Stages of Diversification: France, 1836-1938*

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Abstract

A large literature has documented an association between economic growth and export diversification. We study this question in France between 1836 and 1938. The period witnessed the onset of modern economic growth and sharp changes in the level of international competition. We use a new long term database on French foreign trade at a high level of disaggregation. At the dawn of the first Globalization, France appears to have specialized along Ricardian lines, exporting a handful of textile products in large quantities. There is a decrease in specialization from 1860 to World War I along the lines of modern studies. Changes in trade costs along with economic growth help explain the evolution of France's comparative advantage. The decline of export concentration is associated with a chronic deficit in the balance of trade during the Belle Époque and the major part of the interwar period particularly after 1927.

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1. Introduction

Decades of research on France's economic fortunes during the 19th century come to the conclusion that France was a laggard in the adoption of new technologies. Another strand of the literature emphasizes the slow growth of French exports and other difficulties in competing internationally. The latter is often taken to be a reflection of the country's subpar economic performance.

Standard Ricardian trade models applied to 19th century France might help explain the nation's apparent difficulties. Having to compete with price competitive British exports would lead France to specialize in an ever shorter and more specific range of manufactured products. Since Temin (1997) has persuasively shown that early 19th century Britain was exporting an increasingly large range of manufactured goods, the possibility of de-industrialization and intensified specialization in France would not be unexpected in this view. The pace of French productivity growth lagged the British implying British dominance in many manufactured goods. Nevertheless, in a world of differentiated goods, the economic growth and productivity improvement seen in France in the 19th century might have been associated with improved prospects for French exports in new as well as old products.

The very same Ricardian model, say that of Dornbusch et al. (1977), also makes an interesting prediction about patterns of specialization when trade costs change. For a country facing decreasing trade costs, in this case those associated with the first globalization and trade liberalization, a new range of exports would emerge. A host of new imports would flood in. As is well-known, France did not de-industrialize in the 19th century despite its relatively poor performance. Moreover, France did transition to modern economic growth in the 19th century in addition to seeing marked changes in trade costs due to large shifts in trade policy and globalization.

As it turns out, neither did France end up specializing in an increasingly narrow range of goods. Rather than being outcompeted by Great Britain, trade cost changes and economic growth may have been the dominant forces in explaining 19th century patterns of French trade and specialization. While its exports did not grow as quickly as other countries, and its trade balance worsened after 1860, France diversified its export portfolio after the mid-19th century.

In this paper we document for the first time the evolution of France's comparative advantage during a period that encompasses the onset of modern economic growth and which witnessed large changes in trade costs. Recent work for the modern period by Cadot, Carrere and Strauss Khan (2011, 2013) has highlighted that the initial stages of modern economic growth and trade liberalization are two key drivers of trade diversification. We are unaware of any direct examination of this issue in the historical record. Strikingly, we find evidence in support of these dynamics in this particular historical setting.

More generally, if the pattern of exports reflects the sectoral allocation of economic activity, we are able to make inroads on gauging the level of sectoral diversification in France between 1836 and 1938 in the absence of reliable and consistent information on the sectoral allocation of employment and output. Doing so allows us to connect the French experience to

Imbs and Wacziarg (2003) who document that sectoral concentration in terms of employment follows a U-shape against per capita income. Sectoral diversification increases at low levels of per capita income, but there exists a level of output per capita beyond which the sectoral distribution starts concentrating again. Their evidence suggests an increase in export diversification during the early stages of economic growth and a subsequent concentration. Our data allow us to examine this stylized fact for a leading country prior to World War II whereas Imbs and Wacziarg (2003) focussed only on post-World War II data.

Our analysis relies on a newly digitized long-run database of highly disaggregated French foreign trade. We use information on imports and exports disaggregated at the product level to consider the evolution of the composition of imports and exports. We employ conventional measures of comparative advantage and diversification including export and import concentration ratios, coverage ratios, and the Lafay index of specialization. We also investigate the short-run dynamics and determinants of specialization. Econometric specifications test the stability of specialization and link specialization with trade policy. Overall we find that France became increasingly diversified over the period we study, but that the diversification process slowed dramatically from the 1880s. Evidence points to the idea that lower international trade costs, economic growth and broad-based productivity advance drove these early changes. As trade policy became more protectionist after the 1880s, and the economy matured, the diversification evident between 1860 and 1880 lost momentum. It is likely that the process of diversification bottomed out due to economic growth itself as suggested by Cadot et. al. and many other studies.

This new evidence permits us to highlight French trade performance over the long run in the British (and later the German) mirror. The literature tends to emphasize the inability of French manufacturers to compete, and it is often argued that France lagged behind other industrial nations like Germany, the US, and Great Britain. While changes in relative productivity may have been disadvantageous to certain sectors in France, in some respects, France's export economy thrived in the midst of adversity. Economic growth, which was not insignificant, carried with it a dividend of diversity as regards economic activity and leading exports. In addition, falling trade costs allowed previously uncompetitive product lines to be exported. By the late 19th century rising trade costs associated with resurgent protectionism seem to have locked France into older patterns of production.

The article is structured as follows. Section 2 presents a survey concerning French international trade between 1836 and 1938. Section 3 introduces the original database and some key data. Section 4 provides an analysis of the dynamics of France's comparative advantage and specialization using conventional methodologies. The final section discusses the relation between trade policy and the degree of specialization. We conclude with some explanations and propose some new lines of research.

2. France: Relative Decline in the 19th Century?

There is a large volume of research in the economic and historical literature on France's foreign trade between the 1830s and WWII. However, this research is fragmented and is unable to offer a complete and clear view of long-run tendencies and trends. Pioneering research by Tyszynski (1951) analyses the evolution of exports in manufactured products'

after 1899 concluding that the French share of manufactured exports - in a sample of eleven major countries - decreased from 15.8% in 1899 to 6.4% in 1937. Yates (1959) focusses on primary products during the first part of twentieth century. Maizels (1963) applies shift-share analysis to manufactured goods exports between 1899 and 1913 in order to explain an apparent "French foreign trade decline" that witnessed limited geographical diversification. France is often characterized as being unable to take advantage of the opportunities afforded by the first wave of globalization. French exporters, it is often argued, failed to establish themselves in distant emerging markets which were enjoying strong growth (e.g., the United States, Latin America or Asia). None of these studies examine the issue of the evolution of French specialization patterns and the international division of labor.

Recent papers pay particular attention to short-to-medium term outcomes or specific sectors. Verley (1988) analyses the links between exports and economic growth during the 1860s applying a sectoral method. He found that export spill-over effects were reduced after the trade liberalization of the mid-19th century. Broder (1993) calculated effective protection to call into question the effects of the Méline tariff on specialization responding to an earlier literature which had established that rising tariffs were not effective in developing new sectors such as electric materials or agricultural mechanicals. Broder (2006) focuses on exports and imports of 'Machines and Mechanicals' between 1874 and 1913 showing a lack of innovation in these sectors, and hence an inability to successfully export such items. Other authors suggest that French trade policy was not an offensive one but a defensive one. Even when considering a longer period, research focusses on only a few points in time (Weiller, 1971; Bairoch, 1977; Levy-Leboyer and Bourguignon, 1990; Lefeuvre, 1993; Guillaumet, 2002). For example, Bairoch (1993) studies the sectoral structure of exports at only three points in time: 1886/90. 1911/13 and 1926/29. The latter studies miss the long-run, global trends.

Using annual data, Verley (1997) studies the evolution of seven principal exports between 1827 and 1880 in order to analyse their relationship with French industrialization. He focuses on the textile industry and finds that French exports in the sector were largely complementary to British textile exports on global markets. From the 1820s, the variety of textile products exported and produced increased. This rise was founded on fashion effects, innovation strategies and market segmentation. Because of higher mechanization and hence labor productivity, the UK gained a comparative advantage in the mass production of standardized cotton textiles. The UK had other advantages in complex textiles manufacturing due to new technologies such as the power loom, spinning mule, factory organization and applied steam power. France's textile exports included high quality products (silk trade from Lyon, print cotton from Alsace, articles from Paris…) destined for the luxury markets. Skilled labor was a relatively abundant factor of production (Crouzet, 2003). In the early 19th century, France exported textiles towards a great number of countries not only in Europe but also more distant areas such as Latin America the US etc. By the mid to late 19th century newly industrialised countries such as the USA and the Zollverein imported textiles from France in a sort of intra-industry trade. It would be wrong to say that these industrial upstarts were in pure competition over homogenous goods with French products.

Studying the impact of protectionism in four top industrial countries (France, Germany, Italy and UK), Dormois (2009) computes revealed comparative advantage for France in 1873, 1885, 1900 and 1913; France appears to have a significant specialization in finished textiles

and trinkets. During the first globalization, French specialization in textiles such as cotton, wool, and silk is clearly established by the extant historiography.

The decline of French trade power during first globalization is also well-known in historiography (Cameron, 1961 or Maizels, 1963). As evidence of this decline, Bairoch (1993) shows that France was the world's second largest exporter until 1871 falling to the 4th largest exporter from 1875 (behind Germany, the United States, and Great Britain). Indeed, the share of France in world exports increased from 9% in 1847 to 16% in 1865 but this figure quickly fell thereafter attaining 7% in 1913. Compared to other European countries, the French "decline" appears to be unique (Lewis, 1981; Federico and Wolf, 2011; Dedinger, 2012; Huberman et al., 2015).

Crouzet (2003) blames the apparent slow growth of French exports after 1860 on a rise in wages induced by a 'shortage of labor'. Indeed, France suffered recurrent trade deficits from the end of the 1870s. These imbalances only worsened in the 1880s. Indicators of trade openness, (i.e., the share of value added exported) tell a similar story (Asselain and Blancheton, 2005). The French index of openness contracted at the beginning of the 1880s while other Western European countries "opened up" (see Lewis, 1981). This is as true for France's major competitors like the UK and Germany (see Lewis, 1981) as it is for laggards in industrialisation such as Italy (see Federico and Wolf, 2011) and Spain (Tena-Junguito, 2007). One possibility for France's decline is of course slower economic growth and productivity advance. Comparing labor productivity levels and variations, Dormois (2009) shows that the French lagged the UK and Germany between 1871 and 1911. Dormois concludes, as did Bairoch and Crafts previously, there was a decreasing level of French industrial competitiveness. Lévy-Leboyer and Bourguignon (1990. p.65) highlight: "an error in estimating market trends. Contemporary observations show that manufacturers did not recognize in time that with the development of the urban market, durability and strength, which had justified the successful exportation of their products, ceased to be selling points".[1]

Once all these various assessments are put together, the diagnosis of decreasing competitiveness of French exports owing to industrial failure after 1870 becomes the predominant theme of the literature. The empirical basis for such a conclusion, however, is very slim. Previous work has not been able to reach this conclusion on the basis of the universe of trade data given the difficulty of processing the necessarily large datasets involved. Bringing this puzzle's pieces together in this way still does not give a complete view of French participation in the global market of the 19th and early 20th century, its overall specialization, and the dynamics of France's comparative advantage. It is fair to say that, to date, there is no general overview of French foreign trade and specialization for the entire period in question. The present study is the first to make use of a comprehensive annual database documenting product-level trade for France's over the period 1836-1938.

3. Data and global view of France's foreign trade 1836-1938

[1] Senger (2015) shows a French deficiency in terms of market information. From the 1880s exporters were unable to capitalize on foreign market trends. The 'Agents system' (commissionaires) used by French exporters in all industries cut the direct link between foreign markets and producers. Furthermore, the "agents" captured high gross margins reducing French competitiveness.

To analyse the composition of trade over time in terms of both commodities imported and exported, our strategy has been to build an original disaggregated database for France's foreign trade. Data are recorded annually between 1836 and 1938. Our main data source is the *Tableau général du commerce de la France avec ses colonies étrangères* (*Tableau général du commerce et de la navigation* after 1896).

3.1 Global Perspective

During this 103 year period, France's economy changed significantly. Per capita GDP grew at an annual rate of roughly 1.2% between 1836 and 1938. The share of labor employed in industrial production rose from 25% to 31% between 1841 and 1911. Around 1911 the share of labor employed in industry surpassed that of the share in agriculture (Crouzet, 2003). The share of total output accounted for by industrial output moved from 29% to 39% between 1841 and 1911. To be sure, productivity in industry was relatively low in textiles compared to the UK. Overall labor productivity levels in industry stood close to those of its close rivals Britain and Germany in 1870 but by about 1910 France had fallen behind to a level 80% of that in Germany and Great Britain (Dormois, 2009).

At the beginning of the period, France exported roughly 5% of its total GDP. For the years 1910-1913 this figure increased to just over 14%. At the same time, the share of total exports accounted for by manufactured goods fell from 68% in 1836 to 48.9% in 1913. Unlike the late 19th century US which became a net exporter of manufactures and where industrial goods came to dominate exports (Irwin, 2003), France's net exports of manufactured goods declined over time. In spite of this change, the share of manufactured exports in total exports during this period never declined below 43% (1937) (see Figure A1 in the Appendix). While speculative, these observations about the US and France, and possibly even the conclusion of Temin (1997), are consistent with the idea that the leading countries experienced a diversification of exports as modern economic growth commenced.

France's leading sectors in the 19th century were textiles and of course wine. Circa 1860 cotton, woolen, and silk textiles accounted for a large share of exports. Textiles made up around 1/3 of all industrial output, and half of all industrial employment amongst establishments surveyed for the census of 1861 (Nye, 1987). This sector was once heavily criticized for being much less technologically progressive than Britain's industry and for the small size of its establishments. Subsequent research has shown that relative factor prices may help explain some of these differences (Allen, 2009). Inefficient establishment size has seemingly been exaggerated (Nye, 1987). Over the course of the long run, textile exports increased in absolute terms with an annual average growth rate of 0.51% between 1860 and 1913. Despite facing enhanced international competition, French producers were able to grow.

These aggregate trends are interesting, and the snapshot analysis of firm size from 1860-61 is interesting. However, the underlying dynamics of the evident changes are not well understood in the French case. In France, no dramatic change in factor endowments is evident as in the USA where massive resource discoveries provided the backbone of the American transformation.

The leading hypotheses for these changes seem to be relatively slow productivity growth and/or declines in trade costs. The Imbs and Wacziarg hypothesis does not specifically address the open-economy issues, but it stands to reason that export concentration may mirror trends in the structure of production assuming a world of differentiated goods and a love of variety. Moreover, evidence from the modern period by Cadot et. al (2011, 2013) suggests that economic growth and trade policy are two major drivers of export diversification.

To gain further insight we resort to analysis of a new highly disaggregated data set on exports and imports. Using annual observations between 1836 and 1938 we are able to track the experience of France as a function of productivity changes as well as numerous (positive and negative) shocks to trade costs.

3.2 A New Disaggregated Data Set on French Trade

Our data set covers 107 headings for imports and about 135 for exports (corresponding to SITC rev.3 classifications). Concerning the definition of trade, we track "*commerce spécial*" and not "*commerce général*". Data from "*commerce spécial*" includes the value of goods imported for national consumption and the value of national production exported. Since "*commerce général*" includes goods in transit these data are less useful for our purposes. Our data set does not include traffic from tourism which can be significant as in the case of garments, underwear, trinkets, perfumes etc. Another common problem of nineteenth century trade statistics concerns valuations of goods and the use of official prices. After 1847 the *French Tableau* provides only '*valeurs annuelles*' using conventional prices defined by a committee and not '*valeurs officielles*' founded on traders statements (see Dormois, 2009, chapter 4). The '*valeurs annuelles*' were averages of market-based prices but some judgment and discretion may have been involved in deciding the exact values.

We now proceed to analyze the share of exports by product for France during these years. First, it is noticeable that the list of France's *major* exports did not differ markedly from the beginning of the period up to 1913. These major products consisted of about a dozen items including finished textiles (silk, woolen and cotton fabrics), wine, fancy goods and trinkets.[2] In 1913, France's main exporting industries were still those which had made their fame under the Second Empire, only their share in total trade had been dwindling. During the Belle Epoque (1870-1913) France is generally seen to have been *unable* to get a leg up in modern specializations representative of the Second Industrial Revolution. Whereas Germany came to dominate in fields like 'machines and mechanicals' (Dormois, 2009) and Switzerland succeeded in 'chemical products' (Charles, 2013), France continued to produce and export in fields of endeavor in which it had long been producing. The Second Industrial Revolution seems to have been slow in arriving in France.

Notwithstanding this ostensible "stagnation", France did manage to diversify its exports over the long run. To be more precise, we present first in Figure 1 the evolution of net exports of manufactured products, finished textiles and raw materials. Between 1860 and the start of the 1880s the net export ratios of finished textiles and, more broadly, manufactured

[2] This last product category, specific to the French nomenclature, combined a number of luxury or decorative articles using precious wood, inlaid with bone, ivory, mother-of-pearl including chessboards, tobacco jars jewellery cases, toys and the like; the Board of Trade referred to these as "Small fancy wares and toys."

products decrease very quickly. If a stabilization can be observed prior to World War I for textiles, the rate of decrease rises dramatically for manufactured goods as a class.

Figure 1

In Figure 2 we look at the evolution of the share of the top four exports in total exports and the evolution of the share of the top four imports in total imports between 1836 and 1938.[3] Figure 2 shows that textiles (cotton, woolen and silk) and wine went from accounting for about 47% of total exports down to 16% in 1913. Silk and cotton textiles see the most dramatic declines.

There is less of a discernable trend in the share of the top 4 imports evident in Figure 3. Major imports included primary products such as raw cotton, raw wool, and coal. That these goods were the top imports implies a persistent international division of labor with France importing raw materials and exporting manufactured goods. This first look at the data invites us to consider other measures of export and import concentration.

Figure 2

Figure 3

3.3 Trade Diversification

In order to gain a more comprehensive view of French international trade concentration we compute Herfindahl indexes for *all* exports and imports (Figure 4). The Herfindahl index is given by the following formula: $H = \sum_i X_i^2$ where X_i is the share of product i = 1,…,135 in total exports. The maximal value is 100 implying total specialization.

Between the 1830s and the 1850s, export concentration remains high in line with a Ricardian positioning. During this period, France was highly specialized in a small range of goods. From the mid-1850s, France's trade costs fell dramatically due to advances in international transportation and communications, the signing of the Cobden Chevalier treaty, and subsequent MFN treaties with other major trade partners. The Herfindahl index declined sharply between 1855 and 1865. A momentary deceleration is evident until 1869. From 1870 there is one further strong decline followed by a slower secular decline all the way down to World War I.

This decline would seem to be in opposition to a basic Ricardian trade model suggesting specialization along the lines of comparative advantage. This decline seemingly rules out the idea that productivity growth was concentrated in a few leading sectors or that relative productivity in one or two goods mattered. On the other hand, it is well known that the Ricardian model of Dornbusch et. al. would predict a negative impact of trade liberalization on export concentration. A rise in the share of many goods not previously exported in significant quantities or values should occur. To the extent that trade cost declines heightened international competition, a Ricardian model would also predict that some goods previously produced locally would lose out to international competition. This would be consistent with a lower import concentration ratio which is also visible in Figure 4.

[3] For exports and imports we compute how many way one item is in the top 10 between 1836 and 1938 and calculate an average ranking.

During the interwar period, the *H* index stays stable at a low level. In contrast the index for imports appears relatively stable over the long run. The shock of World War I shows increased concentration, in a context of an export collapse and closed international markets. This is a temporary and exceptional change and it is based on exports of armaments, munitions, and cotton fabric mainly toward military allies like Russia and Italy.

Figure 4

3.4 The Determinants of Export Diversification.

In Figure 5 we show that there is a strong negative relationship between the *H* index of concentration and income per capita. This negative relationship is also consistent with Cadot et. al (2011) and Imbs and Wacziarg (2003). The relationship becomes nearly flat above $3,000 (1990 Geary-Khamis US dollars)

Figure 5

The fitted values in Figure 5 come from the following regression for the years 1836-1938 (t-statistics in parentheses below coefficient estimates):

$$H_t = \underset{(8.85)}{18.25} - \underset{(-1.50)}{0.029}(year) - \underset{(-4.27)}{0.008}\left(\frac{GDP_t}{POP_t}\right) + \underset{(5.23)}{0.011}\left(\frac{GDP_t}{POP_t}\right)^2$$

The R^2 of the regression in Figure 5 is equal to 0.82. To the extent that export concentration relates to employment shares we have uncovered to the best of our knowledge, for the first time support for Imbs and Wacziarg's conjecture from the 19th century. The French case shows a long run decrease in exports concentration in line with their U-shape. The model in Imbs and Wacziarg noted that concentration (in employment) increases at the end of the 1960s when GDP per capita exceeded 10.000 dollars. Cadot (2011) also note that export diversification also declines after a critical level of GPD per capita is reached. Our findings are consistent with both although in this case re-concentration does not occur during the time period covered in our sample.

Cadot et. al. (2011) note that export diversification depends on trade policy as well as the level of income per capita. To see if this is true in the case of France we regress the Herfindahl index of concentration on the lag of the average tariff level as well as GDP per capita, its square, and a linear time trend. The years included in the sample are 1851-1913, years in which trade policy changes are well known and clearly discernible based on changes in tariff revenues. The results below in this case are striking (z-statistics based on robust standard errors reported are in brackets underneath coefficient estimates):

$$H_t = \underset{(4.91)}{21.14} - \underset{(-3.07)}{0.089}(year) - \underset{(-3.05)}{0.011}\left(\frac{GDP_t}{POP_t}\right) + \underset{(3.82)}{0.021}\left(\frac{GDP_t}{POP_t}\right)^2$$

$R^2 = 0.86$, $F = 118.95$, $N = 64$, all of the coefficients are significant at 1%.

$$H_t = \underset{(5.50)}{15.99} \quad - \underset{(-3.96)}{0.076}\,(year) - \underset{(-3.33)}{0.008}\left(\frac{GDP_t}{POP_t}\right) + \underset{(3.83)}{0.014}\left(\frac{GDP_t}{POP_t}\right)^2 + \underset{(8.75)}{0.22}\,(\text{Tariff}_{t-1})$$

$R^2 = 0.94$, $F = 222.68$, $N = 63$ all of the coefficients are significant at 1%.

We find strong evidence once again that the export concentration ratio declined as income grew but that there was a bottoming out in that process towards the end of the 19th century and into the early 20th century. Our regression would predict a rise in the *H* index after a critical level of GDP per capita about $3,355. After controlling for income, we find that the average tariff rate is strongly positively associated with export concentration.

From the 1860s France underwent a liberalization but from the 1880s up to 1893 the average tariff rate nearly doubled from about 6.58% to 11.5%. Without this rise in tariffs, the Herfindahl index would have fallen by roughly one more point. In the event, policy changes seem to have reinforced the dwindling downward pressure of GDP per capita. Based on our regression results, policy changes do not seem sufficient to explain the dramatic slowdown in diversification seen above. Instead GDP per capita seems to be the dominant force in explaining this measure of diversification.

3.5 Evidence Regarding Long Run Decline

In order to deepen our understanding of France's trade prowess and its competitiveness, we compute two foreign trade coverage ratios. The *CR4* coverage ratio for each year takes the ratio of the value of the top 4 exports to the value of the top 4 imports; we note that in each year the set of products covered in the ratio can vary. We also compute a "*global coverage ratio*" (value of exports / value of imports), related to the trade balance yielding a value above 100 when there is a surplus. We observe a perfect correlation between the two measures. The ACD correlation coefficient between the CR4 coverage ratio and the global coverage ratio takes a value of 0.82. When the ratio of the top 4 exports rises above the top 4 imports, a trade surplus can be observed.

Before the end of the 1870s, the *CR4* coverage ratios are generally higher than the global coverage ratios. France's net exports for its top products were much more competitive than the average product line up to this point. Figure 6 shows a turning point at the end of 1870s. The decline of export concentration seems to be somewhat correlated the balance of trade. The chronic deficit in the trade balance from the end of the 1870s until WWI (which improves slightly over these years) is associated with the historically low concentration ratios seen in Figure 4. We observe an even stronger correlation during the interwar period particularly after 1927. At that point, a lack of strong specialization seems to explain the accentuation in the deficit.

Figure 6

4 The Stability of Comparative Advantage: 1836-1938

4.1 Lafay Index of Specialization

In international economics, there are many ways to measure comparative advantage and specialization. The pioneering Index of Revealed Comparative Advantage by Balassa (1965) is an oft-used metric. However, the choice of the right index depends on many elements. We propose to use the Lafay Index of international specialization (1992). For historical work, the Lafay index offers some advantages. It needs only national trade statistics; data on world exports with a suitable disaggregation are not available for our period. The Lafay Index controls for distortions from an overall net deficit. In the context of the first globalization which witnessed increasing intra-industry trade, a careful assessment of international comparative advantages requires us to take into consideration exports and imports. The Lafay Index, by taking account of imports, allows us to control for intra-industry trade. The Lafay Index measures the contribution of different products to changes in total comparative advantage.

We compute the Lafay Index of international specialization for items at the 3-digit SITC classification. For any given product *i* the Lafay Index (LFI) is defined as :

$$LFI_i = 100 \times \left[\left(\frac{x_i - m_i}{x_i + m_i} \right) - \frac{\sum_{i=1}^{N} (x_i - m_i)}{\sum_{i=1}^{N} (x_i + m_i)} \right] \times \frac{x_i + m_i}{\sum_{i=1}^{N} (x_i + m_i)}$$

where x_i and m_i are exports and imports of product *i* and *N* is the number of products. Thus, a positive value indicates the existence of a comparative advantage in a given item (a specialization in the *i*th good). On the contrary, negative values points to de-specialization. All indexes summed over *i* sum up to zero. For each particular good, the part in parentheses measures net exports normalized to average net exports. The weights, which sum to one, scale these deviations by how important each good is in overall trade.

Figure 7

We compute the LFI index, year by year, for each product. Figure 7 shows results for France's top 4 exports. At the start of the period, France was very highly specialized in, and a net exporter of, finished textiles which are included in the top 4 exports (silk, woolen and cotton fabrics). All series show a decline all the way to World War I but there is variance in the outcomes by product.

For silk fabric the LFI index reached a level higher than 10 in the 1850s, although it decreased from the start of the 1860s down to the late 1870s. From then on, France clearly maintained its status as a net exporter of silk textiles until WWII, likely founded on a reputation for quality.[4] The LFI index was high for cotton fabric (with a peak at 8 in 1846).

[4] This industry concentrated in the area of Lyon which was responsible for around 2/3 of all exports until 1860. The principal destination was the USA until the end of the 1850s with Great Britain becoming the number one destination later (Verley, 1997).

The LFI for cotton decreased quickly near the end of the 1840s, and became briefly negative in 1872 after Alsace and Lorraine were ceded to Germany. Its value rose from the 1880s all the way to World War I and stayed stable above 2 during the interwar. For woolen fabric, there are fewer sharp changes. Woolens were able maintain a value of around 4 from the 1860s through the 1890s. Woolens tend to decrease from the late 1890s and this trend continued until the end of the period when France very nearly loses its comparative advantage in this product.

4.2 Methodology to Study Stability of Specialization

To study the (short-run) stability of French international specialization, we use an approach inspired by the seminal contributions of Pavitt (1989) and Cantwell (1989). Our approach follows recent papers about modern specializations such as Alessandrini and Butuo (2010) and Chiappini (2014). Our estimating equation is given by:

$LFI_i^{end} = \alpha + \beta LFI_i^{start} + \varepsilon_i \qquad i = 1,\ldots,135.$

The dependent variable is the value of LFI_i at the end of one period. The key explanatory variable is the value of the same index for the same product at the beginning of the period, α is constant, β is the key parameter of interest to be estimated and ε is a residual term. In order to reduce the impact of year-to-year volatility, we take an arithmetic average of the values of the index in the current year and the preceding two years. The interpretation of the regression is as follows:

- If $\beta = 1$ the specialization of the country is unchanged over time.
- If $\beta > 1$ country has become more (less) specialised in sectors for which it already has a comparative advantage (disadvantage).
- If $0 < \beta < 1$, on average the sign of the specialization is still the same, but the value of the index has increased in sectors for which the initial value of the index was low and has decreased in the sectors for which the initial value of the index was high.
- If $\beta < 0$ the sign of the LFI index has changed and the specialization has reversed.
- If $\beta = 0$ there is no relationship between initial and final pattern of specialization.

Dalum et al (1998) point out that the interpretation of the β coefficient does not allow a conclusion about the overall evolution of a country's specialization. However, more can be said about the distribution of specialization. Cantwell (1989) shows how it is possible to exploit the following relation deriving directly from the regression equation:

$$\frac{\sigma_{end}^2}{\sigma_{start}^2} = \frac{\beta^2}{r^2}$$

where r^2 is the squared correlation coefficient from the regression and σ_{end}^2 and σ_{start}^2 are respectively, the variance of the dependent and explanatory variable. The correlation coefficient is r^2 a measure of the mobility of sectors along the distribution between periods. A high value for this coefficient implies that products' relative position remains almost unchanged. By comparing the regression coefficient to *r* three outcomes can arise:

- If $\beta = r$, the dispersion of the distribution of the index remains the same
- If $\beta > r$, dispersion increases, the degree of specialization has increased
- If $\beta < r$, dispersion decreases, the degree of specialization has decreased

Thus, this method allows a better understanding of both a country's average specialization dynamics and changes in the overall distribution of specialization.

4.3 Estimation

To begin our analysis of the stability of French specialization between 1836 and 1938, we proceed by iteration. We use as a first starting point the years 1836-1837. We then compare successive three year periods to this initial period in order to detect a break point compared to the initial years. A break point appears when the estimate of β becomes significantly different from 1.

If we find a breakpoint, then we use the end period of the sub-sample as a new starting point for successive regressions. The null hypothesis is that β re-sets to 1 after each break point. A useful metric for how fast specialization is changing is the time between two break points. We can evaluate long-run stability with these data. Detected break points are presented in the tables that follow. Tables 1, 2 and 3 show many interesting results.

Table 1

Table 1 explores the period up to the Cobden-Chevalier treaty. With the exception of 1847-1849, between 1836 and 1858 French specialization appears completely stable (the null hypothesis $\beta = 1$ cannot be rejected). The bad harvest of 1847 explains the instability found in 1847-49. Corn imports increased from 99.8 million francs in 1847 to 209 million francs in 1848 and as a consequence the LFI decreases from -5.03 to -10.15. Between 1836-37 and 1859-61, β/r remains very near 1 indicating strong stability in French specialization during a quarter of a century. During this period French trade policy was particularly protectionist.

Taking as a new starting point 1859-61, β is never significantly equal to 1 in the 1860s. Computing the regression every three years leads to the conclusion that there is great instability in the structure of specialization between the start of the 1860s all the way to 1883-85. The regression coefficient β becomes indistinguishable from 1 only when we consider 1883-1885 as a new starting point. The decrease in specialization during the 1860s and the 1870s accompanies an (economically) significant change in the distribution of specializations as seen by values of β/r below 1 for all periods considered.

Table 2

Considering our estimates of β, a period of stability in specialization can be identified between 1883-1885 and 1895-97. Taking a new starting point in 1895-1897, we reject the

hypothesis of stability between 1895-1897 and 1898-1900. After this, two short periods of stability (each of 6 years) can be detected until 1910-12.

Compared to the level of specialization in 1910-1912, the specialization structure of 1913-1915 and 1916-1918 are completely un-stable. This is evidently due to the wartime economy. Comparing specialization in 1910-1912 to 1919-1921 France appears more specialized. The degree of specialization increases such that our measure of the distribution of export activity, β/r equals 1.23 in 1919-1921. France's main exporting industries were still those which had made their reputation in the middle of the nineteenth century (silk fabric, cotton fabric). France was unable to generate much export activity in modern large specializations by this time period.

As Table 3 shows, results for the 1920s are completely un-stable. Exchange rate instability can probably explain part of the phenomena in the period. Between 1931-1933 and 1936-1938 French specialization appears completely stable (the hypothesis that β =1 cannot be rejected). This result is consistent with the idea that higher trade costs led to higher and more stable specialization. As was the case between 1883-1885 and 1910-1912, the rise in protectionism seems correlated with the stability of the structure of specialization.

Table 3

To summarize, our tests for the stability in specialization permits us to identify five periods. Up until the trade liberalization of 1860, French specialization is perfectly stable and highly concentrated. Between 1860 and the middle of 1880s, the degree of specialization decreased; thereafter specialization is quite stable. From the 1880s until WWI, France was involved in a strategic trade regime yielding a relative stabilization in specialization. During the interwar period, the instability of the 1920s associated with exchange rate volatility (depreciation and then undervaluation) is opposed to the stability of specialization of the 1930s once again in a context of elevated protectionism.

5 Trade Policy and Specialization: a Focus on the Trade Policy, 1880-1913

In order to highlight the link between trade policy and specialization stability we propose to test the relation between relative protection and specialization. We compute a regression of the Lafay index at time *t* on the ratio of the average tariff (*CT* defined as tariff revenue for a good divided by total imports), and the Lafay Index at time *t*-1. Specifically we run regressions of the following form:

$$LFI_{i,t} = b_0 + b_1\left(LFI_{i,t-1}\right) + b_2 CT_{i,t-1} + \eta_{i,t}$$

We restrict analysis to 9 of the top 10 specializations (see Appendix I for a complete list of products and their ranks). We exclude trinkets ('articles de Paris'…) because we have

no imports for these specific goods. We run a random-effects regression for all products pooled together for 1850-1913 and include year dummies. The results of this regression are:

$$LFI_{i,t} = \underset{(117.71)}{0.96}(LFI_{i,t-1}) + \underset{(1.79)}{0.007}(CT_{i,t-1})$$

$$N = 534\ (9\ products, 64\ years), R^2_{within} = 0.90, \qquad R^2_{between} = 0.99,$$
$$\text{robust z} - \text{statistics in parentheses}$$

A positive relation between LFI and average tariffs is established, and the coefficient on lagged tariffs is significant at the 7% level. A one standard deviation rise in tariffs is associated with a rise in the LFI of about 0.02---less than 1% of the sample standard deviation of the LFI. Given the adjustment implied by inclusion of the lagged dependent variable, the long-run impact would be about 0.175 (.007/.04) or 6% of the sample standard deviation. This is not an overwhelming impact in economic terms, but neither is it completely negligible.

There is a possibility of unobservable heterogeneity at the product level if for instance some sectors were more privileged in the political process or had better long-term prospects due to endowments and so forth. In response, we included product fixed effects in the panel regression. Such a regression suffers from a Nickell bias, although it is potentially small given that $T = 63$. In this specification the coefficient on tariffs is slightly larger at 0.009 but it is no longer significant (p-value = 0.2).

As a further test, we implemented the Blundell Bond system GMM estimator that builds on the GMM application of Arellano and Bond. This GMM estimator allows us to simultaneously eliminate concerns arising from time-invariant unobservables at the product-level and the endogeneity bias arising from inclusion of the lagged dependent variable. We allow for lags 2 through 5 as GMM-style instruments for the lagged dependent variable. When we do so, we find the coefficient on lagged tariffs is equal to 0.008 (robust p-value = 0.091), and the coefficient on the lagged value of the LFI index is 0.96. We experimented with allowing up to 11 lags in the instrument matrix. Results are almost identical to those reported. Other diagnostic tests for over-identifying restrictions and serial correlation are favorable. Overall, we believe that, while marginally significant, tariffs did have some marginal impact on specialization patterns. Trade policy seems to have been able to slow down export diversification since it was often applied to more traditionally successful product lines. Policy acted to refuse the closure, or paring down, of traditional specializations.

Can trade policy and changes in trade costs explain the patterns of diversification in the decades following 1860, or is a productivity/economic growth explanation more appropriate? Three possibilities arise. First, a Ricardian model would predict increased specialization if greater international competition was based on the evolution of relative productivity in a small number of leading industries. Second, generalized productivity advance across industry in France should have given rise to a diversification in exports. Third, as regards trade costs and trade policy, the Ricardian model of Dornbusch et. al. predicts that a fall in tariffs and other trade costs should result in both an increase in the range of goods imported as well as an increase in the range of goods exported (see Balassa, 1966 and

Dornbusch et al, 1977). Clearly the second and third are superficially consistent with the data. By any measure we can confidently rule out the first hypothesis of increased specialization and narrow productivity advantages.

The third hypothesis, that associated with falling trade costs, is consistent with the data and our econometric results. Nevertheless the impact of tariffs seems small, but trade policy changes and trade cost changes together may have been larger than we are able to capture with the proxy based on tariffs. Undoubtedly the decline (post-1860) and then the rise of trade costs (via tariffs) after 1880 played some role in the increased diversification and its subsequent slow-down as per our econometric models. The onset of diversification around 1860 is surely not purely coincidental. It may be the case that the crude measure of trade policy captured by tariffs is insufficient to capture the dismantling of the quantity restrictions inherent in the trade policy changes of the 1860s. Alternatively, it may be that productivity levels were related to trade policy although such a hypothesis would be impossible to test in these early years.

A simpler, if not sufficient explanation is the second hypothesis. Broad-based productivity growth cannot be rejected. This explanation is in fact consistent with our exploration of the determinants of the Herfindahl index which found a strong role for economic growth at the aggregate level. It is also consistent with the exploration made by Temin for England in the decades preceding our sample. While France lagged some decades behind England in experiencing an industrial revolution, it is evident that this process had started in earnest and continued throughout the period under examination. Moreover, as Cadot et. al. (2013) highlight, economic advance leads to a U-shaped pattern of diversification. While we do not see a U, we do see a strong slowdown in specialization apparent after a certain level of GDP per capita.

Conclusion

Using an original database, this paper focuses on French export specialization and concentration at the onset of modern economic growth. We confirm France's position as an "advanced" country which exported manufactured products (73% of total exports in 1846) and imported primary products. At the same time we show that France's specialization traversed a path in terms of specialization typical of modern LDCs at the onset of modern economic growth. As France grew, it initially expanded the range of exports becoming increasingly diversified. After several decades of growth this process began to slow and diversification stagnated.

Between the 1830s and the end of the 1850s, export concentration remained very high. At the beginning of the period, France appears to have adhered tightly to the predictions of a Ricardian model of trade exporting a few products in large quantities. France was largely specialized in finished textiles (silk, woolen and cotton fabrics, and wine).

In a context of falling trade costs, the trade liberalization of the 1860s and 1870s along with broad-based and sustained economic growth produced a significant decline in the specialization of French exports. The decrease in the degree of specialization associated with these changes suggests that France's export-oriented sector responded more to trade cost

changes *and* internal economic dynamics than to outright industrial competition from highly productive and technologically advanced leaders like Great Britain. To the extent that labor force trends shadowed trade patterns, we find evidence consistent with the U-shaped diversification hypothesis of Imbs and Wacziarg.

Imbs and Wacziarg as well as Cadot et. al. suggested a critical level of GDP per capita would provide an inflection point in diversification. Echoing Cadot et. al. we find that trade policy also mattered somewhat for the deceleration in the trend towards greater specialization. From the start of the 1880s to World War I, the decrease in specialization lost its momentum. During this period, a new trade regime took hold which was more strategic and somewhat discriminatory. Tariffs in this period were partly driven by a need to preserve political and social stability in France. Successive French governments acted to protect industries in which France had a traditional specialization (silk, cotton and woolen fabrics, leather or leather articles, metal tools). This defensive protection strategy can partly explain the stabilization of the specialization structure between 1883-1885 and World War I.

The slowdown in diversification should not be meant to imply that broad-based productivity growth had declined. Instead these patterns seem to be evident amongst all countries growing into mature economies. On the other hand France was unable to gain a major foothold in modern large specializations such as machines and mechanical devices. The literature on the Second Industrial Revolution points out that there were many missed opportunities (Dormois, 2009). Indeed our evidence shows that hiding from international competition with higher tariffs may have slowed down any potential transformation to French industry. In 1913, France's main exporting industries were still those which had established their reputation under the Second Empire although their share in total trade had been dwindling.

Studying export diversification of 156 countries between 1988 and 2006, Cadot et. al. (2011) show that as countries travel across diversification cones, they fail to close a tail of export lines that no longer belong to their comparative advantage but artificially inflate their diversification, until finally comparative advantage catches up. Our evidence, consistent with Cadot et. al. (2013) suggests that trade policy is able to slow down export diversification. Government policy may have refused to close a tail of traditional specializations, but other deeper forces that limited entry and exit and the allocation of resources may have been at play.

Regarding export diversification and de-specialization, a crucial question for further research remains: how exactly did a relatively advanced industrial country like France adapt itself to global markets in the face of falling trade costs and rapidly rising foreign productivity. Further exploration of this question requires a detailed analysis of more finely disaggregated trade data at the product level. Such evidence will allow us to explore more carefully how countries diversify, and possibly re-concentrate over the long-run.

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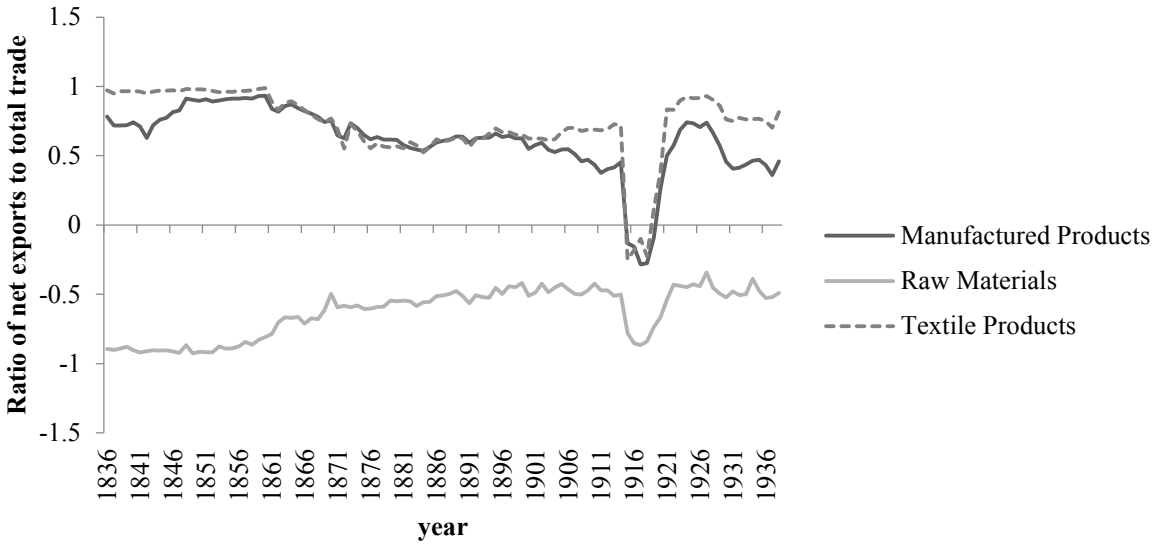
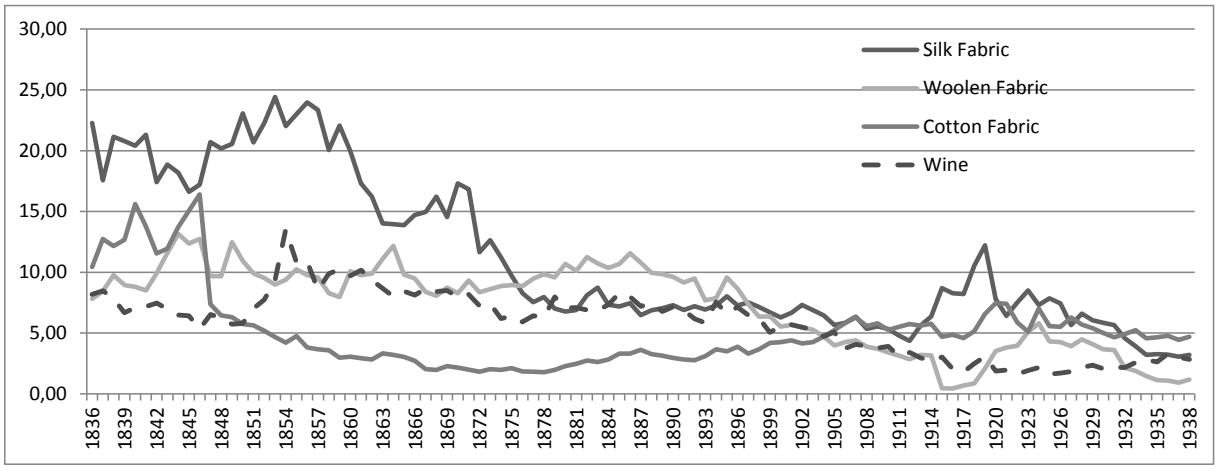
Figure 1. Evolution of net export ratios for raw materials, manufactured and finished textile products (1836-1938)



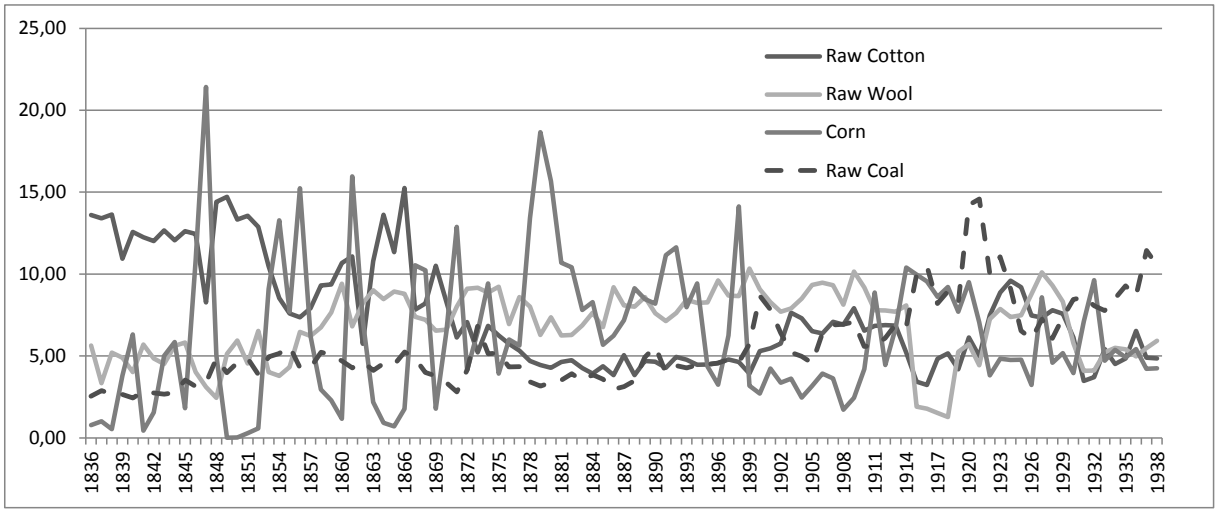
Source and notes: Tableau général du commerce de la France avec ses colonies étrangères (1836-1896) ; Tableau général du commerce et de la navigation (1897-1938) ; own calculations. Net exports for product i at time t are defined by the following formula $(X_{i,t} - M_{i,t})/ (X_{i,t}+M_{i,t})$. X denotes exports and M denotes imports.

Figure 2 Evolution of the respective share of top 4 exports in the total of exports value between 1836 and 1938.



Source : Tableau général du commerce de la France avec ses colonies étrangères (1836-1896) ; Tableau général du commerce et de la navigation (1897-1938) ; own calculations.

Figure 3. Evolution of the respective share of top 4 imports in the total of imports value between 1836 and 1938.



Source : Tableau général du commerce de la France avec ses colonies étrangères (1836-1896) ; Tableau général du commerce et de la navigation (1897-1938) ; own calculations.

Figure 4 Evolution of the Herfindahl Indexes of exports and imports between 1836 and 1938

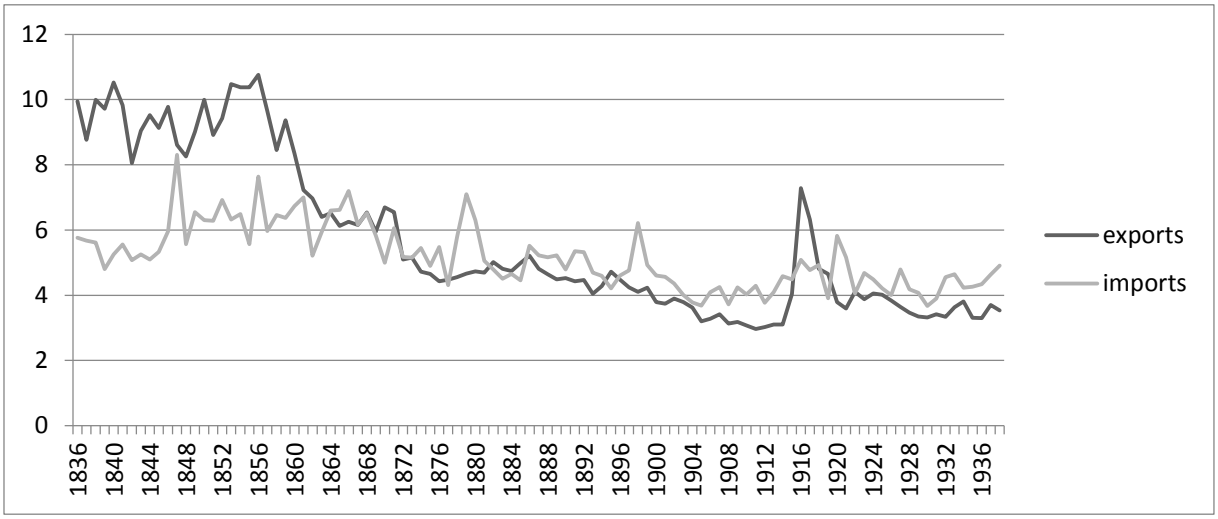
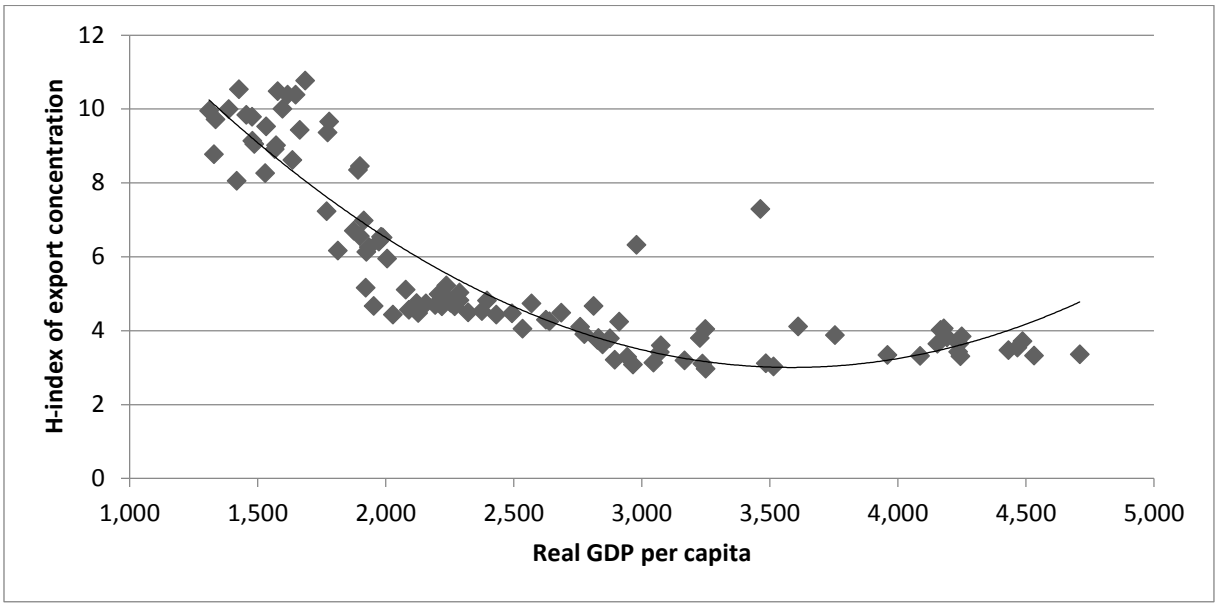
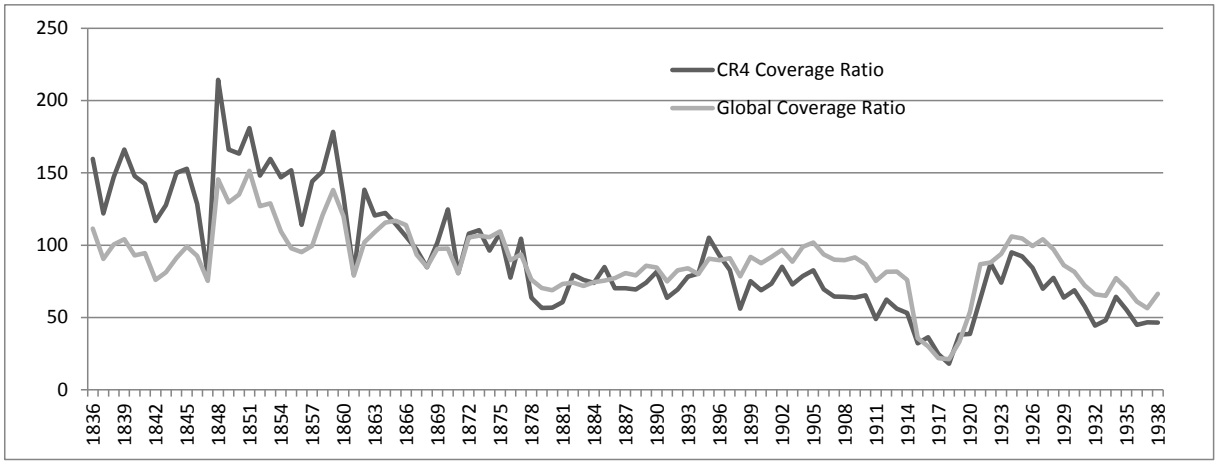


Figure 5 Relation between Herfindahl index of exports and GDP per capita (1836-1938)



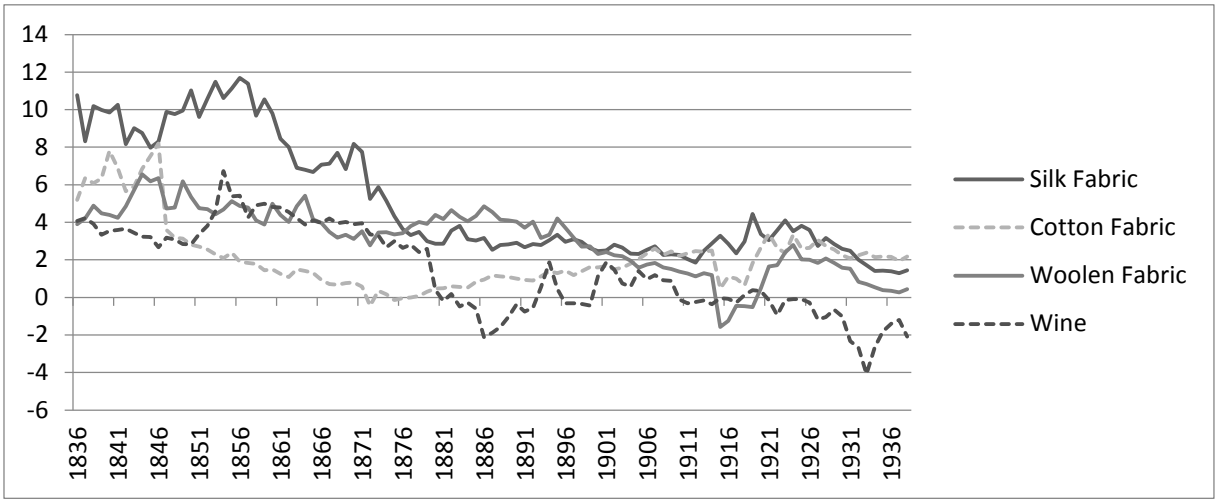
Source: Data on GDP per capita are taken from the Maddison Project Database.

Figure 6. Foreign trade coverage ratios between 1836 and 1938



Source : Tableau général du commerce de la France avec ses colonies étrangères (1836-1896) ; Tableau général du commerce et de la navigation (1897-1938) ; own calculations.

Figure 7. Lafay Index of specialization for Top 4 exports between 1836 and 1938



Source : Tableau général du commerce de la France avec ses colonies étrangères (1836-1896) ; Tableau général du commerce et de la navigation (1897-1938) ; own calculations.

Table 1 Estimations for Stability in French specialization between 1836 and 1861

Start	End							
1836-37	1838-40	1841-43	1844-46	1847-49	1850-52	1853-55	1856-58	1859-61
β	1,0095	0.972	0.975	0.927	0.97	0.933	0.908	0.862
t*	-0.775	1,788	0.985	2,945	0.957	1,679	2,485	4,272
β/r	1,019	0.988	1,107	0.97	1,033	1,039	1,002	0.938

Note : $t^* = (1-\beta)/\sigma_\beta$, we accept the hypothesis : $\beta = 1$ (at 1%) if $t^* < 2, 612$

Table 2 Estimations for Stability in French specializations between 1859 and 1885

Start	End	Start	End	Start	End	Start	End
1859-61	1862-64	1862-64	1865-67	1865-67	1868-70	1868-70	1871-73
β	0.8655	β	0.9625	β	0.908	β	0.899
t*	9,945	t*	2,837	t*	4,811	t*	6,213
β/r	0.879	β/r	0.974	β/r	0.934	β/r	0.918
Start	End	Start	End	Start	End	Start	End
1871-73	1874-76	1874-76	1877-79	1877-79	1880-82	1880-82	1883-85
β	0.888	β	0.861	β	0.89	β	0.883
t*	5,808	t*	3,518	t*	4,456	t*	5,881
β/r	0.915	β/r	0.974	β/r	0.934	β/r	0.912

Note : $t^* = (1-\beta)/\sigma_\beta$, we accept the hypothesis : $\beta = 1$ (at 1%) if $t^* < 2.612$

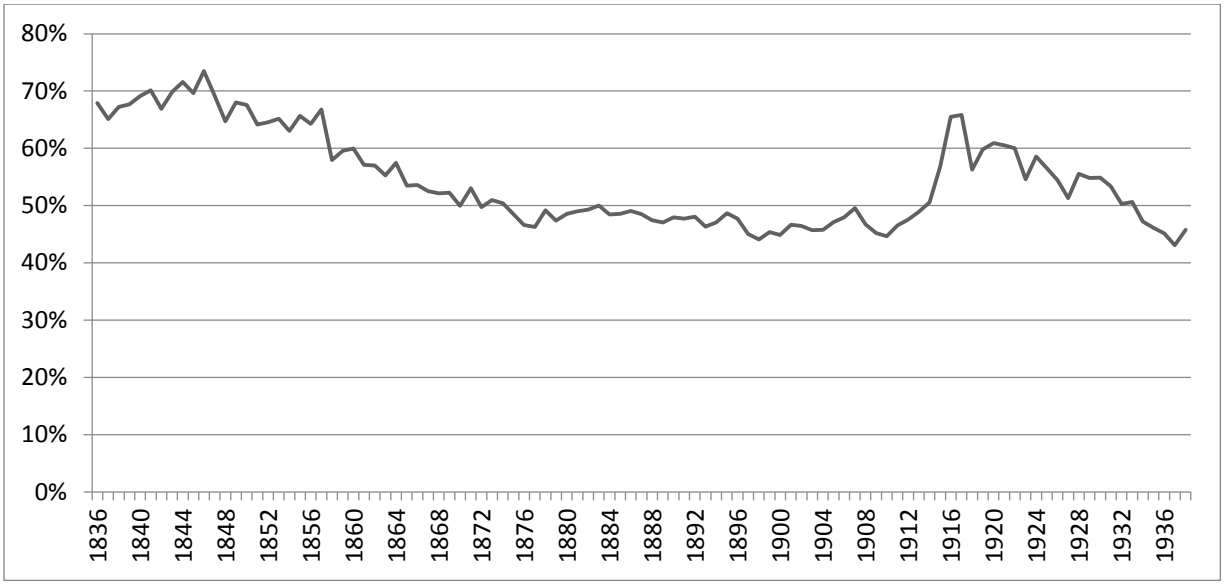
Table 3 Estimations for Stability in French specializations between 1883 and 1938

Start	End			
1883-85	1886-88	1889-91	1892-94	1895-97
β	1,0009	1,011	0.969	0.883
t*	-0.043	-0.439	0.955	3,943
β/r	1,029	1,055	1,037	0.946
1895-97	1898-1900			
β	0.921			
t*	3,364			
β/r	0.96			
1898-1900	1901-03	1904-06		
β	0.981	0.89		
t*	0.721	3,443		
β/r	1,027	0.963		
1904-06	1907-09	1910-1912		
β	1,038	0.905		
t*	-2,236	3,1169		
β/r	1,056	0.968		
1910-12	1913-15	1916-18	1919-21	1922-24
β	0.986	0.546	1,0535	1,246
t*	0.433	7,4825	-0.947	-4,111
β/r	1,051	0.885	1,238	1,423
1922-24	1925-27			
β	0.912			
t*	3,262			
β/r	0.963			
1925-27	1928-30			
β	0.875			
t*	7,859			
β/r	0.894			
1928-30	1831-33			
β	0.859			
t*	3,824			
β/r	0.958			
1931-33	1934-36	1937-38		
β	0.944	0.965		
t*	2,1176	0.906		
β/r	0.989	1,06		

Note : $t^* = (1-\beta)/\sigma_\beta$, we accept the hypothesis : $\beta = 1$ (at 1%) if $t^* < 2.612$.

Appendix I

Figure A1. Share of Manufactured Products in total exports between 1836 and 1938



Source : Tableau général du commerce de la France avec ses colonies étrangères (1836-1896) ; Tableau général du commerce et de la navigation (1897-1938) ; own calculations. Note that manufacturing classes were given in the Tableau and may not correspond to the modern SITC definitions.

Table A2 For exports and imports, number of years in top 10 between 1836 and 1938 and average ranking.

Exports			***Imports***		
Products	Number of ways in top 10	Average ranking	**Products**	Number of ways in top 10	Average ranking
Silk Fabric	103	1.90	**Raw Cotton**	103	3.43
Woolen Fabric	91	2.95	**Raw Wool**	98	3.19
Cotton Fabric	88	4.48	**Raw Coal**	94	4.46
Wine	87	3.72	**Corn**	85	3.85
Trinkets	81	5.35	**Plain timber**	79	6.08
Garments and Underwear	68	6.78	**Raw Silk**	75	3.20
Leather or leather articles	68	7.72	**Leather unrefined**	75	7.69
Wool	57	5.37	**Coffee**	51	8.94

Silk	55	6.19	**Oleaginous grain**	50	7.12
Tools in metal	28	7.64	**Wine**	49	4.80
Chemical products	26	5.31	**Cattles**	30	7.67
Automobile	26	8.31	**Colonial sugar**	29	5.17
Spirits	25	8.24	**Seed**	21	5.45
Corn	23	6.00	**Oil**	18	6.56
Papers and its applications	23	8.04	**Machines and Mechanicals**	18	8.17
Refined Sugar	22	8.64	**Engine**	15	7.20
Works in Hide	21	6.48	**Linen**	15	8.73
Iron. Melting, Steel	19	2.95	**Copper**	11	9.09
Taned Hides	17	9.12	**Olive Oil**	11	7.09
Machines and Mechanicals	14	5.43	**fruits**	10	8.70
Hides unrefined	12	8.92	**Linen and Hemp thread**	8	8.00
Linen and Hemp fabric	11	5.92	**Tabacco**	8	8.88
Pottery, glass, crystal	11	9.00	**Foreign sugar**	7	9.71
Cheese and butter	10	8.88	**Oleaginous fruit**	6	7.17
Fashions and flowers	7	8.57	**Woolen fabric**	5	6.60
Fine Pearls	5	6.20	**Iron, Melting, Steel**	5	4.40
Arms, powder, munitions	4	3.25	**Rubber**	5	8.20
Works in rubber	4	9.75	**Meat**	4	6.5
Iron ore	3	8.67	**Indigo**	4	9.50
Prepared skins, hides	2	6.50	**‘Cendres et regrets d’orfevre’**	4	8.00
Cotton	2	8	**Gem**	4	8.00

Gem	2	8.5	**Fine pearls**	3	8.67
Unrefined suggar	2	9.5	**Arms, powder, munitions**	3	4.33
Wool thread	2	10.00	**Tools in metal**	3	8.00
Horses, mules, cattles	2	10.00	**Cotton Fabric**	3	8,67
Coal	1	3.00	**Linen and Hemp fabric**	3	7.00
Rubber	1	5.00	**Thread**	2	6.50
Madder	1	9.00	**Refined sugar**	1	7.00
			Cellulose	1	10.00

Appendix 1 presents, for exports and imports, how many times one item is in the top 10 between 1836 and 1938 and the average rank for each product. For example, in exports, silk fabric witch appeared as the top French specialization in the period is 103 times in top 10. This product has the highest average ranking at 1.9.