession from 2010 onwards, 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 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.

⁵⁸ 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.

Table 5 Average annual rate of change of price indices for Serbia, 1870–1910

	Palairret	Mijatovic and Milanovic	M and M adjusted
1870–1896	−0.23	−0.04	−0.42
1896–1910	2.20	2.17	2.26
1870–1910	0.47	0.80	0.46

Sources: see text

4.2 Inflation co-movements

Now turning to the co-movements of CPIs, that provides another angle on the historical integration of countries and regions. Thus, how coordinated with the rest was the inflation (or deflation) in one country? 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 8 reports the results, showing the average of the statistically significant (at least 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 apply. The inference is that the higher the correlation coefficients and the more countries that the CPI changes of a country correlated with, the more integrated in the international economy was the country in question.

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 and Portugal somewhat integrated with the European economy, while Greece was even later. By contrast, in Italy and Serbia, price movements indicate integration with the international economy in the 19th century, and such indications are even stronger for the four Nordic countries. Among the core countries, it is a bit puzzling that Belgium has limited correlations in the period 1871–1896 and that France takes a step back in the following period 1891–1914. However, in both periods, Belgium and France were strongly correlated with each other. A tentative explanation of the weakening of French correlations with other countries from the 1890s is the rise of protectionism that insulated price movements.⁵⁹

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 the 1890s, while Poland loses its earlier correlations. However, as described in the survey, the Romanian CPI before 1921 is estimated from

⁵⁹ The Méline tariff was introduced in 1892 but it remains to investigate its impact on the domestic market (Smith 1992). French tariffs rose about 40 per cent in a couple of years (Clemens and Williamson 2004, appendix); however, for an assessment, one should look at its distribution and effect on consumables rather than the average tariff level.

the Austrian, Serbian, and Bulgarian indices, why its alleged integration is hypothetical 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 become 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 nor different from 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. 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 shown in Table 8, in the period 1975–2000, both the average of the statistically significant correlation coefficients and the number of countries with which they were correlated increased for most countries in the west. 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 period 1995–2019. By contrast, in the west, the co-movements were slightly weaker 1995–2019, except for Greece, and for most countries, correlations included fewer covariates. Most strikingly the CPI of Norway was 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 1995–2019 were also an effect of the Great Recession.

Table 6 Average annual rate of change of CPI, different periods 1870–2019

Western Europe	Belgium	France	Germany	Ireland	Netherlands	Switzerland	UK	Average	
1870–1896	-0.46	-0.39	0.19		-1.16	-2.04	-0.98	-0.81	
1896–1913	1.09	0.69	1.66		1.66	1.30	0.81	1.20	
1914–1925	11.7	14.0	94.4		2.67	4.65	3.75	21.9	
1925–1939	1.43	1.82	-1.57	-0.71	-2.09	-1.86	-0.96	-0.56	
1940–1949	13.9	33.1	7.16	4.61	7.01	3.63	4.47	10.6	
1950–1969	2.02	4.11	2.04	3.48	3.13	2.17	3.41	2.91	
1970–1989	6.58	9.22	3.91	12.4	5.22	3.93	10.8	7.42	
1990–2009	1.97	1.64	1.72	2.98	2.33	1.14	2.12	1.99	
2010–19	1.58	0.89	1.23	0.49	1.45	-0.14	1.80	1.04	
Central and Eastern Europe	Austria	Bulgaria	Czecho-Slovakia ¹	Germany (East)	Hungary	Poland	Romania	Russia	Average
1870–1896	-0.80					-0.26	-0.27 ²	-0.30	-0.45
1896–1913	1.75	3.12				3.07	2.47	1.81	2.44
1914–1925	171.6	38.7			150.7		52.7		87.7
1925–1939	-0.15	-4.36	0.01		-1.02	-5.75	-3.11		-2.40
1940–1949	22.0	36.9	12.7		152.6	62.5	179.7		77.7
1950–1969	3.39	4.25	0.04	-3.01	1.18	2.85	3.04		1.68
1970–1989	5.18	9.96	1.41	0.00	6.33	18.7	2.31		6.27
1990–2009	1.98	50.2	6.23 ¹		12.2	11.9	47.9		21.7
2010–19	1.72	0.99	1.47		1.74	1.03	1.80		1.46
Nordic Countries	Denmark	Finland	Norway	Sweden	Average				
1870–1896	-0.83	-0.67	-0.87	-0.71	-0.77				
1896–1913	1.33	1.53	1.18	1.42	1.36				

Table 6 (continued)

Nordic Countries	Denmark	Finland	Norway	Sweden	Average
1914–1925	6.26	26.8	7.14	4.28	11.13
1925–1939	-0.31	-0.99	-1.77	-0.49	-0.89
1940–1949	2.32	26.1	2.58	2.32	8.32
1950–1969	4.07	5.08	3.56	3.67	4.10
1970–1989	8.81	9.70	8.67	8.92	9.03
1990–2009	2.11	1.59	2.12	1.53	1.84
2010–19	0.93	1.08	2.17	0.86	1.26
Southern Europe and Serbia	Greece	Italy	Portugal	Spain	Average
1870–1896	0.58	-0.29	0.17	0.16	0.16
1896–1913	-0.18	0.83	0.34	0.28	0.32
1914–1925	28.7	16.3	38.6	5.35	22.2
1925–1939	2.97	-1.50	-1.30	2.15	0.58
1940–1949	42.8	64.8	7.31	11.2	31.5
1950–1969	3.67	3.52	2.52	6.03	3.91
1970–1989	17.8	13.8	19.7	14.0	16.3
1990–2009	5.44	2.71	3.49	3.29	3.73
2010–19	-0.15	0.92	0.91	0.91	0.65
					Serbia
					-0.42
					2.26 ³
					-3.50
					9.51
					41.2
					29.0 ⁴
					3.62

Sources: See text. Notes: 1) From 1992 Czech Republic; 2) the period 1870–1896 begins with 1878 for Romania; 3) last year 1910 for Serbia; 4) Serbia from 1995, the year after hyperinflation and currency reform

Table 7 Spearman's rank correlation between initial income levels and average annual rates of change in CPIs

	Excluding eastern countries		Including eastern countries	
	Rank correlation ρ	Number of countries	Rank correlation ρ	Number of countries
1870–1896	-0.556*	16	-0.593**	19
1896–1913	-0.018	16	-0.304	20
1914–1925	-0.814***	15	-0.708***	18
1925–1939	-0.064	17	0.286	22
1940–1949	-0.590*	16	-0.317	21
1950–1969	-0.165	16	-0.128	22
1970–1989	-0.715**	16	-0.343	22
1990–2009	-0.709**	16	-0.879***	22
2010–2019	0.138	16	-0.252	22

*Denotes statistical significance at 5% level, ** at 1% level, and *** at 0,1% level (Zar 1972). Serbia is included in the eastern countries after WWII. Income levels as PPP-adjusted GDP per capita (Maddison Project database 2020; Maddison 2001)

5 Concluding discussion

As highlighted by the survey of CPIs, it is often not clear from open sources even for rather recent periods how a country's CPI has been constructed. A contribution of this article is to give an overview of the state of the arts that indicate weaknesses and inspire further research.

The survey of CPIs demonstrated further 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 behaviour 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 informs about economic

Table 8 Pearson's correlation between annual changes of CPIs between countries

	1871–1896	1891–1914	1920–1940	1950–1975	1975–2000	1995–2019
<i>Western Europe</i>						
Belgium	0.6267 (2)	0.4822 (9)	0.5552 (7)	0.7082 (14)	0.7965 (13)	0.6474 (11)
France	0.5551 (3)	0.5185 (5)	0.5917 (15)	0.5242 (13)	0.8441 (13)	0.6754 (12)
Germany (BRD)	0.6237 (9)	0.5297 (13)	0.8236 (4)	0.6071 (12)	0.6876 (13)	0.6384 (11)
Ireland	n.a	n.a	0.7280 (14)	0.6723 (12)	0.8247 (13)	0.5618 (14)
Netherlands	0.5285 (9)	0.5280 (10)	0.7011 (14)	0.5771 (15)	0.7620 (12)	0.5015 (12)
Switzerland	0.5238 (8)	0.4886 (14)	0.7052 (11)	0.6525 (13)	0.5650 (12)	0.5404 (17)
United Kingdom	0.5027 (8)	0.5027 (8)	0.7196 (15)	0.6528 (15)	0.7729 (14)	0.5367 (10)
<i>Central and Eastern Europe</i>						
Austria	0.4817 (7)	0.4732 (5)	0.9198 (2)	0.6346 (11)	0.7905 (13)	0.6237 (12)
Bulgaria	n.a	0.4879 (4)	0.5558 (12)	0.6571 (9)	0.4561 (1)	0.5729 (3)
Czechoslovakia/Czech Republic	n.a	n.a	0.7064 (14)	0.5745 (7)	0.6761 (2)	0.6037 (11)
East Germany (DDR)	n.a	n.a	n.a	0.4187 (2)	0.0 (0)	n.a
Hungary	n.a	n.a	0.5919 (5)	0.5647 (7)	0.5818 (3)	0.6834 (11)
Poland	0.4269 (3)	0.0000 (0)	0.6115 (12)	0.5989 (2)	0.4161 (1)	0.7090 (9)
Romania	n.a	0.5394 (10)	0.6217 (14)	0.6172 (5)	0.5687 (4)	0.5749 (7)
Russia	0.4947 (1)	0.5592 (6)	n.a	n.a	n.a	n.a
<i>Nordic countries</i>						
Denmark	0.6104 (8)	0.5558 (10)	0.6732 (12)	0.5857 (15)	0.7780 (14)	0.5719 (16)
Finland	0.6131 (7)	0.5650 (8)	0.6589 (12)	0.5888 (13)	0.8219 (13)	0.6049 (11)
Norway	0.6254 (7)	0.5690 (6)	0.6731 (12)	0.6139 (16)	0.7213 (14)	0.0000 (0)
Sweden	0.6666 (7)	0.5544 (10)	0.7499 (10)	0.6218 (16)	0.7702 (13)	0.5778 (11)
<i>Southern Europe</i>						
Greece	0.0000 (0)	0.4857 (2)	0.6471 (5)	0.4468 (1)	0.5320 (12)	0.6816 (12)
Italy	0.5135 (7)	0.4971 (6)	0.6609 (10)	0.6689 (13)	0.8509 (13)	0.6387 (17)

Table 8 (continued)

	1871–1896	1891–1914	1920–1940	1950–1975	1975–2000	1995–2019
Portugal	0.0 (0)	0.4295 (2)	0.5716 (6)	0.5939 (13)	0.6972 (13)	0.6197 (17)
Serbia	0.4041 (3)	0.5402 (8)	0.7162 (14)	0.5375 (8)	0.5816 (1)	0.5777 (11)
Spain	0.3909 (2)	0.4694 (4)	0.6087 (9)	0.5414 (13)	0.7821 (13)	0.6504 (17)

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

integration. Thus, the somewhat deviating patterns of Mediterranean countries before WWI suggest lack of integration rather than erroneous data.

In the interwar period, the comparative analysis corroborated the received picture of international disintegration but nonetheless showed an increased integration between individual countries across Europe. Price movements of Austria and Germany became insulated, but among other countries, correlations between price movements were wide and strong. Yet, poorer countries had not higher inflation, which means that there was no equalization of price levels and hence no general integration.

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 CPIs 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 21st century trends changed, whether due to the Great Recession temporarily so or more long-term, it remains to be seen.

Appendix 1: On Bulgaria and Romania

See Tables 9, 10.

Table 9 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 r ²	0.62	
F-stat	15.83	0.000
Durbin–Watson	1.77	

Source: See text

Table 10 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	

Source: See text

Appendix 2: Reconstruction of CPI for Italy 1870–1913

The reconstructed CPI 1870–1913 for Italy is based on consumer prices for foodstuffs in ISTAT (1958a). To meet Fenoaltea’s criticism, prices for maize flour have also been added, despite these are wholesale prices. Prices are for the following foodstuffs, grouped as (1) vegetables, (2) animal foods, and (3) groceries: (1) bread, pasta, rice, dried beans, potatoes, maize flour, (2) beef, pork, eggs, milk, butter, lard, and (3) olive oil, wine, coffee, sugar. Moreover, from 1886, ISTAT (1958a) contains four consumer price series for textiles, which have been taken for “clothing”.

An index is calculated for each commodity and the average for each group, except for the group of vegetables, where bread is given a double weight. Weights for the groups are taken from Nuremberg 1857 (Pfister 2018), which are assumed to be broadly valid for Italy a few decades later: vegetables 50.3%, animal foods 32.2%, and groceries 17.5%, from 1887 including clothing, and therefore, weights are 44.4% vegetables, 28.4.2% animal foods, 15.5% groceries, and clothing 11.7%.

The differences if bread is given single weight or if maize flour is excluded are very marginal. On the contrary, as can be seen in Fig. 13, the difference to ISTAT is larger if the index is just an unweighted average of all the commodity price indices. It is therefore reasonable to assume that the ISTAT CPI, when retrospectively constructed in the 1920s, included more price data than food and textiles and was weighted (according to the contemporary doctrine with the same basket as in the 1920s). Table 11 reports the periodical rate of change in consumer prices with the different estimates.

Appendix 3: List of sources for CPI database

For explanations more in detail, see Sect. 2 in the article.

Western Europe

Belgium: 1870–1939 Scholliers (1995), 1940–2022 Statbel (2023a, b), the gap from May 1940 to 1946 has been interpolated according to trend.

France: 1870–1954 Singer-Kérel (1961) index for Ouvrier A, the gap during WWII is interpolated with Singer-Kérel (1961) 213 article-index; 1955–2022 IMF (2023), linked 1954–1955 with Mitchell (2013).

Germany: 1870–1889 Pfister (2018); 1890–1912 present reconstruction; 1913–2022 Statistisches Bundesamt (2008, 2023).

Ireland: 1922–2022 CSO (2023).

The Netherlands: 1870–1913 van Riel (2021); 1914–2022 CBS (2023).

Switzerland: 1870–1920 HSSO (2012); 1921–2022 FSO (2023).

UK: 1870–1960 Feinstein (1995); 1961–2022 IMF (2023).

Central and Eastern Europe

Austria: 1870–2017 Hubmann, Jobst and Maier (2020a, b); 2018–2022 IMF (2023).

Bulgaria: 1890–1941 SEE (2014); 1942–47 Mitchell (2013); 1948–1984 present estimate (use with care!); 1986–1995 AMECO (2017); 1996–2022 IMF (2023).

Czechoslovakia/Czech republic: 1923–1991 Mitchell (2013), gap 1948–1953 bridged with J Adam (1984); linked to Czech Republic 1992- IMF (2021, 2023).

East Germany: 1950 and 1955–1989 Mitchell (2013); 1951–1954 Adam (1984).

Hungary: 1914–1923 NICB (1927); 1924–1972 Mitchell (2013); 1973–1980 AMECO (2017); 1981–2022 IMF (2023).

Poland: 1870–1914 present construction, calculations on Allen (n.d.); 1922–1949, a gap 1940–1945 interpolated, and 1956–1960 Mitchell (2013); 1950–1955 Adam (1984); 1961–1989 AMECO (2017); 1990-IMF (2023).

Romania: 1878–1920 present estimate (use with care!); 1921–1940 SEE (2014); 1941–1947 Mitchell (2013); 1948–1970 present estimate (use with care!); 1971–1987 Clouininfra (use with care!); 1988–1991 European Bank for Reconstruction and Development (1991); 1992–2000 AMECO (2017); 2001–2022 IMF (2023).

Table 11 Comparison of period trends of different estimates of Italian consumer prices, 1870–1913

	ISTAT	Fenoaltea	Reconstruct	Unweighted
1870–85	−0.40	−1.11	0.12	0.36
1885–95	0.35	−0.20	0.04	0.24
1895–1913	0.76	0.81	1.14	1.17
1870–1913	0.01	−0.52	0.01	0.18

Russia: 1870–1914 present construction on data from Allen and Khaustova (2019).

Nordic countries

Denmark: 1870–1991, Pedersen (1930); 1914–1967 H C Johansen (1985); 1968–2022 IMF (2023).

Finland: 1870–1938 Heikkinen (1997, 2017) and Heikkinen and Lundh (2020); 1940–1960, R Hjerpe (1989); 1961–2022 Statistics Finland (2023).

Norway: 1870–2018 Grytten (2018, 2020); 2019–2022 IMF (2023).

Sweden: 1870–1913 Myrdal (1933); 1914–1917 SOS 1933; 1918–1954 present reconstruction; 1955–1960 SCB (2020); 1961–2022 IMF (2023).

Southern Europe

Greece: 1870–1914, Mitrophanis and Riginos (in Dertilis 2005); 1915–1949 SEE (2014); 1950–1960 Mitchell (2013); 1961–2022 IMF (2023).

Italy: 1870–2010 ISTAT (2010); 2011–2022 IMF (2023).

Portugal: 1870–1960 Nune et al. (1989); 1961–2022 IMF (2023).

Serbia: 1870–1910 present reconstruction; 1926–1940 Palairt (1995); 1953–1991 Statistical Yearbook of Yugoslavia; 1992–1993 Palairt (1995); 1994–2022 IMF (2023).

Spain: 1870–1960 Maluquer des Motes (2013); 1961–2022 IMF (2023).

Appendix 4: CPI in the Nordic countries 1870–1914

See Fig. 15.

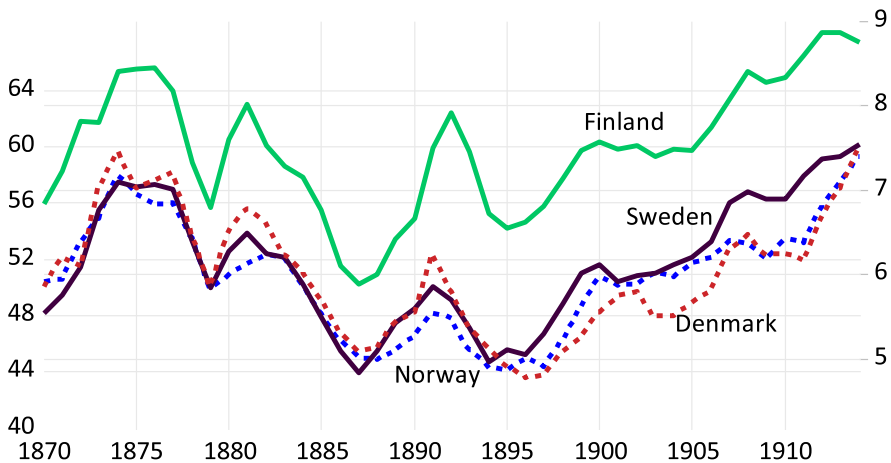


Fig. 15 CPIs of the Nordic countries (1929=100), 1870–1914. *Note:* Denmark, Norway and Sweden, left hand scale, Finland right hand scale. Cointegrated? See footnote 55. *Sources:* see text

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