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Sweden and Britain during the 19th and 20th Centuries

Ljungberg, Jonas

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PO Box 117
221 00 Lund
+46 46-222 00 00

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General Issues

Prices and Market Integration *Sweden and Britain during the 19th and 20th Centuries*

Jonas Ljungberg

Prices and Market Integration

Sweden and Britain during the 19th and 20th
Centuries*

Jonas Ljungberg

Introduction

Why do commodity prices in different countries converge? There are two opposing theories concerning the working mechanism through which international trade brings about price equalization. One is based in Walrasian equilibrium analysis, and states that international trade quickly fixes the relationship of prices between different countries. This considers not only tradables, but non-traded goods as well, and thus causes the relative prices to harmonize in trading countries. Rather provocatively, this theory has been condensed by Donald McCloskey in the following words: "At the extreme, then, if Mars were connected to Earth by the market in chewing gum alone, the two price levels would nonetheless be fixed in relation to each other."² With an eye to the financial markets, this theory states that the process of convergence in commodity markets is very fast and that "long run" should refer to a period as short as one year.³

* Paper presented to the European Historical Economics' Workshop on *Market integration from the Renaissance to the present*, Lercici 1-4 April 1993. The paper contains some preliminary results from an on-going research project -- financed by The Bank of Sweden Tercentenary Foundation -- on Sweden in international market integration during the 19th and the 20th centuries.

² McCloskey & Zecher 1984, p. 129.

³ See also McCloskey 1981, p. 196: "...in a general equilibrium of prices the fixing of any price by trade determines all the rest. The adjustment of the real

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Department of Economic History, Lund University
Mail address: P.O. Box 7083, S-220 07 Lund, Sweden
Telephone: +46 46 107475
Telefax: +46 46 131585

The other theory diverges on the time perspective and looks upon convergence of prices as a historical process. It finds support in Bertil Ohlin's explanation of the equalization of factor prices as the working mechanism which over the course of time have repercussions on the prices of non-traded goods, and thus harmonize relative prices among trading partners. It was along these lines that Léon Dupriez, N B Féltoronyi and G Szapary reasoned, when they analysed modernization and prices. In comparative studies of prices and wages, they found long periods of gradual convergence of relative prices in the case of Britain-Germany, completed first in the early 20th century, while the case of Western Europe-USA was still in the process of convergence after World War II.⁴

The present research on the integration of Sweden in an international market during the 19th and 20th centuries took as its point of departure, as far as commodity markets are concerned, a study of the structure of prices in Sweden for the period 1885-1969.⁵ One conclusion of this study was that the relative prices of manufactures were typically, and negatively, correlated to the change in production volume. That is, falling relative prices for a commodity tended to go hand in hand with an increase in the share of this commodity in total industrial production, and rising relative prices were correlated to a decrease in that share. Table 1 illustrates these findings on a more aggregated level. During four periods -- the first starting in 1888 and the fourth ending in 1969 -- 36 to 38 branches of industry, representing almost the total of Sweden's industry, have been grouped according to their change in relative prices, *i.e.*, in relation to an aggregated price index for all manufactures. As variability of relative prices changes between the periods -- this is one point of the periodisation -- the composition of the groups differs accordingly. From the table, it can be seen that during three of the four periods, the branches of industry which had the largest decrease in relative prices were the most expansive. On the other hand, industries with the highest rise in relative prices were at bottom as regards growth during only two of the periods. A closer examination shows that the deviations from the negative correlation between relative prices and volumes, were often related to special demand

equilibrium of relative prices, which must be achieved eventually, can be slow or quick. The monetary theory assumes that it is quick."

⁴ Dupriez *et al.* 1966.

⁵ Ljungberg 1990.

Table 1. Aggregated annual growth in production volume for branches of industry in Sweden 1888-1969, grouped according to annual change in relative prices.

Period	Average annual change in relative prices:					
	>1 Strongly rising	1 > 0.3 Rising	+0.3 -0.3 Stable	-0.3 < -1 Falling	< -1 Strongly falling	Total industry
I. c1890-1910	2.8	4.2	5.3	8.1	10.4	5.1
II. c1910-30	3.2	1.0	2.7	4.2	6.2	3.2
III. c1930-50	3.2	4.7	3.8	2.4	7.9	4.2
IV. c1950-70	2.3	4.1	6.2	7.5	4.8	5.1

Note: The periodisation for relative prices and production volumes do not exactly coincide. Relative prices have been compared between the following years: *Period I* 1888/94 and 1907/13; *Period II* 1907/13 and 1928/34; *Period III* 1928/34 and 1949/55; *Period IV* 1949/55 and 1963/69. Production volumes: *Period I* 1888/90 and 1910/12; *Period II* 1910/12 and 1929/31; *Period III* 1929/31 and 1953/55; *Period IV* 1953/55 and 1967/69.

conditions, *e.g.* on the export markets, in some cases related to special supply conditions, *e.g.* fierce foreign competition, and sometimes related to institutional change.

Two interpretations: The first one

There are two possible alternative interpretations of the tendency toward a negative correlation between relative prices and growth. The first one concludes that Sweden was smoothly integrated into the international economy. As prices are fixed by the world economy, then our finding is an indication that Swedish industry kept pace with economies of scale on the international level. Rapidly advancing manufactures, often innovations themselves or based on process innovations, should quickly have been adapted to production in Sweden.⁶ A glance at the economic history of Sweden makes this sound reasonable, and further support could be found in the coincidence between the trend periods of relative prices in the world economy and in Sweden.

Following Kondratiev, Hilgerdt and others, Rostow has termed the alternating, roughly twenty-year long, rise and fall in the ratio between prices for primary produce and manufactures *trend periods*.⁷ In the Swedish economy, approximately the same trend periods, as those used in table 1 have also characterized the behaviour of relative

⁶ The negative correlation is a commonly observed fact in economic history. See, *e.g.* Gerschenkron 1962. On the generalisation of this, see Ljungberg 1991, 1992.

⁷ Rostow 1978.

In the Swedish economy, approximately the same trend periods, as those used in table 1 have also characterized the behaviour of relative prices among manufactured goods. One feature of this behaviour is that the prices of manufactures containing a high share of raw materials for the most part have increased during the periods 1890-1910 and 1930-1950, while they fell during the periods 1910-1930 and 1950-1970 as compared to manufactures with higher value-added. Thus it seems so far, as if international market integration is a quick process, and was well established in the late 19th century as far as Sweden is concerned.

The second interpretation

As indicated by the trend periods, it is obvious that the world economy was an important factor for the structure of prices, *i.e.* the relative prices at a given point in time, in Sweden already a century ago. However, the negative correlation between relative prices and growth could not be explained by an adaptation to the equilibrium of the international market. Instead, it was the outcome of developments that in some cases may have disturbed the international equilibrium, and in other cases was disturbed itself by the international influence. Structural change and transformation in national economies was the causal factor. Innovations in both processes and products were such factors in generating long swings in the Swedish economy, which roughly outlined can be characterized as phases of transformation and of rationalization. Largely, the transformation swings or phases have corresponded to those international trend periods with rising relative prices for primary produce, *i.e.* 1890-1910 and 1930-50. Swedish electrification, for example, forged ahead during these periods when the relative prices of fuels were increasing. In the rationalization phases, well established industries were increasingly directed towards export markets, that is, during the periods when relative prices of manufactures rose, roughly 1910-30 and 1950-70.⁸

The second interpretation, then, would be that for the Swedish economy there has been a happy coincidence between long swings in the national economy and trend periods on the international scene; a coincidence which is reflected in the movement of prices. Moreover, just as the competitiveness among nations is not fixed and stable, nor

are the relations between relative prices. Common sense tells us that, this seems fairly reasonable since superior competitiveness is due to more value for money or cheaper prices. However, to a world of orthodox general equilibrium, the law of one price governs as soon as markets have been integrated, *i.e.* become *one* market.

The problem

So far, a couple of problems related to market integration have been discussed. There is the problem of coincidence between trend periods and long swings which, according to "the second interpretation", were found to have been a causal factor in the growth of the Swedish economy. Can a similar pattern between relative prices and trend periods be found in other countries as well, and could it be related to success and failure in the economy? Further, there is the problem of market integration. To settle the question which interpretation is closest to reality, one must know how market integration developed and functioned.

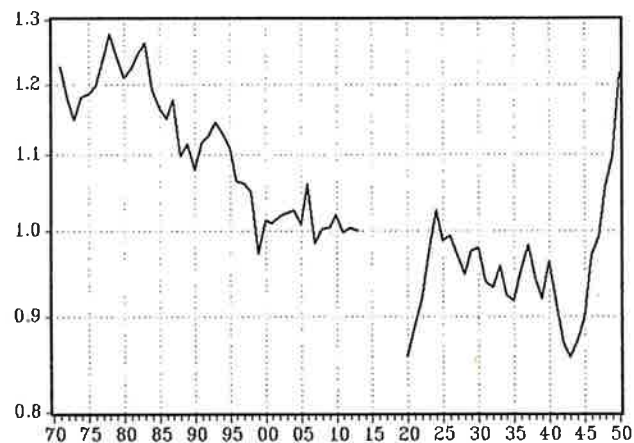
This paper will concentrate on the latter problem through a comparison of British and Swedish prices. The study of Swedish prices referred to above spanned a period from the 1880s to the late 1960s. As integration may already have been completed in the first trend period or long swing of that study, it is of interest to extend the present study back in time. Where price data have been available, the comparison begins in the 1850s. For many reasons -- space, material, institutional complications -- it has been convenient to cut off the comparison in the 1930s.

In this context, Britain not only means the larger country, but British prices are mostly counted as those in the international market into which Sweden was integrated. It seems natural that integration should mean that in some sense prices became equalized. However, according to the "second interpretation", market integration was a gradual process, and once attained, the equalization of prices could be shifted to a state of disequilibrium. This may seem illogical, as integration should mean *one* market which is defined as the area in which there is *one* price. The following pages will show if this is as well ahistorical.

⁸ See, *e.g.* Schön 1991.

Graph 1. Ratio between Wholesale Prices in Britain and in Sweden (1913=1), 1871-1950.

British WPI: Board of Trade Journal, Jan 15, 1920, Statistical Abstract for the United Kingdom, and Annual Abstract of Statistics. Swedish WPI: Åmark 1921, linked to official WPI in 1913, Statistisk årsbok.



The behaviour of prices in Britain and in Sweden

Graph 1 illustrates the relation between indexes of wholesale prices in Britain and Sweden. Irrespective of the inevitable unity in the base year of 1913, what is striking is the stability in the ratio from the turn of the century up to World War I, while in other periods British wholesale prices mostly deteriorated as compared to those of Sweden. Moreover, in the 1940s the British WPI recovered from its almost secular decrease and during the course of a few years rose about 40 per cent relative to Swedish WPI. This recovery, however, points to the difficulties of comparing aggregated price indexes, like CPI's, WPI's, or GNP-deflators. Are they constructed in the same way, and are their compositions valid for comparative purposes? Even if appropriately-constructed indexes display similar behaviour in different countries, what do they tell about the price structure? Important differences in relative prices are concealed by indexes.

Thus a comparison of prices in different countries faces a number of problems. Neither does it seem fruitful to compare the absolute level of prices for single commodities, since in most cases it will be open to dispute that the employed price data refers to commodities of

the same make and quality. The problem of space, implying differences of transaction costs, is another problem in such a comparison.

To compare the interrelationship of the structure of prices in two countries, hereafter also called the structure of relative prices, requires a standard for each, for example, a price index for domestically-produced manufactures computed in the same way for both countries. Then, the relative prices for individual commodities or industries could be gauged irrespective of monetary factors.⁹ In an attempt to compensate for the lack of such standards, another method is tested in this investigation. Trends and variability in price series from Britain and Sweden are compared. The variability is measured as the deviation from trend. To evade the problem of aggregation, price series for single commodities are used or indexes which have been constructed from several price series for a group of related commodities, *e.g.*, cotton yarn are utilized.

From the inspection of the price material, a periodisation is made, largely in accordance with the received view of history, *i.e.* the phases of the Kondratievs, or trend periods. Thus they span from the middle of the 19th century up to the early 1870s; the next period ends around 1890; and the third runs up to World War I; the fourth period ends in the Depression; and the final period ranges over World War II and ends in the early 1950s. Most comparisons are pursued for the second, third and fourth periods, while the price data are more scarce for the first and last periods. The precise range of the periods in use will be clarified below and are shown in the tables in Appendix B. However, to account for differences with regard to turning-points in the series, the periods are overlapping, *e.g.*, the first period ends in 1875 while the second starts in 1866. When there is great turbulence in prices during a period, as in the fourth period during and immediately after World War I, the linear trend may not be an appropriate measure. Such cases should be kept in mind when interpreting the results.

The trend is also open to other problems of interpretation. It may be the same in the compared series or it may differ. Of course, "same" is an issue of fact. As a rule of thumb, a difference in trend of 0.5 per cent could be taken as critical, as it will produce a change in relations of roughly 10 per cent in a period of 20 years. Moreover, when the

⁹ Another alternative, used in the referred studies edited by Dupriez, is to compare factor and commodity prices. Nevertheless, one would still face problems of validity, *e.g.* when using wage series.

trend differs, prices may diverge or converge. The level of the differences is, however, not the point. The level of absolute prices may differ, yet relative prices may be the same. To conclude if the structure of prices is equalized between the countries in question, the pattern of trends should be compared for more than one period and more than one commodity. If the trends are the same, or the differences between them tend to disappear from one period to the next, it may be possible to conclude that the structure of prices is approaching equalization. On the contrary, if the opposite is the case, it seems reasonable to assert that relative prices were not fixed. The patterns of variability, *i.e.* the correlation between residuals showing deviations from trend, should also be helpful for the interpretation.

First, the trends during the different periods are surveyed in the search for some pattern. Thereafter the variability is taken into consideration as well. Finally, an attempt will be made to test McCloskey's "chewing gum theorem". Obviously, the conclusions will be highly dependent on the quality and validity of the price series. Therefore, the problem of the data must be included in the discussion.

Comparison of trends

The level of prices in both countries behaved roughly similar according to the well known pattern of the trend periods. However, there were differences in the rate of change, which have already been seen from graph 1.

If the average trend for the two countries respectively, is estimated from the price series in the present investigation, the results will show only a slight difference in three out of the four periods. However, this is an (arithmetic) average which just like an index conceals structural differences. An estimation of these requires some extra effort. Thus, the trend or rate of change for each of the Swedish series was matched to the corresponding British ones. When there are several Swedish series for one commodity, *e.g.* oats, each of them was coupled to the same British series. On the other hand, when more than one British series is at hand, *e.g.* butter, the average was taken. The reason for this inconsistency is that multiple Swedish series represent disparate regions, while British series often display small price differences between various qualities in one market. The result of the procedure was a cross-section of rates of change for prices in Sweden and in

Table 2. Differences of annual rate of change in prices for selected commodities in Sweden and Britain

	Period 1 1850-75	Period 2 1866-94	Period 3 1890-1914	Period 4 1907-34
Number	31	38	42	22
Coefficient of correlation	0.43	0.42	0.42	0.61
Level of significance	>99%	>99%	>99%	>99%
Mean difference	-0.22	1.06	-0.01	-0.10
SD of mean difference	0.75	1.43	0.87	1.32
Max. difference	0.9	4.8	2.6	1.7
Min. difference	-2.2	-2.1	-1.9	-3.7

Data are found in Appendix B. In some cases periods are shorter, *e.g.* first period starting in 1855 for textiles. Deals and battens are left out for periods 1-3.

Britain. Then the differences between Swedish and British rates of change were computed, and this was done for four periods. The results can be seen in table 2.

At first sight, the stable coefficients of correlation may convince us that markets were highly integrated already by the mid-19th century. As already mentioned, the mean of the differences is less than 0.5 p.c. points in three out of the four periods. Only during the second period was the difference obvious, when the price level in Britain sank in relation to that of Sweden as was illustrated by graph 1. It is reasonable that Britain, importing raw produce in large quantities, during that period of dwindling freight costs experienced larger decrease in prices. However, a change in the relation between price levels does not necessarily mean that the structure of relative prices changed. In other words, the coefficients of correlation and the mean differences can support, yet not prove, the presumption that the structure of relative prices was harmonized from at least the 1850s onwards.

Another look at table 2, however, shows standard deviations of mean differences which indicate that the price structures of the two countries during each period were changing in relation to each other. Roughly two-thirds of the difference can be assumed to fall within the range of the SD's, and the larger the SD, the greater the structural change in relation to the other country. For example, irrespective of the changed relation between the price levels over the 25 years in the first period, one standard deviation adds up to a difference of 21 per

cent. The corresponding figure for the following periods are 49, 23 and 42 per cent respectively.

A preliminary hypothesis can be stated: The structure of relative prices, meaning the relative prices in both countries compared, did not become more stable from the mid-19th century up to the Great Depression. On the contrary, the structure of relative prices was ever changing and was part and parcel of the changing conditions of economic life.

Two objections must immediately be raised.

The first one is logical. So far, it has not been refuted that there is some kind of systematic behaviour in the structure of relative prices. For example, it seems reasonable that the old structures were increasingly disturbed, especially after 1870 when transport costs declined and international trade expanded. The contracting dispersion during the next period, 1890-1914, could of course be interpreted as a result of convergence. The increased dispersion during the fourth period then, may be the effect of the turbulence around 1920 which, as has already been pointed out, affected the trend notwithstanding the level of the series at the outset and at the end.

The second objection concerns the validity of the price series. The selection of data confirms to the rule that "beggars cannot be choosers", that is, large sections of the commodity markets are left out because of a lack of data. Hence, there is no proper weighing whatsoever. For example, cotton textiles are represented by a very few pairs of series while there is a manifold series of food. While this is true, the selection is actually not that bad. There are tradables as well as non-traded goods, and even some manufactures which were not used to be included in WPI's for older times. The criticism should perhaps focus on the price series and the way they have been matched together. Then, in pursuing the examination, we should take a closer look at some of the price series, and their behaviour during the trend periods. The comment below follow roughly the same order as they appear in Appendix B.

The price series considered

Grain

Where regional Swedish data are at hand, as is the case for grain, it is plain to see that by the mid-19th century, the dispersion of the change

rates for prices could be as large within Sweden, as between Sweden and the London market; the latter mostly being the place of quotation for the British prices.¹⁰ Thus, in the period 1850-1875, the annual average rate of change in grain prices differed more between Stockholm and Malmöhus counties than between either of them and London. The deviations from the trends were highly correlated between Stockholm and Malmöhus as well as between these counties and London, especially for wheat with r values around 0.80. For the northern region Västernorrland, however, the correlation was somewhat weaker, towards the other regions and towards London too. At this time wheat was still minor in Swedish agricultural production as well as in consumption, and rye, for which quotations from the London market are missing in Sauerbeck and The Economist, was the great staple. In Swedish foreign trade in the mid-19th century, all grains were rather unimportant, except for oats, which was exported on a rapidly increasing scale during the third quarter of the century. One main export district was Malmöhus county, and most of the Swedish oats went to London. Not unexpectedly, the strongest correlation for deviations from the trend for oats are found between London and Malmöhus. However, the less traded wheat displayed the same r value for London-Stockholm. The volume of the trade was thus not decisive for the degree of market integration.

During the next period, 1866-1894, the trend was largely synchronized among the Swedish grain prices, while the greater decrease in the London prices reduced the difference in absolute levels between Britain and Sweden. Moreover, the difference in trends were roughly of the same order as the average for the whole sample of series. The deviations from the trend did not change their pattern and still were highly correlated. On an increasing scale, wheat was imported, and around one third of total consumption was imports towards the end of the period.

It is scarcely a controversial conclusion, that grain markets were highly integrated internationally by mid-19th century; nor is the conclusion, that prices equalized during the last quarter of the century. It may be noteworthy though, that the interregional differences in Sweden seems to have lasted longer, as indicated by the diverging trends in the third quarter of the century.¹¹

¹⁰ See Appendix A on the sources of the price material.

¹¹ Jörberg, 1972 vol. 2 p. 203, found that albeit the integration of Swedish grain markets was "largely completed" during the latter part of the 19th century, "there

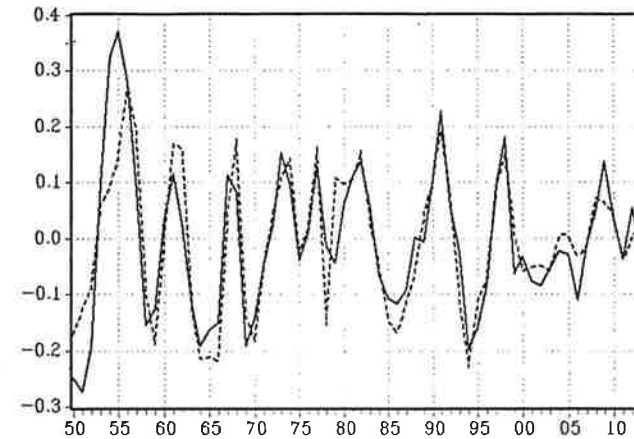
From Sweden's point of view, exports of oats were huge, but from Britain's viewpoint they were only marginal. In a few years around 1890, they abruptly dried up.¹² This was at a point in time when the differential between the London prices and the prices in Sweden were upheld for oats relative to those for barley and wheat. In other words, exports expired concurrently with oats becoming comparatively cheaper and the other grains becoming comparatively more expensive. Thus, one could expect growing imports to Sweden of the latter. However, tariffs were introduced and duties seem to have been prohibitive for barley, the import of which remained negligible, while the imports of wheat and even rye only stabilized.

For the period spanning World War I, 1907-34, the Depression and thereby regulation policies influence the trend, which differed between Britain and Sweden. However, even if the period is broken in 1930, before regulations were introduced, the trends are not synchronized. As regards wheat, the difference was due to a further levelling out of price differentials, but this was not so for the fodder grains. The international integration of grain markets notwithstanding, it seems as if the structure of relative prices for grains were at variance. Customs may still have been a factor as far as barley is considered, but for oats the market was free.

What was said above about the indifference of market integration to the actual volume of trade is illustrated by wheat flour. Of course wheat flour was a voluminous commodity, but it was plainly minor in Sweden's foreign trade. The price data for 19th century Sweden is scarce. Myrdal presents one series for Stockholm City and another, slightly different, for the country as a whole. During the first period, trends differ, but under the condition that the second period is deflated by the general difference between Britain and Sweden, they then coincide up to World War I. As regards variability, it was very close as early as in the first period and continued to be so up to World War I -- see graph 2. Considering the deviations from the trend, the correlation between the Stockholm and the London flour prices (and the English wheat prices as well) was even stronger than the

Graph 2. Prices for Wheat Flour, deviations from trend 1850-1913.

Residuals for the periods linked in 1873 and 1890.
Continuous line: England (Sauerbeck), Dotted line: Stockholm City (Myrdal 1933)



correlation between prices for flour and wheat in Stockholm during all three periods.

Butter

Butter is another example where international integration seems to have been completed before interregional integration. In most regions of Sweden, even those quite remote from each other, the prices for butter had levelled out before the mid-19th century.¹³ However, through the third quarter of the century, Malmöhus county, close to Copenhagen and from the 1880s the foremost district in the then flourishing butter export, had a price of butter 20-30 per cent above the average for the 24 counties. By the turn of the century, the differential had been reduced to 10 per cent.

Butter had no significance in Sweden's trade on Britain until the 1870s, nor were there any large quantities traded between Sweden and Denmark. Nevertheless, already in the third quarter of the century the

was still a fairly wide regional price range in absolute terms. Thus the problem has changed character and what requires to be explained are the remaining differences rather than the reduction in the price range."

¹² "Never, either before or later, had a commodity that had occupied such an important position in exports disappeared in so short a time." Fridlitzius 1963 p. 30; also Fridlitzius 1957 pp. 71, 271 ff.

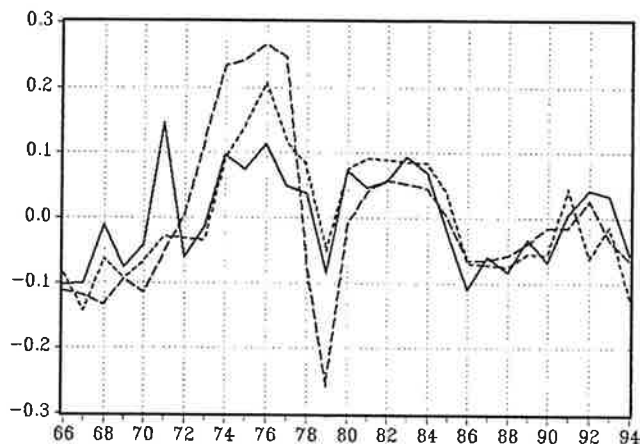
¹³ On this process, and the role of Stockholm's import of butter from Finland, see Jörberg 1972, vol. 2 p. 274.

variations of the price of butter in a sample of five Swedish counties were rather well interrelated to those in Copenhagen. However, only Malmöhus county were somewhat correlated ($r=45$, above 95% level of significance) to the London market, not even the Copenhagen butter price did show any covariance in this period. As a matter of fact, in the London market the correlation r values ranged from 0.78 to 0.93 between the different qualities.

In the period 1866-1894, all the Swedish regions represented here had attained a correlation with London well above 99 per cent significance, and the r values ranged from 0.49 to 0.78, the latter held by the Malmöhus prices. This is illustrated by graph 3, where the smoothing of the covariance from 1880 stands out. Now the butter price in Copenhagen was as strong interrelated to London as was that in Malmöhus. During this period the difference in the absolute prices between Malmöhus and Copenhagen levelled out, the former being around 15 per cent lower in the beginning of the period.

Graph 3. Prices for Butter, deviations from trend 1866-1894.

Continuous line: Dutch in London (The Economist)
Dotted line: Malmöhus county Broken line: Kopparberg county (Jörberg 1972)



In the next period, 1890-1914, correlation between deviations remarkably deteriorates. Compared to the price for Dutch butter in London, correlation was still high for regional Swedish butter prices, though weaker than in the preceding period. Compared to the price for Danish butter in London, which The Economist began to quote in 1894, only Malmöhus county had a significant correlation ($r=0.56$, above 99%). Even between the Swedish counties and Copenhagen the interrelation weakened considerably.¹⁴

Tentatively, these new results can be explained by stiffened competition in London, and diversification in Sweden. First to London. An analysis of monthly data by cross correlation indicates that when the price of Danish butter changed, Australian and Dutch butter prices followed suit. The market became more flexible in the sense that price changes more frequently took the opposite sign compared to previous month. Nevertheless, Danish butter was the most expensive while Australian was the cheapest, but customer preferences were obviously strong.

Then, about Swedish diversification. In the last decades of the 19th century dairies were established and butter produced on the farms became seen as second class, known as country butter. Maybe that the local markets for country butter became less dependent upon urban and international prices.

By way of summing up, from the mid-19th century to the 1890s, the butter markets were characterized by gradual, and successful integration; thereafter competition and diversifications seem to have disturbed the order, but integration largely remained, which is shown by the equalization of trend. For the period 1907-1934 only the Sauerbeck series for Dutch butter and the price for butter in Sweden is compared. Deemed from these two series at least, the order of the perfect market was restored. Trends were equal and the correlation between deviations was very strong ($r=0.89$).

Considering other foodstuffs, e.g., beef, pork, and potatoes, it is obvious that market integration did not keep pace with grains or butter. Except for pork, the trends display a varying pattern. During the first period, there was also a tendency for the peripheral prices of beef to lag behind those of the metropolis. That is, the correlation between the deviations was higher when prices in London were

¹⁴ Butter price in Copenhagen from Pedersen & Petersen 1938.

compared to those in Sweden one year later, and the same for the relation between Stockholm and the Swedish countryside.

Lags can also be seen in the prices for a highly international commodity -- sugar. As can be expected, the trend was synchronized from the first period onwards (given that the rates of change for the second period are adjusted for the general difference in price trends). However, the deviations lagged in Sweden, and were considerably less volatile than the London prices. After the breakthrough of the domestic sugar industry in Sweden (based on beets), the lags faded away.

Textiles

Textiles, as far as cotton and woolens are considered, displayed a divided picture. On the one hand, the cotton markets were in some sense integrated in the mid-19th century. The markets for woolens, on the other hand, were only partly integrated at that time but became well integrated during the last decade of the century.

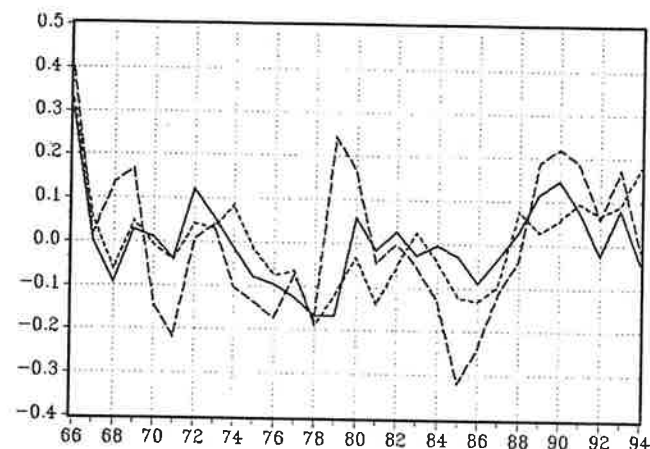
The cotton famine during the American civil war, which increased the prices of raw cotton fourfold in London, may partly be due to the strong correlation for cotton textiles (r values above 0.90 for deviations in the period 1855-1875). Both in England and in Sweden the prices of cotton yarn rose almost three times between 1860 and 1864. But the similarity does not end with the cotton famine. The trends were also coordinated. It has been pointed out that mechanization had a breakthrough in the Swedish cotton industry in the 1850s. The industry not only faced foreign competition, but also superseded the established woolen industry on a growing home market.¹⁵ This picture of the early industrialization in Swedish cotton agrees with the evidence from prices of a far-reaching integration.¹⁶

¹⁵ Schön 1980.

¹⁶ In passing, it can be noted that the reliability of the Swedish yarn series is corroborated by this comparison. From a methodological point of view, this series could be questioned, as it is based on unit values from official production statistics. However, it comes smooth to The Economist quotations, with an r value for deviations from trend of 0.74. The Stockholm series which is based on quotations by the Stockholm Exchange, display more volatile fluctuations, but as they mostly have the "right" sign the series seems reliable (r value 0.59 with The Economist, and 0.58 with the Swedish series).

Graph 4. Prices for Cotton Yarn, deviations from trend 1866-1894

Continuous line: England (The Economist). Dotted line: Swedish industry (Schön 1988, BISOS:D). Broken line: Stockholm, quotations by the Stockholm Exchange (BISOS:F).



While prices in general decreased more in Britain than in Sweden during the second period, those for cotton textiles kept largely the same pace or fell slightly more in Sweden. In other words, Swedish cotton textiles became comparatively cheaper. At the same time, the deviations were well correlated, as illustrated by graph 4 (r value 0.59 for cloth and 0.74 for yarn, both well above 99% significance). Even if the correlation values were lower than during the first period they indicate a close interrelation between the markets. The weaker correlation may be due to a diversification in the Swedish production, thus reflected in the aggregated price index. In the third period, development continued along the same lines, and with comparatively falling prices in Sweden for some cotton textiles, considerable market share could be conquered through import substitution.

Even if it can be stated that the markets for cotton textiles were integrated as early as the mid-19th century, it remains to be seen how well integrated they were. Was British cotton competing against Swedish cotton in the Swedish market in the same qualities, and had prices conformed to the same absolute level in the mid-19th century? If not, could the second period, 1866-1894, when Swedish prices were relatively falling and production was more diversified, be described as

a catching up with the British cotton industry? The import substitution that took place during the third period, up to 1914, is what makes this idea reasonable. It follows then that during the preceding decades, the Swedish cotton industry developed and grew although it was inferior to its British competitors. If this is correct, was the integration of cotton markets, even though it was established before 1860, first complete decades later.

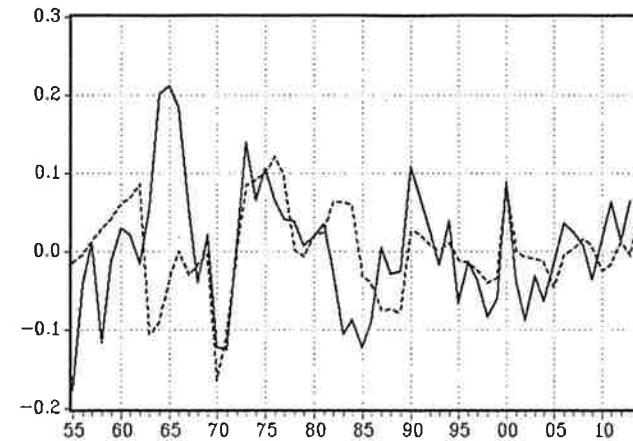
Why was the process so gradual? One explanation could be that the Swedish market for cotton textiles, mainly extended through a vast countryside, was far from perfect. However, this is not convincing against the background of a rather well organized pedlar system. What remains to be concluded is that integration was more or less fully developed by 1860, and that the Swedish cotton industry was already at the competitive edge. A more comprehensive analysis of price data may settle the question.

As already touched upon, Sweden's woolens and worsteds (hereafter abbreviated to woolens) industry was in a different state than cotton in mid-19th century. Characterized partly by mechanized, however oldfashioned factories, and partly by proto industry or home production, markets for woolens were not unified. While the prices of Swedish industrial woolens fell during the first period, those of proto industry were stable, and English prices increased. Correlation between deviations was, with a few exceptions, far from significant. One exception with rather high correlation was English yarn and cloth, quite natural as the series in question are based on data from the same worsteds factory in West Yorkshire. Another was Swedish industrial cloth and English yarn with $r=0.32$ in the vicinity of 90% significance; finally, if proto industrial cloth is lagged one and two years, it is correlated to Swedish industrial yarn ($r=0.38$ and 0.39 , between 90 and 95% significance). It is reasonable to interpret these lags as imperfections of the market.

Although slowly, markets were integrating. In the second period, 1866-1894, Swedish industrial yarn and cloth had change rates similar to the English ones, when allowances are made for the difference in general price trends. The correlation between deviations was rather high between Swedish industrial cloth and English cloth ($r=0.54$, well above 99% significance), and in graph 5 one can see how deviations became smoothed, first in the late 1860s, and then around 1890.

Graph 5. Prices for Woolen Cloth, deviations from trend 1855-1914

Continuous line: England (Ljungberg MS). Dotted line: Swedish woolen industry (Schön 1988, Ljungberg 1990)



As can be inferred from graph 5, in the period 1890-1914, the correlation between the deviations for cloth prices was rather high ($r=0.61$), and even between yarns a connection is manifest. Swedish industrial yarn as well as the protoindustrial yarn was correlated to the English yarn on the 95% level (r values 0.40), while the correlation between the Swedish yarns of different origin still was less. Trends were synchronized for cloth, but still differed for yarns. For the fourth period, ending in 1934, only yarn series remain to compare. The trends were still different, however only slightly, and the deviations from trend almost coincided ($r=0.96$). In short, the case of woolens pictures a gradual integration of markets.

Sawn Wood

The market for deals and battens was integrated early, yet it presents a contradictory picture, which is only possible to touch upon in this paper. As can be seen from the table in Appendix B, the trends were highly disparate between deals of different origin. But that is not all. For example, one could expect a close relation between the prime export district and the foremost import market, and find that even

these trends could be divided. In London, prices for "Swedish Good" increased by an annual rate of 1.7 per cent between 1866 and 1894, while in Västernorrland sawn battens decreased by 1.4 per cent, a differential moving opposite to freight costs. There are also considerable differentials in trends between The Economist's maximum and minimum quotations. This can be interpreted, either (1) as an indication of quality change in one and the same series, e.g. deteriorating quality in the minimum price series; or (2) as an effect of strong demand preferences for wood of a certain origin or quality.

Notwithstanding these differences in trends, the deviations from trend were highly correlated, at least in the two first periods. Thus, in the period 1857-1875, the average of the r values for the correlation between 15 of The Economist's maximum series is 0.56. For the second period, 1866-1894, this average increases to 0.71. This is as expected, as quotations were made in one market -- London. Further though, prices in the major Swedish export district were highly correlated, in the first period to Swedish deals in London, and in the second period to Russian and Canadian deals as well. Some of these interrelations are illustrated in graph 6.

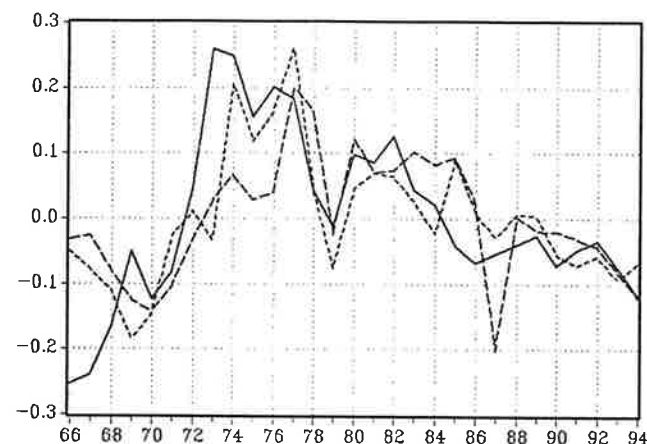
However, things did not stay the same. In the third period, ending in 1914, the average correlation between the fifteen maximum series deteriorates well below significant levels ($r=0.27$). The most obvious cause was that the prices for European deals on the one hand, and those for American and Canadian on the other, were at variance to each other; they were now usually negatively correlated. On the other hand, even in this third period, there was a high correlation between Swedish and Russian deals in London ($r=0.70$). However, the division between American and European wood does not account for all the difference. Thus the interrelationship between variations in prices in the major Swedish export district and the London market was largely broken. Remarkably though, correlation was still relatively high between prices in Sweden and those for Canadian second deals in London ($r=0.48$ to 0.49 , around 99% significance).

This survey cannot but leave several problems unexplained. The difference in trend is one. The seemingly disintegration of the London market after 1890 is another. Nonetheless, it seems reasonable to conclude that integration remained. Presumably the market became more diversified, and qualities of the different quotations changed.¹⁷

¹⁷ E.g., in Swedish exports the volume of planed wood and smaller dimensions increased relative to rough, stout battens. Söderlund 1951.

Graph 6. Prices for Sawn Wood, deviations from trend 1866-1894

Continuous line: Sawn Battens in Västernorrland county (Jörberg 1972). Dotted line: Deals, "Swedish Good" in London (Economist). Broken line: Deals, "Russian" in London (Economist)



A more comprehensive analysis of the price data would possibly support this presumption, as stronger correlation can be traced among a limited number of the series. Moreover, a comparison with scant data from the interwar period points in the same direction. Thus, the trend and deviations were almost identical between a certain Swedish quality of deals sold in London, and a similar quality of deals sold in Sweden.

Iron and steel

Bar iron was the traditional Swedish export staple. First in the 1850s, the mercantilistic prohibition on the export of pig iron was abolished, and exports of this product grew as well. The Economist did not quote these major Swedish goods, though some types of "Swedish steel" were quoted up to the 1870s. For the present, Swedish series are compared to series for corresponding products of British origin. As can be seen from Appendix B, the largest number of series are available for the period 1890-1914.

Throughout the free trade era, iron markets seem fairly well integrated -- but with the exception of the first decade. In the period

1850-1875, trends were synchronized for pig iron and roughly for bar iron. Although the correlation between deviations was high for these qualities (r values around 0.70 between corresponding British and Swedish products), Swedish prices reacted with a clear lag in the years before 1860. As in several cases referred to above, *e.g.* cotton textiles and wheat flour, which even at this early time had a concurrent variability, the delayed reactions of Swedish iron prices can only partly be seen as a "natural" consequence of the communications of the day. The integration of iron markets seems to have matured during the first period.

In the second period, the general pattern of a more pronounced decrease in British prices was manifest in the iron series too. However, there seem to have been differences in the British market, as the Economist series for bar iron, quoted at works in Staffordshire and Wales, comes close to Swedish bar iron, while the Sauerbeck (unspecified) series displays a steeper drop. When deviations from trend are considered, both were closely correlated to the Swedish series and to each other.

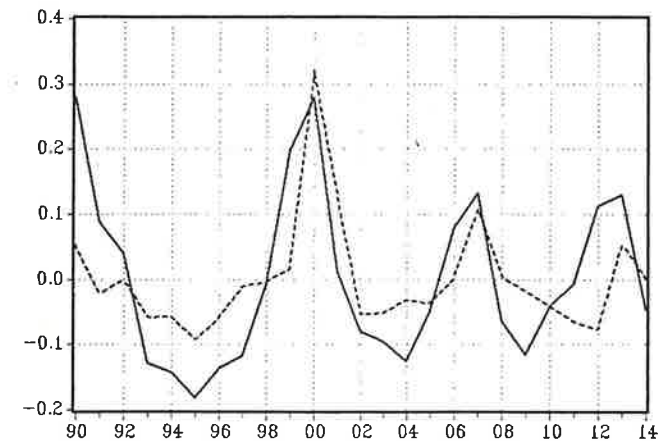
The period 1890-1914 displays a more divided picture as regards trend. A slight difference can be discerned between the British North and North East series for pig iron, and Swedish pig is a little under both. For bar iron the trends coincide, except for a stronger increase in the Sauerbeck series, but this made up exactly for the difference in the earlier period. However, the British series for steel rails and ship steel increased more than the corresponding Swedish prices. The rails were imported to Sweden from Germany, but the ship steel, both plates and bars, were of home origin. That the markets were still well integrated can be seen from the deviations from trend. Except for pig iron, where correlation had sunk somewhat (r values ranging from 0.44 to 0.49, at 98 to 99% level of significance), the correlation was high, as for ship steel and rails ($r=0.63$ to 0.74), and very high in the case for bar iron ($r=0.71$ to 0.88). For more specialized products, exemplified here by hoops, spring steel, sheets and tin plate, there were less difference in trends and, prices were nearly stable. The correlation between the deviations for the not too distantly related hoops and spring steel was not so bad, better than between the Swedish spring steel and British pig iron ($r=0.45$ respectively 0.28). For sheets and tinplate, the correlation was as fair as among other steels ($r=0.66$). The close integration of the period is illustrated by graph 7.

While the similarities in the shorter fluctuations indicate integration of markets, it is reasonable to see the disparity in trends as the effect of structural change in the international steel industry. This was certainly due to the forging ahead of the German and American steel works, which did not adapt to existing prices but disturbed the order by lowering them.

The following period, 1907-34, seemingly repeated the pattern, though only pig and bar iron are considered. Trends diverged but deviations were interrelated. Over the period, the Swedish prices increased less than their British counterparts. If the period is cut in 1929, to leave out the Depression, the pattern is still divided, although the Economist/WPI series approaches to Swedish prices while the Sauerbeck series do not. The background was, however, a bit different from that of the third period. In the late 19th century, competitiveness changed due to rapid technological and organizational development. In the 1920s, the international steel industry faced a structural crisis. Swedish traditional charcoal iron was especially hard hit and prices were depressed.¹⁸ Both decades before 1914 and the 1920s exemplify

Graph 7. Prices for Steel Ship Plate, deviations from trend 1890-1914.

Continuous line: British North and North East (Economist). Dotted line: Malmö, South Sweden (Ljungberg 1990).



¹⁸ The role of duties, which were important in German competition during the third and fourth periods, is left aside in the present paper.

the far from perfect markets. However integrated, they were not perfect enough to quickly restore *one* equilibrium level.

Machinery and ships

For machinery and related products, a thorough analysis is not yet possible, as price series for both countries do not fully correspond, and some of the series are still in a provisional state. Yet, a few comments seem not to be out of place.

The method of constructing a price index for engineering from prices of iron and wages, is not recommended. The trend is widely diverging between different products, which is a reflection of innovative activity. Mostly have new products rapidly falling prices, and in the period 1890-1914 the milk separator is a representative example. The opposite example with stable prices in long periods, is the one-furrow plough, which found its basic construction in the early 19th century, and then was improved piece meal. The English steam engines in the period 1866-1894 do not conform with this picture, however. Some of these models must be considered to be important innovations at the time, but yet they experienced rising relative prices, as compared to the general decrease in the British price level. During the period 1890-1914, the trend for the prices of steam engines in England can be compared to that of one standard model in Sweden. The trends diverge, and one hypothesis is that this is not due to a levelling out of price differentials and to Sweden catching up with Britain, but to the result of a dynamic change in Swedish engineering in this period. The cases of Swedish engineering products that can be found in Appendix B were not extreme but representative. With the exception of the plough, these products all of which had negatively-sloping price curves.

Here our focus should be directed to the market for ships in the 20th century. From early in the century up to the Depression, the British price series from Fairplay and the series constructed from Kockum shipyard in Malmö could be an illustration of the law of one price. Trends were alike, as shown in Appendix B, and the deviations were highly correlated ($r=0.96$). In the next period while prices were strongly increasing, the Swedish shipbuilder squeezed prices. While the Fairplay index for a dry cargo ship of a certain tonnage increased at a rate of 9.7 per cent 1930-1955, Swedish dry cargo vessels increased at a rate of 8.6 per cent and tank ships at 7.3 per cent. This

should be seen against the background of a more rapid change in Swedish shipbuilding concerning production technology and organization. But it is inconceivable without also taking into consideration the innovative activity as regards ship types, *i.e.* the development of diesel engines, tank ships and welded hulls. In this process the development block between Swedish shipbuilders and Norwegian tank shipping was crucial.

Chemicals

Charles Wilson points out in *The History of Unilever*, that it was not until the end of the 1880s that the British market for soap was unified.¹⁹ Even on the international scene, if this can be restricted to Britain and Sweden, integration was a slow process. In the first period, trends seem to have been similar by mere coincidence, as correlation between deviations was negative; it was not until the period 1907-1934, that trends for hard soap were synchronized. Deviations were, however, roughly correlated ($r=0.45$) in the second period, but more so if British prices are lagged one year behind ($r=0.52$). From graph 8 one may infer that general economic conditions and possibly the prices of raw materials were the causal factors, not the integration of commodity markets. However, this may be due to the character of the data; in Britain, soap was already so diversified a commodity that unit values may conceal quality changes or have other shortcomings. From the higher correlation values, it seems plausible that markets at least were integrated in the third period, 1890-1914. But, as already mentioned, not before well into the 20th century trends conformed.

If the gradual integration of markets may be plausible for a locally-produced good like soap, it seems curious that a traded good like soda had seemingly separate markets in Britain and in Sweden as late as the early 20th century. Trends differed, and correlation between deviations was faint ($r=0.22$, 1890-1914). Sweden did not produce soda and imported huge quantities of it from Britain, although continental producers became important suppliers towards the end of the century. For an explanation of the disparity it would be natural to account for the low price of soda, less than half that for the same quantity of wheat, making it relatively expensive to transport. Thus,

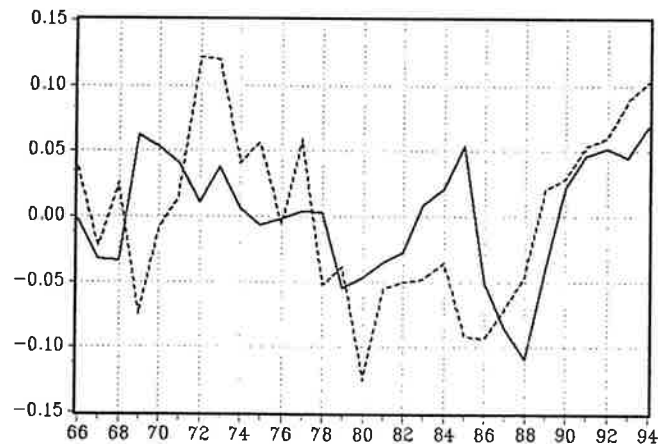
¹⁹ Wilson 1954 vol. 1, p. 62.

cheaper freights may have caused the reduction in the Swedish price for soda, from three times to one and a half that in England, during the last quarter of the century. However, the freight argument is not convincing, as the prices for soda in Copenhagen came much closer to British prices. Neither had Sweden levied any duties on soda. Actually, the Danish market for soda seems to have been well integrated with the British already in the second period, when deemed from the correlation between deviations ($r=0.75$ from 1867, when the Sauerbeck series starts, to 1894). In the 1870s soda prices in Copenhagen were only one and a half those in London, half the Swedish prices, and this differential seems more reasonable to account for freight. In the late 1890s prices in Copenhagen even fell below the London market, which may be an effect of continental producers' earlier employment of the Solvay process.²⁰

Notwithstanding the developments in neighbouring Denmark, the soda market in Sweden remained insular. Right up to 1914, deviations

Graph 8. Prices for Soap, deviations from trend 1866-1894

Continuous line: Unit values of British exports (Board of Trade 1903). Dotted line: Unit values of Swedish industry -1884; 1885- purchase prices of Kockum shipyard (Schön 1988, Ljungberg 1990).



²⁰ Copenhagen prices from Pedersen & Petersen 1938. These authors observed the lower Danish price, but added, "we are unable to explain this lack of correspondence with the Danish material." *Ibid* p. 87.

from trend were independent of prices in London, and it was only after the war that markets actually integrated. Still trends diverged, but deviations became rather well correlated ($r=0.72$ in 1921-34, at 99% significance).

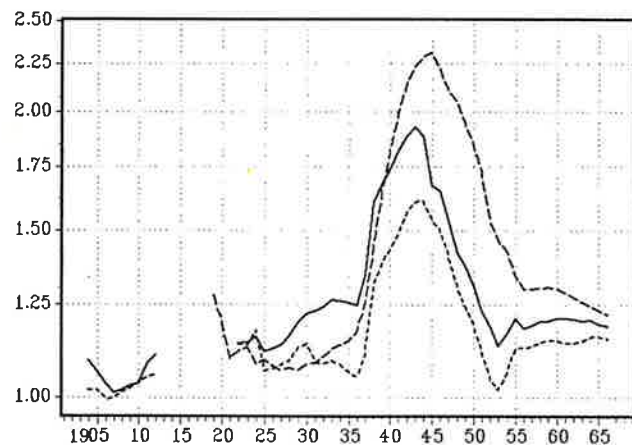
Pulp and paper

In the early 20th century pulp superseded wood as the major product in Swedish exports and Britain was a major customer. Paper, especially newsprint, also became an important traded good between the two countries. Not surprisingly, markets soon integrated. From 1901, the year from which corresponding price series are available and when the trade was well established, and up to 1914, the price trends for pulp were synchronized. Deviations were, however, only roughly synchronized (r values 0.44 and 0.46, just over the 90% level). But during the next period, 1907-34, as well as the postwar years 1949-69, correlation was quite strong ($r=0.81$ to 0.99). Nevertheless, what remains to be explained is the diverging trends during the three later periods. Before 1910, absolute prices had levelled out, yet thereafter the differentials grew, as illustrated in graph 9. While variations between individual years could be large, a seven-year moving average has been used.²¹ A preliminary explanation is that the important improvements in production technology in the Swedish works during the 1920s and 1930s in combination with economies of scale lowered Swedish prices beneath international prices. As a consequence, the relation between relative prices in Britain and in Sweden changed, while the commodity markets were closely integrated.

²¹ The author has to confess, that duties are not considered. However, no abrupt break can be discerned in the series except during the 1940s and at British deregulations in early 1950s. Another argument against the influence of duties is the differences in the individual patterns. Naturally, a more comprehensive analysis must include duties: if, when and how much!

Graph 9. Ratio between prices for Pulp and Newsprint, 1901-1969.

British prices according to exchange rate through Swedish prices; seven-year moving average.
 Continuous line: Mechanical pulp. Dotted line: Unbleached sulphite. Broken line: Newsprint.



A test of "The chewing gum theorem"

According to equilibrium theory, even small volumes of international trade will fix the structure of relative prices between the countries considered. Moreover, it will do so in the short run. This is what I call "the chewing gum theorem," with an allusion to the citation from McCloskey in the first section of this paper. From that point of view, the ratio between prices for one commodity in the trading countries should be interdependent with the ratio for other commodities. As a test of this hypothesis I have pursued regression analysis on the deviations from trend for different commodities. Table 3 condenses the results.

Table 3. Regression analysis of price ratios between Sweden and Britain

t-statistics in parentheses

Dependent variable: Cotton cloth

Constant	Pig iron iron	Bar iron	Butter	Deals	Beef
Period 1890-1912.					
.000 (.00)	-.547 (-4.16)	.765 (5.85)	.999 (3.08)	-.464 (-2.47)	.524 (2.68)
<i>Adjusted R2=0.76 and Durbin-Watson=2.52</i>					
Period 1866-1894					
.000 (.00)	0.145 (0.63)	0.025 (0.18)	-0.041 (-.17)	0.272 (1.59)	0.275 (1.35)
<i>Adjusted R2=0.07 and Durbin-Watson=1.77</i>					
Dependent variable: Bleached and dyed cotton cloth					
Constant	Chemical pulp	Woolen yarn	Oats	Pork	
Period: 1920-40					
0.003 (0.16)	-.777 (-7.11)	.762 (4.26)	.733 (2.04)	-.296 (-1.92)	
<i>Adjusted R2=0.85 and Durbin-Watson=2.07</i>					

If developments in the two countries had been synchronized, it should be possible to apply one model to all periods. For the period 1890-1912 one model had some limited success. However, as the D-W statistics are distinctly different from 2, there is an indication of some systematic variation in the dependent variable which is not explained by the independent variables. Moreover, the negative sign for pig iron and deals casts doubts on the basic presumptions of the model. These constraints notwithstanding, the model should show similar relations for the preceeding period if integration had been quick and its results stable. However, when employed for the years 1866-1894, no coefficients were significant, and the adjusted R2 indicates that there was not the slightest chance to estimate the price ratio for cotton cloth from the other prices. From the present sample of commodities, only deals produce a significant coefficient in connection with cotton cloth during the period 1866-1894. It seems reasonable to conclude that relative prices were in turmoil, and that they were not fixed between the two countries.

In the interwar period, again the model produced insignificant coefficients for those commodities which seemed relevant before World War I, *e.g.* iron. This may support what has been said above about the structural crisis in the iron and steel industry. However, another group of commodities could now be related to the price ratio for cotton cloth. Among them was a new major good, chemical pulp, but with a negative sign. Then there were some more or less important commodities, among them pork with a negative sign and just beneath the offering (*t-statistics* under 2) as shown in the parentheses.

If these exercises should be taken seriously, they point to one of two things: either, was the structure of relative prices was ever-changing and then "the chewing gum theorem" must be refuted; or the theorem is too complicated to be captured in such a simple model.

A summing up

Empirical evidence rests with "the second interpretation", as presented in the introduction. That is, market integration was a gradual process, taking place over several decades. Markets for some traded goods, but not necessarily the most voluminous in trade, were well integrated already in mid-19th century. Even if only a few less-traded goods have been included in this discussion, the gradual process of integration indicates that non-tradables lagged considerably. In some cases integration was not completed until the early 20th century, or in the interwar period.

Consistent with the gradual development of international integration were the observations concerning interregional integration. Where special local demand conditions (as in the case of butter) or supply conditions (as can be shown by regional Swedish price data for sawn wood) prevailed, the interregional disparity in price movements often outlived international differences. Besides, it should not be controversial, that relative prices in a national economy need not be synchronized between regions. Actually, that would be a tough nut to crack for the "chewing gum theorem".

Market integration did not mean that the relationship between relative prices in Britain and Sweden was entirely fixed. On the contrary, this structure of relative prices was unstable. While market integration is indicated by the correlation between the variability of prices, *i.e.* the deviations from trend, the flexibility of the structure of

relative prices is shown by the dispersion of trends. In the period 1907-1934, the dispersion of trends in commodity prices increased as compared to 1890-1914. This is explained by structural change which was not synchronized in the two countries, and therefore disturbed the relations of costs and prices.

In integrated markets, why was it that prices did not quickly equalize when old relations were disturbed? Bertil Ohlin pointed out: "...every explanation of pricing which attempts more than a statement of certain equilibria must consider time, and this is the chief cause of the difficulties a concrete theory of pricing encounter."²² Actually, this is a general problem raised by economic differences between regions and countries. Why are constraints not quickly overcome?

Commodity markets are indeed a special case and they should clear quickly and level out differences. A constraint in this context is the diversification of production and commodity markets. Even in the cases referred to here of rather homogeneous products, such as butter and sawn wood, diversification meant a break in the convergence of prices. When the products are more complicated, as in engineering, innovations and technical change result in diversification with considerable effects on the structure of relative prices. One related example was ships in the mid20th century.

Moreover, diversification will extend the scope for bounded rationality in commodity markets. Even if improved communications, advertising etc, make markets function better, as does diversification in the sense that consumers are better satisfied, diversification at the same time generates constraints which obstruct the textbook function of the market. That may be one of the reasons why the seemingly illogical "second interpretation" is not ahistorical.

In conclusion then, the study of the structure of relative prices is certainly instrumental not only for the problem of integration, but also for the enhancement of the knowledge of economic transformation and change. Consequently, it can be argued that the observed negative correlation between relative prices and volume shares in Sweden's manufacturing, basically had its origin in the Swedish setting. When that relationship between prices and volumes fails, it may be used as a measure of the variance between the national and the international economies.

²² Ohlin 1933, p. 51.

Appendix A The price material

The British price data are based on Sauerbeck-Statist's annual quotations published in *The Journal of The Royal Statistical Society*; on the first quotation every month in *The Economist* during the years 1857-1940; on *Board of Trade's* report of 1903 on wholesale and retail prices as well as *Board of Trade Journal and Statistical/Annual Abstract for the United Kingdom*. Some series are fetched from the literature, with due references. *The Economist's* excellent quotations of cotton textiles have been used before, by Blaug and Sandberg, but as I wanted all the individual series and extend them until they end in 1935, they have been recorded anew; and in this case the weekly quotations are used. Further some series have been constructed from archival sources, price lists as well as accounts. This work is still going on and the results will be published. A critical discussion of the material will be pursued in that context.

The Swedish price data are mainly based on Jörberg 1972, Ljungberg 1990, and Schön 1988. Where the source referred to, in Appendix B below, is denoted *BiSOS* it means the [Contributions to] Swedish official statistics.

Appendix B

Annual average change in prices for selected commodities in Britain and Sweden

Countries denoted by B and S respectively; when regional series, S:1 is Stockholm county; S:06 is Kronoberg county in the southern inland; S:11 is Malmöhus county in southernmost Sweden; S:13 is Gothenburg and the annexed county; S:19 is Kopparberg county, the northern part of the central iron region; S:21 is Västernorrland county, with the leading sawmill district of Sundsvall. A note on the source is given in parenthesis; MS considers hitherto unpublished series, and BoT Board of Trade.

Commodity, country	1850-75	1866-94	1890-1914	1907-34	1930-55
<i>Food</i>					
Wheat, B (Sauerbeck)	0.3	-3.0	0.7	-0.8	7.8
Wheat, American, B (")	-	-3.3 ¹	1.0	-0.7	6.8
Wheat, S:1 (Jörberg)	0.0	-1.6	0.6	-	-
Wheat, S:1 (Ljungberg)	-	-	0.5	0.0	-
Wheat, S:11 (Jörberg)	1.2	-2.0	1.0	-	-
Wheat, S:11 (Ljungberg)	-	-	0.9	0.4	4.2
Barley, B (Sauerbeck)	1.2	-1.9	0.2	0.5	6.7
Barley, S:1 (Jörberg)	0.4	-1.1	0.5	-	-
Barley, S:11 (")	1.6	-1.2	1.4	-	-
Barley, S:21 (")	0.8	-1.1	1.0	-	-
Barley, S (Ljungberg)	-	-	0.6	-0.6	4.9
Oats, B (Sauerbeck)	1.0	-1.6	0.4	-0.2	7.0
Oats, S:1 (Jörberg)	0.3	-1.1	0.8	-	-
Oats, S:1 (Ljungberg)	-	-	0.9	-0.4	4.7
Oats, S:11 (Jörberg)	1.8	-1.3	1.5	-	-
Oats, S:21 (")	1.3	-0.6	1.6	-	-
Potatoes, B (Sauerbeck)	0.7	-1.8	0.4	1.7	3.9
Potatoes, S (Myrdal)	1.0	-0.3	1.0 ²	-	-
Potatoes, S (Ljungberg)	-	-	1.3	3.2	5.8

¹ 1871-1894; when the period starts in 1871, the annual change rate is increased with 0.2-0.3 p.c. points for all wheat series.

² End year 1913.

Commodity, country	1850-75	1866-94	1890-1914	1907-34	1930-55
Beef, Prime, B (Sauerbeck)	1.8	-0.8	0.7	0.9	4.5
Beef, Middling, B (")	1.9	-1.0	1.3	1.0	4.4
Beef, S:1 (Jörberg)	1.3	0.7	1.4	-	-
Beef, S:21 (")	1.0	2.0	2.2	-	-
Beef, S (Myrdal)	2.2	0.2	1.1	-	-
Beef, S (Ljungberg)	-	-	1.1	0.4	5.8
Pork, B (Sauerbeck)	1.0	-0.8	0.8	1.5	4.8
Pork, S:1 (Jörberg)	1.0	-0.3	1.0	-	-
Pork, S:13 (")	0.9	0.1	1.6	-	-
Pork, S (Myrdal)	1.5	-0.2	1.7	-	-
Pork, S (Ljungberg)	-	-	1.7	-0.2	5.6
Butter, B:Waterford (Economist)	1.1 ³	-	-	-	-
Butter, B: Carlow (")	1.2	-	-	-	-
Butter, B: Dutch (")	1.0	-1.0	0.9	-	-
Butter, B: Dutch (Sauerbeck)	0.7	-0.8	0.8	0.5	2.8
Butter, B: Danish (Economist)	-	-	1.1 ⁴	-	-
Butter, B: Australian (")	-	-	1.4 ⁴	-	-
Butter, B: Jersey (")	1.0 ⁵	-0.8 ⁶	-	-	-
Butter, S:1 (Jörberg)	0.9	0.1	1.1	-	-
Butter, S:06 (")	0.3	0.3	1.6	-	-
Butter, S:11 (")	1.4	0.3	1.0	-	-
Butter, S:19 (")	1.8	0.7	1.1	-	-
Butter, S:21 (")	1.2	0.5	1.3	-	-
Butter, S (Ljungberg)	-	-	0.9	0.1	4.5
Wheat flour, B (Sauerbeck)	-0.2	-2.5	0.7	-0.5	5.3
Wheat flour, S (Myrdal)	0.5	-1.5	0.5 ⁷	-	-
Wheat flour, S (Ljungberg)	-	-	0.6	1	4.6
Sugar, cane, B (Sauerbeck)	-0.2	-2.8	-0.8	-1.1	-
Sugar, beet, B (")	-	-3.1	-0.3	-3.3	-
Sugar, S (Myrdal)	-0.2	-1.8	-0.7	-	-
Sugar, beet, S (Ljungberg)	-	-	-0.3	-1.8	-

³ End year 1873

⁴ Start year 1894, which in the other series for butter would increase the annual rate with 0.1-0.5 p.c. points. Australian adjusted for seasonal bias due to missing quotations.

⁵ Start year 1859.

⁶ End year 1892.

⁷ End year 1913.

Commodity, country	1850-75	1866-94	1890-1914	1907-34
<i>Textiles</i>				
Woolen yarn, B (MS/WPI)	1.5	-2.5	1.0 ⁸	2.3 ⁹
Woolen yarn, S (BiSOS:D/Ljungberg)	-0.6 ¹⁰	2.0	1.7	1.7 ⁹
Woolen yarn, S (Jörberg)	0.1	0.1	-0.9	-
ditto, undyed, S:1 (BiSOS:F)		-3.6 ¹¹	-	-
ditto, dyed, S:1 (")		-3.5 ¹¹	-	-
Woolen cloth, B (MS)	0.9	-2.7	1.2 ¹²	-
Woolen cloth, S (Schön/Ljungberg)	-1.3	-1.5	0.9	2.3
Woolen cloth, S (Jörberg)	0.2	-0.2	1.4	-
Cotton yarn, B (Economist)	0.9	-3.1	1.8	0.7
Cotton yarn, S (Schön/BiSOS:D)	1.1	-2.8	1.1	2.3
Cotton yarn, S:1 (BiSOS:F)	-0.8 ¹³	-3.4	-	-
Cotton cloth, B (Economist)	0.5	-2.4	2.1	1.6
Cotton cloth, S (Schön)	0.5	-2.9	-	-
ditto, bleached&dyed, S (Ljungberg)			2.5	3.1
ditto, unbleached, S (Ljungberg)			0.5	-2.0

Commodity, country	1857-75	1866-94	1890-1914
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Deals and battens¹⁴

Swedish Good ¹⁵ , B:X (Economist)	0.2	1.7	2.1
ditto Common, B:Y (")	-0.4	0.4	1.9
Norwegian, B:X (")	-0.9	-3.0	1.5
ditto, B:Y (")	0.1	-4.1	2.9
Russian, B:X (")	-0.4	0.8	2.2
ditto, B:Y (")	-0.6	-2.7	3.2
Finnish, B:X (")	-0.3	0.1	0.9
ditto, B:Y (")	-1.0	-0.5	1.7
Canadian 2nd, B:X (")	-1.8	0.9	2.5
ditto, B:Y (")	-1.6	-0.5	4.6
Can/Am Spruce, B:X (")	-0.7	0.6	3.0
ditto, B:Y (")	-0.1	-1.5	2.4
Domsjö sawmill, S:21 (Gårdlund)	-	0.8	3.1
Battens, S:21 (Jörberg)	1.1	-1.4	3.2
Battens, S:11 (Ljungberg)	-	-	1.4

⁸ End year 1912.

⁹ Gap 1914-1919.

¹⁰ Start year 1860. With the same start year the average rate for the British series is 0.5 p.c., and for the Jörberg series 0.0 p.c.

¹¹ Both these series (which are from the official statistics on foreign trade, however based on quotations made by the Stockholm Exchange) are only for the period 1874-1891. For these years the British series had a -3.9 p.c. rate of change, while the other two Swedish series had 0.9 and 0.3 p.c. respectively.

¹² End year 1913.

¹³ 1857-1875, for which period the rate of change for the British series is -0.4 p.c., and for the other Swedish series 0.3.

¹⁴ For The Economist series, an X denotes the maximum price, and a Y the minimum price.

¹⁵ Before 1885 the quality was not differentiated. The range of the upper and lower price limits for the single quality corresponded, however, roughly to the compound price range of Good and Common, why an extrapolation was reasonable.

Commodity, country	1924-39				
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Swedish, 3x9", B (Economist)	0.2				
ditto, 2½x7", B (")	0.0				
ditto, 2x4", B (")	-0.7				
Can/Am Spruce, B (")	2.4				
Pitch Pine, B (")	1.3				
Sawn, unplaned, S	-0.5				

Commodity, country	1850-75	1866-94	1890-1914	1907-34	1930-55
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Iron and steel¹⁶

Pig iron, B (Economist/WPI)	-	-1.7	1.6	0.5	-
ditto, Scotch, B (Sauerbeck)	1.5	-1.9	1.3	1.0	7.1
ditto, Cleveland, B (")	-	-	1.7	0.9	7.0
Pig iron, charcoal, S (Jörberg/Ljungberg)	1.5	-0.8	0.9	0.2	6.6
Bars, B (Sauerbeck)	1.1	-2.1	1.5	1.5	5.2
Bars, B (Economist/WPI)	-	-1.4	0.8	1.2	-
Bar iron, S (Jörberg/Ljungberg)	0.7	-1.1	0.7	0.2	5.7
Iron rails, B (Economist)	-	-1.6	-	-	-
Steel rails, B (Economist)	-	-	1.7	-	-
Steel rails, S (Nilsson)	-	-	0.8 ¹⁷	-	-
Iron ship angles, B (Economist)	-	-1.6 ¹⁸	2.0	-	-
ditto steel, B (Economist)	-	-	0.9	-	-
Ship steel bars, S (Ljungberg)	-	-	0.5	-	-
Iron ship plates, B (Economist)	-	-1.9 ¹⁸	1.5	-	-
ditto steel, B (")	-	-	1.0	-	-
ditto ditto, S (Ljungberg)	-	-	0.4	-	-
Hoops, B (Economist)	-	-1.8	0.3	-	-
Spring steel, S (Ljungberg)	-	-	0.1	-	-
Sheets, B (Economist)	-	-1.3	0.1	-	-
Tin plate, S (Ljungberg)	-	-	-0.2	-	-

Commodity, country	1850-75	1866-94	1890-1914	1907-34	1930-55
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Machinery, etc

Plough, one-furrow, B (MS)	0.9 ¹⁹	0.4	0.4	3.3	-
ditto, ditto, S (Ljungberg)	-	-	0.2	3.0	-
Tractor plough, B (MS)	-	-	-	3.0	5.3
Spring-harrow, S (Ljungberg)	-	-	-	2.1	4.3
Lawn mower, B (MS)	-	0.0 ²⁰	0.0	2.9	-
ditto, motor, B (MS)	-	-	-	1.8	-
Combustion engine, S (Ljungberg)	-	-	-2.8 ²¹	0.3	-
Milk separator, S (Ljungberg)	-	-	-4.8	4.2	-
Electrical motor, S (Ljungberg)	-	-	-4.0 ²²	-1.5	-

¹⁶ The lower price of The Economist's quotations has been employed. Some series are extrapolated, e.g. pig iron where Scotch and North East series are spliced.

¹⁷ End year 1912.

¹⁸ Start year 1876.

¹⁹ Start year 1857.

²⁰ Start year 1868.

²¹ Start year 1894.

²² Start year 1893.

Commodity, country	1850-75	1866-94	1890-1914	1907-34	1930-55
Portable steam engine, B (MS)	-	-0.1	0.3	-	-
Expansion ditto, B (")	-	-0.9 ²³	0.3	-	-
Compound steam engine, B (")	-	-	0.4	1.3	-
Vertical steam engine, B (")	-	-0.1	0.6	-	-
Light traction steam engine, B (")	-	0.8	0.6	1.7	-
Portable steam engine, S (Ljungberg)	-	-	-0.8 ²⁴	-	-
Locomotives, B (MS)	-	-1.0 ²⁵	0.2	1.3	-
ditto, S (MS/Ljungberg)	0.0 ²⁶	-0.1	-0.7	-	-
Ships, dry cargo, B (Cairncross/Fairplay)-	-	-4.5 ²⁷	-0.1	-0.7	9.7
Ships, S (Björkenstam)	-	-2.5 ²⁸	-	-	-
ditto, S (MS/Ljungberg)	-	-0.9	-0.8	-0.7	8.6
Ships, tank, S (Ljungberg)	-	-	-	-	7.3

Commodity, country	1850-75	1866-94	1890-1914	1907-34
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Chemicals

Nitrate of Soda, B (Sauerbeck)	-0.7	-2.1	1.5	-1.0
Soda crystals, B (")	-	-2.7 ²⁹	0.1	2.8
ditto, S (MS/Ljungberg)	-	-4.8 ³⁰	-1.4	1.7
Soap, hard, B (BoT 1903/Wilson)	-0.6	-1.1	-0.6	3.0
ditto, soft, S (Schön/Ljungberg)	-0.8	-2.3	2.0	-0.7
ditto, hard, S (Ljungberg)	-	-	0.6	2.7

Commodity, country	1863-75	1866-94	1875-94	1875-1902
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Building materials

Cement, B (BoT 1903)	-0.9 ³¹	-1.5	-2.4	-1.7
ditto, S (MS/Ljungberg)	-	-	-2.6	-1.5
Bricks, B:Glasgow (BoT 1903)	2.9	-0.1	0.1	0.5
Bricks, S (Jörberg)	0.8	-1.2	-2.1	-0.6

Commodity, country	1901-14	1907-34	1930-55	1949-69
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Pulp and paper

Mechanical pulp, B (Reader)	-0.2	0.7	9.3	0.7
ditto, S (Ljungberg)	0.1	0.0	8.0	0.2
Chemical, unbleached, B (Reader)	-0.3	0.6	9.3	0.4
Sulphite, unbleached, S (Ljungberg)	-0.4	0.4	7.8	-0.8
Sulphate, unbleached, S (")	-	-	8.8	-1.0
Newsprint, B (Reader)	-	-	7.8	1.6
ditto, S (Ljungberg)	-1.2	0.6	4.5	2.8

²³ Start year 1868.

²⁴ End year 1912.

²⁵ Start year 1871. When the same start year is applied to Swedish locomotives, the rate of change is -0.3 p.c.

²⁶ Start year 1856

²⁷ Start year 1870, the same as for Björkenstam's Swedish series. Applied to the present author's Swedish, still preliminary, series this start year results in -1.7 p.c..

²⁸ See preceding footnote.

²⁹ Start year 1867.

³⁰ Start year 1874. With the same start year British soda crystals changes -2.2 p.c., and nitrate of soda -2.8 per cent.

³¹ Starting in year 1850 cement fell 0.8 p.c. p. a.

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