NBER WORKING PAPER SERIES

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Working Paper 20851
http://www.nber.org/papers/w20851

NATIONAL BUREAU OF ECONOMIC RESEARCH
1050 Massachusetts Avenue
Cambridge, MA 02138
January 2015

We benefited from the comments of participants in seminars and presentations at the 2014 meetingsof the Economic History Association, INSEAD, Universitat de Barcelona, University of California-Berkeley, Université de Genève, Paris School of Economics, Université Paris-Sud, Queen's University, and the Shanghai University of Finance and Economics. We also thank Concepción Betrán, Dan Liu, and John Tang for their suggestions. Data collection funded by the Social Sciences and Humanities Research Council of Canada and a grant from the Université Libre de Bruxelles. The usual disclaimer applies. The views expressed herein are those of the authors and do not necessarily reflect the views of the National Bureau of Economic Research.

Technology and Geography in the Second Industrial Revolution: New Evidence from the Margins of Trade
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NBER Working Paper No. 20851
January 2015
JEL No. F14,F15,N73

ABSTRACT

In the Belle Époque, Belgium recorded an unprecedented trade boom, but growth in output per capita was lackluster. We seek to reconcile this ostensible paradox. Because of the sharp decline in both fixed and variable trade costs, the trade boom was as much about the expansion in the number of products delivered and markets served as it was about shipping more of the same old products. We use a new highly disaggregated data set on bilateral exports at the product level to illustrate these claims. In line with new trade theory, the effect of trade on productivity was mediated by sector-level firm heterogeneity and product differentiation. In new technology sectors, like tramways, the high degree of firm heterogeneity amplified the effect of trade on productivity. But in other sectors, mainly old staple industries like cotton textiles, a high level of firm uniformity muted the effect of trade. Into the twentieth century, old staples trumped new technology sectors, per capita income growing modestly as a result.

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I. Workshop to the world: Round two

Of the known unknowns about the dynamics of globalization, the relationship between international trade and economic growth presents a vexing question. Consider Belgium's trade boom between 1870 and 1914. In the mid nineteenth century, the country exported a narrow range of products to a handful of destinations. By the eve of the war, the number of products shipped abroad had more than doubled, and so did the number of export destinations. Like the UK fifty years earlier, Belgium had emerged as a workshop to the world.[1] The trouble is that, despite the exceptional performance in trade, growth in output per capita failed to accelerate in step.

There are a number of competing explanations of the link between trade and growth in the late nineteenth century. In the factor-endowment framework of O'Rourke and Williamson (1999), the exchange of New World resources for Old World manufactures, the signature trade of the period, promoted convergence in real wages. This portrait of the Belle Époque would come as a surprise to a transporter in Antwerp for whom intraindustry shipments were as important as interindustry ones, if not more so. In Temin's (1997, 2000) Ricardian model of the industrial revolution, the broad brush of technological change promoted and sustained UK export superiority across a broad range of sectors.[2] But in the second industrial revolution, the mapping of exports onto productivity fit awkwardly. Typically, a Ghent textile manufacturer sold goods in low and high-productivity countries alike, even the UK.

Other leading trade models yield different predictions—and raise other problems. In a model incorporating increasing returns and a "love of variety" (Krugman 1979), the process of economic growth expands the range of goods produced and exported (Hummels and Klenow 2005). The implication is that, by the late nineteenth century, because of home-market effects and agglomeration economies industrial and export activities would have been concentrated in the largest and richest domestic markets, the U.K., France, and Germany. Relatively smaller and poorer countries would have been shut out from many

[1] During this same period, Kindleberger (1956) reported comparable transitions in the Netherlands, Switzerland, and to some extent in Scandinavia.

[2] Temin (2000) believed that the British experience was unique:

> I showed in my [Temin] 1997 article that the list of manufactures exported from England was very long and very different from the list of imports. It seems unlikely that any other country was exporting "other manufactures" in such diversity and at such low prices…There are trade data for other countries in this period; did these other countries export the same astonishing variety of manufactured goods as Britain? If not, and I predict not, then the suggestion of intra-industry trade must be deemed ahistorical.

destinations. This depiction is at odds with Belgium's achievement. The increase in the export share of GDP was about twice that of big and rich economies (O'Rourke and Williamson 1999, p. 30; Huberman 2012, p. 6). By 1900, the country was the fifth largest exporter in Europe (De Leener 1906). Taking the Krugman model as a baseline, Belgium was clearly punching above its size.

This paper presents a new perspective on Belgium's trade boom, and, more generally, the relationship between globalization and growth before 1914. We do so in several ways. First, we introduce explicitly trade barriers, specifically the fixed costs of entering a new destination and creating a market for a new product. A Krugman-type model assumes only variable trade costs and predicts that all goods are exported to all countries, if they are exported at all. A typical feature of the period, however, was that new goods were not shipped everywhere and that new destinations did not receive all goods. To explain this phenomenon, we posit that beachhead or fixed costs varied across products and destinations, and that firm-level productivity was heterogeneous within sectors. The intuition is that barriers to trade and relative productivity were two sides of the same coin (Romer 1994). Below some threshold, unproductive firms did not export. Thus the surge in exports could have represented an increase in the innate productivity advantages of new and more firms to overcome the threshold. But it may have also been the case that more firms participated in trade because the fall in trade costs, in certain products and destinations, established a lower threshold of exporting.

The second contribution of the paper is the attention we give to fixed costs. Classic studies (Harley 1988) of international trade in the period have tended to focus on transport costs, which are typically classified as "variable" or ad valorem. This focus is partly due to the availability of information on freight rates. Exploiting the comprehensive reports prepared by an international network of trade diplomats, organized and subsidized by the Belgian state, we identify the role of business intelligence in lowering the threshold of setup costs in new markets and for new goods.

Our final contribution derives from the level of analysis. In effect, the impact of trade costs is revealed in the margins of trade: the intensive margin (bilateral exports per product or total exports per country) and the extensive margin (the number of products exported to a destination or the number of countries served).[3] Using granular trade data,

[3] A parallel decomposition holds for imports. We refer to export margins throughout this paper. Here, by assumption, and because of the lack of firm-level data, we mainly identify firms with products. The contemporary trade literature draws on firm-level data and, occasionally, firm shipments. See Cadot et al. (2012) for a review of recent research.

our decomposition of trade renders a novel interpretation of the supposed paradox of globalization and productivity in Belgium before 1914. Because of the sharp decline in both fixed and variable trade costs, the trade boom was as much about the expansion in the number of products delivered and markets served as it was about shipping more of the same old products.[4] In support of new trade models (Chaney 2008), the effect on the number of products was amplified in sectors with a high level of product differentiation and a high degree of uniformity in productivity across firms. The rub was that the fall in trade costs in the same sectors had the likelihood of attracting previously uncompetitive firms into export activity.[5] In this fashion, the expansion in trade between 1870 and 1913 went hand-in-hand with modest growth in output per capita.

Aside from data availability, our choice of Belgium merits comment. In many ways, it was a microcosm of late nineteenth-century Europe. It shared a common institutional framework, the legacy of longstanding commercial and political relations with its neighbors. It participated in, if not initiated, international trade agreements on the Protection of Industrial Property (1883) and the Brussels Convention on unfair competition (1900). Typical of other continental economies, the proportion of intraindustry trade exceeded that of interindustry exchanges. And like many of Europe's small economies, it maintained low tariffs in the face of rising protectionism on the continent.

The puzzle we have identified is not particular to Belgium. In fact, the evidence on the output gains of trade before 1914 is decidedly thin (O'Rourke 2000; Irwin 2002; Liu and Meissner 2013). For skeptics, tariff protection seems to have been an ally as much as an adversary of productivity growth. But different policies may have had different and offsetting effects in a world of trade costs and imperfect competition. In Belgium, the state promoted trade liberalization, but it also invested in an international network of diplomats that grew the trade boom. On this basis, the opposition of states and markets is a false dichotomy.

Allen's (2009) general model of industrialization provides an alternative framework to situate our findings. Allen observes that in the first half of the nineteenth century, a period in which economies were relatively closed, continental wages were too low (and energy prices too high) relative to British levels to bring about the adoption of modern technology. The open-economy forces of the last quarter of the century ought to have

[4] From a conceptual perspective, the extensive margin exists because firms that could not cover fixed costs do not export at all.

[5] The same decline in trade costs may have led to more import competition. But these types of forces were likely to be muted in a small-open economy like Belgium producing new goods in differentiated markets.

pushed wages up in economies like Belgium which was also abundant in coal (O'Rourke and Williamson 1999; Liu and Meissner 2013).[6] As more productive firms congregated in the export sector, and uncompetitive firms closed down, the trade boom would have nudged continental economies closer to the technological frontier, a defining feature of the second industrial revolution, However, Belgium did not seem to benefit entirely from the positive selection effects of trade.[7] Into the early twentieth century, Belgian wages decidedly lagged British levels. In this regard, the decline in trade costs had generated a race between a core group of technologically advanced incumbents and new low performing entrants in export activities. The final balance sheet was mixed, the trade boom having only a moderate effect on growth.

The paper is organized as follows. In the next section, we describe the trade costs that precipitated the trade boom, and identify two features of the Belgian economy, the large share of small firms and the degree of product differentiation of exports, that may help explain the absence of a strong effect of the decline trade costs on economic growth. We proceed to introduce a simple new trade model that incorporates these parameters, along with fixed and variable trade costs. The model makes several predictions about the relation between trade costs, the margins of trade, and economic growth. Next, we present our dataset on Belgian exports. We then evaluate the effect of trade costs on the extensive and intensive margins. In the last section of the paper, we study the impact of the trade margins on productivity growth.

II. International trade and economic growth in Belgium

Measured by the share of exports and imports in GDP in Figure 1, Belgium's international exposure increased at a rate of 1.1 percent per annum between 1870 and 1900, and 1.5 percent in the shorter period between 1900 and the eve of the war.[8] On a per capita basis, Belgium’s trade exhibited the fastest growth in Europe. The standard account of the trade boom starts with the transport revolution, which in Belgium can be dated to the opening of the Scheldt and subsequent investments in the port of Antwerp (Loyen 2002). Thereafter, maritime freight rate fell, by about 30 percent between 1870 and

[6] Neither the Stolper-Samuelson effects explored in O’Rourke and Williamson (1999) nor the market potential channel explored in Liu and Meissner (2013) depend on total factor productivity to bring about rising real wages and convergence. Gains from trade accrue solely from the elimination of resource-wasting trade costs.

[7] Between 1870 and 1913, Belgian wages remained at 75 percent of British levels (Williamson 1995). See Huberman (2008) and Scholliers (1995) on the persistence of the low-wage economy.

[8] Trade share of GDP in 1870 = .34; 1913 = .60. Figures based on nominal GDP from Smits, Woltjer, and Ma (2009), and trade values from Horlings (1997).

1913, much of the decline happening in the first part of this period (Jacks et al. 2010; Jacks and Pendakur 2011). Because of investments in its rail and canal networks, the sharp contraction in shipping costs was matched by that of inland freight rates.[9] Although Antwerp remained far and away the major hub of traffic, the share of five other international ports (in order of importance: Ostend, Ghent, Brussels, Bruges, and Nieuwpoort) increased over the period. According to one assessment (Suykens 1986, p. 375), competition among ports forced Antwerp to maintain the lowest pilotage and loading fees in Europe.

The decline in transport costs, while substantial, did not secure foreign market access, if only because all countries benefited from lower freight rates. In contrast, the fixed costs of acquiring international market presence were not only considerable, but idiosyncratic, because they varied across products, and by sources and destinations. These costs ranged from gaining familiarity with local market conditions, to establishing or accessing wholesale networks, and learning about shipping methods and customs' formalities. Belgium faced particular disadvantages in this regard. Unlike France and Great Britain, the country did not reap the advantages of a large empire; unlike Germany and Italy, it could not rely on emigrants to promote its goods.[10]

Belgium pursued a mixed strategy of reducing fixed costs. From the 1860s, the country accorded most favored nation treatment with its close neighbors and new trading partners.[11] The number of treaties peaked in the decade after France and Germany approved restrictive trade policies. In addition, the country signed general trade agreements, *traité d'amitiés*, for instance with Venezuela in 1884, and specific treaties, such as protocols safeguarding product design and trade marks with Romania in 1881

[9] On maritime and inland transport costs, see Jacks and Pendakur (2011). On the Belgian rail network, see Huberman (2008).

[10] From 1885 to 1908, the Congo Free State was the private enclave of the Emperor Léopold II, after which it became a colony of Belgium. In 1900, the Congo accounted for less than 5 percent of manufacturing exports. On empire and trade, see Mitchener and Weidenmeir (2008). As for immigration, the trade consul in the US mid west (*Recueil Consulaire* [hereafter *RC*], vol. 86 (1894), p. 394) observed a large concentration of Belgian immigrants in Green Bay, Wisconsin. The consul went on to report that the new arrivals did not have much need for Belgian goods, especially cheese.

[11] In the wake of the Cobden-Chevalier treaty of 1860, Belgium signed a MFN agreement with France in 1861, followed by treaties with Britain (1862), the Netherlands (1863), and Prussia (1865). Late into the century, when the two-tier tariff system was widely adopted in Europe, the country negotiated agreements with new partners, including Mexico (1895) Greece (1904) and Bolivia (1912). On Belgian commercial policy, see Degrève (1982). In the empirical sections of this paper, we rely on Pahre's (2007) dataset of trade treaties.

(*Traités de commerce* 1900). As for financial risk, the adoption of the gold standard (1878) progressively locked in exchange rates with its commercial partners.[12] All told, the uncertainty of doing business abroad declined since trade policy reversals became more predictable—but also less likely.

Still, across these measures, Belgium had no apparent advantages, acting as much as a follower as leader. In many ways, 'natural' disadvantages of size constrained access to foreign markets. Big countries, like Germany and the US, tended to have a high proportion of large firms that achieved lower unit costs because of large domestic markets, and that also had the capacity to invest in merchant houses and networks of agents in the field (De Leener 1906, p. 156). Because of their ties to financial institutions, German manufacturers offered foreign customers favorable credit terms. In contrast, the average size of firms was smaller in Belgium—we return to this feature below—and industry concentration considerably less. Belgian firms had few if no commercial agents, often depending on the availability of British and German services (De Leener 1906, p. 16). And while Belgian had a developed financial sector, with some exceptions, most exporters had limited means to offer financing.

Belgium's comparative advantage seems to have been embedded in its particular institutional framework (Nunn and Trefler 2014), the outcome of the role it had established for itself in the international community. As a small, open and non-aligned country, Belgium sought to participate, and often initiate, international networks, such as those in the fields of labor and social reform, and science. The state's engagement to nurture trade networks (Rauch 1999) was an extension of this preoccupation. At home, the country hosted a series of international trade fairs (Antwerp 1885 and 1894; Brussels, 1888, 1897, and 1910; and Liège 1905) that showcased export lines. Abroad, Belgium was the first foreign country to have a chamber of commerce in New York (Bairoch 1989, p. 97). Since private initiatives in this field had proved to be insufficient, the state assumed responsibility for establishing an international presence in support of commercial interests.

From an early date, the state invested resources in developing an extensive network of consular offices. The first delegates at mid century were located in neighboring countries, but, as early as 1870, Belgium was represented on all continents, even if trade with many regions was trivial or non-existent. At the turn of the century, of the nearly 600 representatives (some of whom were actually foreign nationals) in 84 destinations (independent countries and colonies), more than half were located outside the European

[12] On the gold standard and trade, see López-Córdova and Meissner (2003).

core (De Leener 1906, p. 209).[13] Altogether, spending on political and consular agents rose from 0.6 million francs in 1860 to 1.5 million in 1890 (Bairoch 1989, p. 96). The consular network was complemented by the presence of foreign representatives in Belgium. Figure 2 summarizes the available information on Belgian and foreign diplomats, along with other means the country exploited to manage trade costs. The spike in delegates, and other measures after 1890, conforms to the sharp upswing in trade in the decades before the war.

The reports of the consuls, published annually in the *Recueil consulaire* (*RC*), provided an inexhaustible source of business intelligence for Belgian manufacturers.[14] In 1910, the *RC* comprised 5 volumes, containing 127 reports on 41 countries, and covering over 250 different items. The state promoted Belgian goods and effectively subsidized the fixed and variable costs of conducting business abroad. The résumé on Chile (*RC*, vol. 63, 1888, pp. 325-53) concentrated on exchange rates, tariff policy, and internal transport; that for Japan (*RC*, vol. 39, 1882, pp. 23-71) on consumer preferences and freight rates; the report on the Philippines on packaging, labeling, and the importance of keeping to contractual deadlines (*RC*, vol. 142, 1908, p. 492-501). Ever practical in their outlook, the consuls gave recommendations on opportunities in individual markets. The representative (*RC*, vol. 53, 1885, p. 138) in Lisbon acknowledged that, although the productivity of British cotton-textile workers was superior and that Lancashire's hold on foreign markets in "sheetings" and "shirtings" was impenetrable, Belgian firms had opportunities for "towlings, embroidered textiles, checked domestics," among other narrow varieties.[15] Did this type of information reduce the probability of failure? Although we give a more definite answer below, at first pass, the answer would be in the affirmative. In 1890, Japan, was not a major destination for Belgian goods. In the next two decades, the number of diplomats doubled, from 4 to 8. By the eve of the war, Japan was Belgium's eighth largest export destination.

The collapse in trade costs ought to have coincided with a movement of resources to the export sector and the shuttering of uncompetitive import-competing concerns. After all, there was no shortage of capital, and because of its dense rail network, Belgian workers

[13] Figures on the diplomatic network are from *RC*, vol. 106 (1900, pp. 3-45).

[14] The geographical distribution of the reports mirrored that of the trade diplomats. Based on the countries listed in the indexes of the *RC*, in 1870 the percent of European reports was 40 percent; by 1910, the figure was cut in half.

[15] The consul in Chile (*RC*, vol. 63, 1888, p. 374) gave a typical list of market opportunities: "lingerie confectionnée pour hommes, de toutes étoffes (chemises, caleçons, gilets, pantalons, cols, cravates, etc.), la lingerie confectionnée pour dames (bonnets, chemises, jupons, peignoirs, cols, collerettes, manches, mouchoirs, etc.), la lingerie de table, de toilette et de bain (nappes, serviettes, peignoirs, caleçons, etc)."

were highly mobile across sectors (Huberman 2008). The terms of trade would have improved. For the most part, however, structural change was glacial, economic performance being hostage to a handful of regionally based staple industries, such as textiles and glass making (De Brabander 1981). There was no discernible trend in patents delivered (*Annuaire statistique*, various years) and human capital formation was weak, levels of education being well behind the European norm. Summarizing the dominant narrative, Van der Wee and Goossens (1991) described a *fin-de-siècle* economy "ossified, rigid, and imprisoned in traditional, unviable sectors, without economic future." Overall, growth in Belgian per capita growth was about half that of the trade component of GDP. Until 1890 it was 0.65 percent per annum, and only slightly more, 0.89 percent, in the decades before the war (Horlings and Smits 2002, p. 86). The second industrial revolution seemed to have pass Belgium by, the 'modernization' of industry postponed until the 1920s (Boschma 1999).

In the absence of an overarching explanation, the literature does provide several clues that may help in explaining the weak effect of the trade boom on output per capita. First, was the nature of the export expansion itself. Drèze (1960, 1989) claims that because of its small domestic market, Belgium restricted exports to "standardized goods," that is semi-finished and non-differentiated goods.[16] High entry costs in distant markets compelled firms to sell to customers close to home and ship more of the same goods, as opposed to diversifying into new markets and new goods. The high degree of substitution between foreign and Belgian goods had the same effect. As a result, Drèze concluded, the lack of specialization dampened the potential gains of trade.

This image clashes with the testimony of foreign diplomats on product differentiation.[17] It does not follow, however, that the expansion in product varieties translated into higher per capita income. In fact, Drèze's explanation can be turned on its head. The export of specialized goods may have had ambiguous effects on productivity, because competitive forces were weaker in highly differentiated and often farflung markets. In markets with a greater degree of substitution between goods, competition would have been stiffer, and firms had to meet high performance standards to survive.

A related feature of the Belgian economy was the predominance of small firms. Business historians (Van der Wee 1984) concur that big concerns and dynamic enterprises were few and far between, even in the international sector (Cassiers 1989). During the

[16] Drèze (1989) is a translation of the original article in French published in 1960.

[17] Rauch (1999) made the more general point: By their very nature, few manufactured commodities are actually traded in organized markets.

peak years of the trade boom after 1896, the absolute size of the domestic or putting-out sector actually increased (Belgium, *Recensement* 1910; Delbeke 1982). The degree of industry concentration was comparatively low (Van Meerten 2003). Cooperation between investment banks and industry was restricted to transport and iron and steel, and, even in these sectors, cartelization was less pronounced than in Germany.

This portrait is curious because in dynamic export economies, firms in the tradable sector have been found to be generally larger, more capital intensive, and more productive than those in the domestic sector (Bernard et al. 2006, 2007). The claim is that firms operating below a certain profit threshold do not export. In cases where the distribution of firms is concentrated or heterogeneous, the fall in trade costs causes a shift in resources to highly performing concerns, aggregated productivity increasing as a result. Using contemporary data on Sweden, Ferguson and Forslid (2014) report that large and medium sized firms benefit most from government spending on trade promotion, like the establishment of foreign trade consulates. Again, these results can be inverted. If the distribution of firms is uniform, a small change in trade costs would enable those firms clustered slightly below the profit cut off to enter export activity, leaving only a small footprint on productivity.

In the remainder of this paper, we study the impact of trade costs, both fixed and variable, on the Belgian trade boom and output per capita. Our claim is the effects of trade costs were mediated by the degree of product differentiation and the distribution of firms. The expansion in the number of products might have come at the expense of productivity in differentiated goods industries and in sectors dominated by firms of similar size. To sort through the possible outcomes, in the next section we present a simple model of international trade that integrates both product and firm differentiation.

III. Trade costs and trade margins: A conceptual framework

Consider Chaney's (2008) model of international trade in which firms produce a range of differentiated goods. Assuming a Pareto distribution, firms are heterogeneous with respect to their labor productivity. The amount of heterogeneity in firm-level productivity is summarized by the shape parameter γ. As γ increases, firms are more homogeneous and productivity is more uniform. Consumers purchase a set of products, each good containing a number of varieties. Firms are identified by varieties. Each product, k, is allowed to have a different elasticity of substitution between varieties, σ^k, such that varieties of a product with higher σ are closer substitutes for each other. Chaney's setup provides for variation within industries (which is to say within products) in firm productivity. Since we have no information on shipments by firm and are restricted to product level data, our specification will equate each item exported as a variety produced by a representative firm, or a set or firms within which firms were sufficiently homogenous. Firms are heterogeneous in productivity across products. In this setup, a sector *k* consists of a group of products. As such, we will largely be interested in the bilateral value of exports for a sector *k*, the value of exports in a sector per good, and the number of goods exported.

With this framework, Chaney starts with observation that lower trade costs decrease the productivity threshold necessary for firms to attain export status. He proceeds to compare the effects of changes in variable and fixed trade costs on bilateral (aggregate) exports for a sector, exports per firm (the intensive margin) and the number of firms engaged in export activity (the extensive side). The breakdown is informative because changes in the fixed and variable costs on trade have different implications for exports per firm and the number of exporters.

Start with the effect of variable trade costs on trade. The elasticity of exports to a country *d* for sector *k* with respect to a change in variable trade costs is given by the sum of the elasticities on the intensive margin and the extensive margin:

$$\xi_{k\tau} \equiv -\frac{d\ln x_{dk}}{d\ln \tau_{dk}} = \overbrace{(\sigma^k - 1)}^{\text{intensive margin}} + \overbrace{\left(\gamma^k - (\sigma^k - 1)\right)}^{\text{extensive margin}} = \gamma^k \tag{1}$$

The overall elasticity of export values for a change in variable trade costs is larger as firm-productivity heterogeneity declines, or γ increases. The first component, $(\sigma^k - 1)$, denotes that the impact of a change of variable trade costs on the intensive margin (exports/good) decreases in the degree of product differentiation or the elasticity of substitution of σ^k. The impact on the extensive margin depends on both productivity heterogeneity and the elasticity of substitution between goods. The strong prediction here is that, in a gravity regression for *total* exports in a given sector, the coefficient on measures of variable trade costs should be larger in absolute magnitude in industries in which firms do not differ much in their productivity.

Consider next the effects of changes in the fixed costs of trade. Chaney (2008) demonstrates that the elasticity of bilateral exports of a given sector *k*, with respect to a change in the fixed costs of trade, is given by

$$\xi_{kf} \equiv -\frac{d\ln x_{dk}}{d\ln f_{dk}} = \overbrace{0}^{\text{intensive margin}} + \overbrace{\left(\frac{\gamma^k}{\sigma^k - 1} - 1\right)}^{\text{extensive margin}} = \frac{\gamma^k}{\sigma^k - 1} - 1 \qquad (2)$$

where f denotes the fixed costs of exporting a particular good. By inspection, fixed costs affect the total value of trade, but *only* through the extensive margin. The intuition is that demand for a particular good is not related to fixed costs. Fixed costs affect only the entry decisions of goods (firms). Moreover, the elasticities on the extensive margin and on total trade are related inversely to the level of firm-level heterogeneity, and positively to the degree of product differentiation. In industries with significant firm-level differences in productivity, the overall elasticity is expected to be small in absolute value. Holding firm-level heterogeneity constant, industries with a high level of differentiation, or a low elasticity of substitution between home and foreign goods, would have large elasticities. In other circumstances, a high degree of heterogeneity may offset a high level of product diversification, and the elasticity would be smaller.

The Chaney model informs our resolution of the Belgian paradox. We are specifically interested in three main predictions of the model.

1) Whereas the decline in variable trade costs affected both intensive and extensive margins, the decline in fixed costs caused a change in the extensive margin only.

2) The decline in trade costs raised bilateral trade as the degree of product differentiation and the uniformity of productivity across firms increased.

3) The effects of lower trade costs (and increased trade) on sectoral productivity also varied. In sectors with a high degree of firm heterogeneity, productivity increased in step with trade. But in sectors in which firms were more similar, and product diversification greater, the effect of trade on productivity was softened.[18]

[18] In theory, some firms at the low end of the productivity distribution, often those producing exclusively for the domestic market, might have been eliminated due to competition from imports. Some caveats may apply. Our story concentrates on the declines in trade costs in new markets arising from Belgian investments in diplomatic capital and other beachhead costs. In these cases, Belgium may have faced relatively little direct competition from producers in less developed countries because of different patterns in specialization

III. Boats, cars, and trams: Belgian trade, 1870-1914

Our main data source on international trade is the *Tableau général du commerce extérieur*. We recorded the trade of manufactured goods, which represented about 50 percent of all exports in 1900 and 20 percent of all imports, at five-year intervals beginning in 1870 and until 1910.[19] The *Tableau* separates goods in transit from those manufactured in Belgium. It includes shipments along all means of transport which remained relatively stable over the period. For exports, about 45 percent of goods were shipped by boat, a similar share by land transport, and 10 percent by barge using the canal and river system. The Appendix gives background information on the *Tableau* and the methodology used in defining new and established goods, categories of goods, and destinations.

Figure 3 depicts the growth in the (net) number of export items and destinations. The expansion in products has a sharp break after 1890; that in destinations was steady, reflecting, no doubt, the limit in the number of outlets available. The approximately 70 outlets recorded in 1910 was a considerable achievement since there were less than 200 potential trading partners, composed of sovereign states, colonies, and territories, at this date. The steady accretion in destinations is at odds with a world of zero gravity (Eaton and Kortum 2002), or a world without fixed costs of trade, in which initially firms would have sold products to many destinations and, as new products came on stream would have them shipped to a comparable set of markets. In presence of significant entry costs, firms learned about their export potential market-by-market (Albornoz et al. 2012). At first, they might have restricted export lines to a handful of the lowest cost destinations, and then expanded the scope of their markets, either because trade costs declined or because of productivity improvements.

The types of goods traded and destinations (Figures 4A and 4B) evolved over the period. The relative share of textile exports declined, although it still amounted to about 30 percent, whereas that of clothing, metal products, and vehicles increased. The persistence of textiles as a major export item gives credence to Van der Wee and Goossens's (1991) claim about a torpid economy steeped in old staples. That said, the share of exports of these same industries may also indicate that trade costs had fallen

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and gaps in technology. Owing to the country's size and location, it was also likely that, in many of the industries we study, most firms were exporters. In this case, marginal firms become less productive when trade costs fall.

[19] In a previous treatment of the *Tableau*, Degrève (1982) was mainly concerned with estimating the value of trade. His presentation does not identify export destinations and import sources.

considerably to permit even low-performing firms in differentiated goods markets to extend their reach. The rest of Europe bought more than 90 percent of exports in 1870, but by 1910 its share had dropped to about 65 percent, replaced by the development of new markets in Africa, the Americas, and Asia.

In making their recommendations on market opportunities, the trade delegates classified goods by the degree of overlap or substitution between rival items. Along this line, in the empirical sections of this paper, we divide products into four categories of differentiation.[20] Category 1, the least differentiated items, comprised labor-intensive manufactures, manufacturing inputs (for instance, threads, hides, parchment, and paving stones), and low-value metal products. These types of goods were destined primarily for domestic markets. Category 2 goods consisted of semi-skilled industrial goods and textiles. Product differentiation in this category was increasing in significance. The *Tableau* in 1910 identifies exports and imports of 17 varieties of cotton textiles (items 38-55 in the appendix). Category 3 included semi-skilled or high-skilled manufacturing goods with substantial capital input (high-end textiles, crystal, and elaborate and finished metal products), and category 4, the most differentiated goods, high unit value capital-intensive manufactures, such as tramways, ships, machines, and machine tools. By the turn of the century, Belgium exported streetcars made of copper, iron, steel and wood (items 164-167). Based on the number of references in the indexes of the *RC*, the trade diplomats devoted increasing attention to category 3 and 4 goods. This made sense since markets for category 1 and 2 goods were more competitive. Anticipating Rauch's (1999) concept of related trade, the consuls insisted that differentiated goods were not traded in organized or 'auction' like markets. Hence, the value placed by manufacturers in obtaining information on potential buyers and their specific preferences in order to establish brands and grow demand.

Figure 5 presents a closer look at the relationship between destinations and products. The number of destinations is estimated from a weighted regression of the number of countries served by each product on the number of periods Belgium had non-zero exports of this item, as well as a full set of period and good level indicators. After the first period, the conditional average number of destinations was 17.75. The average number of markets served peaked after five periods, leveling off at about 26 markets. Firms, it appears, built their market base sequentially, the ability to stay in each market being strongly correlated with the number of trading partners. This correspondence sits well with Besedeš and Prusa's (2006) finding that, while the duration of trade is very low

[20] The appendix gives full details on products by category and the value of trade by category.

for many products, if firms survive the initial period or two, and meet operating costs, they stay in these markets for a long time.

Finally, the above relationship is reversed in Figure 6 which gives the number of products delivered to each destination. The dispersion of products cannot be easily explained either by geography or by market size or income. As expected France, received the most products, but Switzerland imported as many products as the US and Argentina, countries at different levels of development and with different commercial policies. Canada and Japan became trading partners of Belgium around the same time and had the same arc in imports. Interestingly, the number of diplomats was the same in the two countries.

To summarize, the portrait of international trade that emerges from the *Tableau* differs considerably from that usually described by economic historians. The factor-endowment trade model of O'Rourke and Williamson presumes that goods were homogenous. A basic Krugman model of imperfect competition assumes a given number of destinations because it ignores fixed costs of entry. The dataset we have assembled points to the contrary on both fronts. The expansions in product categories and in destinations were the defining features of Belgium's trade performance before 1914.

IV. Trade costs and the extensive and intensive margins

In this section, we examine the basic predictions of the Chaney model regarding the effects of variable and fixed trade costs on trade. We are particularly interested to what extent the degrees of product differentiation and firm heterogeneity filtered the impact of trade costs. To gain leverage on these effects, we decompose the value of trade into extensive and intensive margins.[21]

We use gravity models of bilateral exports to study the impact of trade costs on the trade margins. As in Lawless (2010a, 20110b; Dutt et al. 2013), we are restricted to country level data. Our dependent variables are then: (1) bilateral exports; (2) the number of products exported per country (extensive margin); (3) average exports or the ratio of the value of exports to the number of products per country (intensive margin).[22] In subsequent gravity regressions, we explore bilateral exports of these margins for different industry or sector classifications. Since GDP data is limited, we use population of the trading partner as our measure of size. We include proxies for both variable and fixed

[21] The appendix estimates the relative importance of the extensive and intensive margins in bilateral exports.

[22] As before, we implicitly identify products with firms.

costs in our regression specification. In the absence of direct information on freight rates, we use great circle distance between national capitals to approximate transport costs. Other indicators of trade costs include whether or not the trading partner shared a common border and language with Belgium, signed a trade agreement, and pegged its exchange rate. We also exploit information on diplomatic representation both in Belgium and abroad, and include an indicator variable for whether the trading partner is a colony of another country. To the extent that these factors increased information and decreased uncertainty, they may be construed to be good proxies for the fixed costs of trade, although we acknowledge that they could also plausibly be associated with variable, ad valorem costs of trade. For instance, the reports of the diplomats provided business intelligence on setup costs for each product in each market, as well as information on tariff rates and transport costs.

The coefficients in Table 1 have the expected signs. For bilateral exports, Belgium traded more with bigger and more proximate markets. Entry costs were lower in independent states than in the colonies of other countries. Trade increased when the partner pegged its exchange rate and had signed a trade agreement. Investments in the consular network seem to have paid dividends, diplomatic representation in a foreign market growing the value of exports. So did the presence of trade delegates in Belgium. All told, business intelligence was a contributing factor in the Belgium trade boom.

There are subtle but important differences between the extensive and intensive margins in columns two and three of the table. The former is less responsive to distance than the latter. This is what we would expect if Belgium exported differentiated goods. In line with equation 2, the coefficients on variables that proxy for fixed trade costs are generally larger in the regression of the extensive margin. The presence of trade diplomats effectively reduced setup and other costs in new markets. The intensive side was less responsive to business intelligence of this type, the implication being that the diplomatic network operated mainly on fixed costs. A complementary reading is that new goods became known and new markets established, the effect of trade diplomats on average sales diminished. A trade treaty does not appear to have an effect on the extensive margin, perhaps because Belgium negotiated accords with countries with which it had previously established trade relationships. But it may also have been the case that an MFN agreement was less effective in opening doors than diplomatic ties, since trade in differentiated goods was dependent on informal related networks,

The bottom line of the Chaney model is the notion that the effects of trade costs on trade are mediated by the degree of product differentiation and the heterogeneity of firm productivity.[23] Consider a variable cost like distance. Standardized items would be shipped closer to home, and so, too, would have been older goods that had achieved a long product cycle, or those produced using well-known technologies. Conversely, highly differentiated goods may have found openings in faraway destinations because competition was slack in these markets. Neither would geography have been a barrier for firms retaining first-mover advantages or delivering newer goods developed on experimental technologies. As for the distribution in firm productivity, equation 1 implies that variable costs, like distance, would have had a larger negative impact on exports in industries in which firms are relatively similar.

To evaluate these effects on bilateral exports, in Table 2, we classify goods into the four categories introduced previously, the degree of product differentiation being lowest for category 1 goods. We expect heterogeneity to be lowest as well in category 1 since, from equation 2 (Chaney 2008), variable trade costs have a decreasing influence on the total value of bilateral trade at higher levels of firm-level heterogeneity. The impact of trade costs on trade did indeed vary with the degrees of differentiation in products and firms. For category 1 goods, trade costs strongly dampened trade. Exporters depended on proximity, an MFN agreement, and diplomatic representation to sell more goods. The effect of distance diminished with the degrees of specialization and firm heterogeneity. For category 3 goods, better intelligence obtained by the diplomatic network abetted trade. The most highly specialized goods in category 4 seem to have sold by themselves, reputation being a more important determinant of sales than an MFN agreement or diplomatic representation. For instance, Belgium was renowned for its streetcars, producers having customers in 40 destinations in 1910. Nevertheless, the exposure of these goods in the colonies and protectorates of Britain, France, and Portugal was delayed. According to Martínez López (2003), sales of tramways and investments in supporting infrastructure were concentrated in the Middle East and Southern and Eastern Europe, since U.K. manufacturers of similar goods invested heavily in the British Empire.

As a further test of the model's claim about variable costs, we investigated the role of distance on bilateral exports at the industry level. To start, we aggregated products into 20 different industries.[24] We then employed a gravity model of trade at the industry level

[23] We find similar results (not reported) when we include item specific dummies in a regression on the total value of bilateral exports by product in order to control for value to weight ratios within categories. Low value, high bulk goods should be more sensitive to distance, the opposite being the case for goods with high value to weight. It would also be informative to classify goods by their elasticities of substitution. Unfortunately, the data do not allow for this type of estimation.

[24] The industries selected are based on Gaddiseur's (1980, 1997) series of sectoral output.

that included the full vector of trade costs in Table 1. The results in Table 3 support the Chaney model. Producers of standardized goods, like wool and linen threads, were restricted to customers close to home. At the other extreme, machinery and streetcars, typical category 4 goods, were sent all over the globe. These findings would not come as a surprise to the trade consuls who implored manufacturers to intensify specialization so as to succeed in distant markets.

Next, exploiting information on the different categories of goods, we studied the association between variable and fixed trade costs and the intensive and extensive margins (value of exports per product and number of products). Recall the basic predictions of the Chaney model (equation 2). For the intensive margin, the effect of variable trade costs decreases with the degree of product differentiation, but fixed costs have no impact. As for the extensive side, the effects of variable and fixed costs of trade vary negatively with the elasticity of substitution between traded goods and the degree of firm-level heterogeneity. If the degree of firm-level heterogeneity increases (a decline in the Pareto dispersion parameter) in proportion to the decline in the demand elasticity, the impact on the extensive margin of fixed costs is expected to be similar across products.

To fix ideas on the effects of product differentiation and firm heterogeneity, consider the glass and crystal industry. Celebrated for its diversified product range, the industry served about 60 destinations in 1910, exports reaching distant markets in Asia with improvements in packaging. Still, the trade diplomats puzzled why the industry never achieved its potential of being world leader (*RC*, vol. 90, 1895, pp. 126, 304, 388, 421). According to one study (Douxchamps 1951), the patchwork of firms of different sizes impinged on export performance. At one end of the distribution, there was a large proportion of small firms exploiting artisanal techniques; at the other, a smaller group of large firms using state of the art technologies. Over the trade boom, the number of firms in the industry remained stable, with entry at both tails. The consequence was that while the degree of product diversification deepened the impact of declining trade costs on the extensive margin, the degree of firm heterogeneity had the opposing effect.

For the entire sample of products, Tables 4 and 5 invoke the gravity model to investigate the relationship between trade costs and trade margins for each category of goods. On the intensive side, defined as average sales (sales per product), the effect of distance declines as the level of differentiation and firm heterogeneity rises. Interestingly, several variables, including diplomatic representation, colonial status, and shared language, are statistically insignificant and relatively small. These variables approximate information available to manufacturers about foreign markets, and other technical, political, and economic barriers that comprise the beachhead costs of trade. In confirmation of Chaney's model, these variables are unlikely to operate through the intensive margin.

Table 5 gives direct results on trade costs and the extensive margin. The dependent variable is the number of products by category sold in a destination country.[25] Here the impact of our proxies for trade costs seems to be stable across categories, the effects of fixed and variable costs having roughly the same magnitude across industries and goods. This is consistent with models of heterogeneous firms in which the degree of heterogeneity increases, or γ declines, in proportion to the elasticity of substitution, σ. This seems natural since, as we surmised, the degrees of product differentiation and firm heterogeneity increase in tandem across the categories.

To summarize: The availability of high quality information and adequate commercial infrastructure, among other factors, fed the expansion in products and possibly in destinations too. In industries exhibiting a considerable degree of product differentiation, manufacturers could expect to sell goods in distant markets. But there was a flipside to this story. The effect of trade costs on trade varied inversely with the degree of firm heterogeneity. In the next section, we look at the implications of these offsetting forces on the relationship between productivity and growth.

V. The margins of trade and productivity: Case studies

New trade models give conflicting predictions about the effects of trade costs on aggregate productivity. A general reduction in trade costs, as in Melitz (2003), causes aggregate productivity to increase because of positive firm selection effects. Some of the weakest firms in the economy are forced to exit. The export sector benefits from the reallocation of resources, the most productive firms within the set of exporters increasing their share of the market (Melitz 2003); also, as revenues go up, exporters invest in new technologies (Bustos 2011). But the same decline in trade costs also lowers the threshold level of productivity required for domestic firms to begin exporting (Melitz 2003; Chaney 2008). This 'negative' selection effect might be substantial in export markets for highly differentiated goods. In these markets, firms do not compete head on against commercial rivals and, as a result, they can succeed in capturing market share. The positive reallocation effects arising from exit may be also less likely under these circumstances.

[25] This is the same definition of the extensive margin as before except it is by category. Santos Silva, Tenreryo and Wei (2014) rely on a similar definition.

In this section, we provide some tests for the presence of these types of selection effects during the Belgian trade boom. The growth of industry-level productivity contracted, or did not grow as quickly as it might have, in sectors with low firm level heterogeneity, even as the extensive margin increased. We show this first for a cross section of industries, before turning our attention to case studies.

Our first step was to determine the association between openness and productivity at a disaggregated sector-level. Unfortunately, data on productivity is not as detailed as that on exports and imports. We rely on Gaddiseur's (1980; 1997) estimation of labor productivity and real output growth for 20 industries for two subperiods, 1880-1896 and 1896-1910. The sectors studied comprise 80-90 percent of the products exported and imported. Average productivity growth of these industries in the first period, 1880-1896, was 1.08 percent (1.26 on an export value-weighted basis); for 1896-1910, growth was 3.03 percent (2.45 percent on a weighted basis). These averages mask significant industry-level variation. We then proceeded to match as many goods in our dataset as possible to the 20 industries.

We are interested in the following relationship:

$$\widehat{\left(\frac{Y}{L}\right)}_{gt} = \alpha + \beta \widehat{\left(\frac{exports}{output}\right)}_{gt} + \eta_{gt} \qquad (3)$$

where t denotes one of two time periods (1880-1896 or 1896-1910) and the hats represent percentage growth rates. For our panel of 20 industries over two time periods, Figure 7 plots the relationship between the change in openness (the difference in the average growth rates of exports and total output) and average productivity growth for these years. The 'circles' represent industry size and are proportional to total exports in 1880. Overall, the trade boom did not have much of a positive impact on productivity growth, if anything the relationship was negative. Column 1 of Table 6 reports the regression underlying the figure. The coefficient on the change in openness is -0.79 and is significant at the 5% level.

To be sure, the true relationship in column 1 of Table 6 could be obscured by endogeneity or simultaneity problems. First, output growth enters directly on both sides, and third forces, not included here, could have been acting to change exports and productivity. To limit these problems, we follow an approach based on Frankel and Romer (1999) who use ostensibly exogenous geographic information from a gravity model to predict trade at the bilateral level, and then use predicted total trade as an instrument. Specifically, we run a gravity regression of the following form:

$$\ln(exports)_{dig\tau} = \kappa_i + z'_{d\tau}\beta_{g\tau} + \epsilon_{g\tau} \quad (4)$$

where τ indicates a subset of years {1870, 1875, 1880}, {1890, 1895}, or {1900, 1905, 1910}, g indicates one of the 20 industries classified by Gaddiseur, i indicates a particular item belonging to industry g, and d represents a destination. The explanatory variables in the vector z include the logarithm of distance to Belgium, the log of destination population, indicators if the trade partner was a colony of another country, shared a border and a common language, and if the country had a diplomatic representative in Belgium, and year dummies. We assume that the variables in z are exogenous in the sense that they drive trade patterns and hence overall trade, but they do not have any influence on productivity except via their effect on trade. In order to generate instruments (IV), we aggregate as follows:

$$IV = Z_{gt} = \ln\left[\sum_d \sum_i \exp\left(\hat{\kappa}_i + z'_{d\tau}\hat{\beta}_{g\tau}\right)\right] \quad (5)$$

We are able to predict trade for 1880, 1895 and 1910 using the three subsets of years denoted by τ, one subset for each year of our sample. To gain statistical power we use the levels of IV in the first year of each period as well as the 16-year differences. Our first stage regression result, presented in Table 6, confirm that we do not suffer from a weak instruments problem. The second stage instrumental variables regression, where we use export growth to explain productivity growth, suggests no significant positive relationship between these two variables (OLS is reported in column 3). We also enter predicted trade directly as a determinant of productivity in the last column. This regression measures the direct relationship between that portion of trade determined by trade costs and foreign market factors, and productivity growth. In effect, there is no statistically significant relationship. The evidence corroborates our main claim that that as trade costs fell, low productivity firms were able to produce, export, and survive.

In essence, the association between exports and productivity varied by industry or category.[26] To this end, column 2 of Table 6 allows for the different slopes on the change

[26] Figure 7 highlights considerable variation across industries. To see this, we broke down growth in productivity for industries in categories 1 to 4, where group 4 included the most differentiated products and the highest degree of firm heterogeneity. As anticipated, category 1 has the lowest average annual growth rate of productivity (0.95); category 4 (3.48) significantly higher growth. Categories 2 (2.52) and 3 (1.85) had similar rates. Averages weighted by export value in 1880. Productivity figures from Gaddiseur (1997).

in openness for each of our four categories. Panel OLS regressions suggest much lower productivity growth in category 2 compared to category 4. The point estimates for category 1 and category 3 are also much lower than those of category 4, but we cannot reject equality at high levels of confidence. The upshot is that our claim about firm uniformity and flat productivity growth holds at the category level.

The fates of Belgium's metal and textile industries illustrate the channels by which the degree of product differentiation and firm heterogeneity impacted on productivity. The metal sector produced a range of products, from crude and medium grade iron and steel to machine-making equipment, the latter being highly specialized items. At the same time, the distribution of firms indicates a high degree of heterogeneity. Figure 8a presents histograms of the distributions of firms in 1880 and 1910 for five levels of total capitalization based on data from the *Annuaire Statistique*. The heyday of the trade boom saw a hollowing out of the middle, with major growth occurring in larger concerns, and to a lesser extent at the smaller end. Because of the combination of product diversity and firm heterogeneity, the decline in trade costs translated into strong export performance *and* a commensurate increase in productivity.[27] The share of steel output exported was about 30 percent, and, since exports were not sensitive to distance (Table 3), producers in 1910 served a customer base of more than 30 destinations (Brooks and La Croix 1920). Productivity growth matched the export expansion, achieving a rate of 3.38 percent per annum between 1896 and 1910.

Finally, consider the effects of product diversification and firm heterogeneity on the cotton-textile industry. The business intelligence on market opportunities provided by the trade diplomats widened the range of products manufactured and exported. Interestingly, owing to enhanced differentiation, distance was less of a barrier for textile exports than those of glass, the number of destinations served by the industry doubling, from 25 to 50, between 1880 and 1910. The increase in trade caused by product diversity was complementary to that which can be attributed to the degree of firm similarity. According to one estimate, 20 new spinning establishments began production after 1896 (Van Houtte 1949, p. 101).[28] These establishments were often small, some of which were temporary sheds located in the countryside. The outcome, portrayed Figure 8b, was a major transformation in the distribution of firms. Using evidence on capitalization in spinning,

[27] In comparison, the glass and crystal industry had high level of product differentiation, but a larger share of smaller firms than the metal and steel sector. It recorded a productivity advance of 1.03 percent per annum, less than half the average rate of Gadisseur's 20 industries.

[28] Van Houtte (1949, p. 103) estimated 142 establishments in the cotton-textile sector in 1896, and 306 in 1910.

weaving and clothing manufacture, for wool, linen and cotton, the 1880 distribution was dominated by medium-large firms; that of 1910 indicates a broader distribution of sizes, mostly concentrated in the middle ranges. The growth in the number of small firms had implications for sectoral productivity in cotton textiles which increased by a meager 0.13 percent per annum between 1896 and 1910.[29] Spinning in linen and wool also recorded subpar performances with growth rates of 0.83 and 0.70.

VI. Conclusion: Technology vs geography in the second industrial revolution

There are a number of competing explanations why the exponential rise in international trade did not unleash stronger economic growth. O'Rourke and Williamson (1999) have popularized the textbook factor-endowment model to track the dynamics of trade and growth in the first era of globalization. Others, like Temin (1997), have posited a Ricardian structure to back out the forces of early industrialization. These competing paradigms dominate our understanding of nineteenth-century international trade, the outcome of an inordinate focus on British trade and an over-reliance on aggregate trade statistics. To a large extent, both approaches ignore the presence of intraindustry trade in differentiated goods and a "love of variety".

Exploiting granular data, we study the case of Belgium, a small open economy in the crucible of the second industrial revolution during the pre-1914 trade boom. In the spirit of modern trade theories, we find that trade costs explain as much, if not more, of the patterns of trade as factor endowments. In particular, investments by the Belgian state in the trade diplomatic network expanded the number of products delivered and markets served. At the industry level, the effect of trade costs on the value of trade, the direction of trade, and the composition of goods traded varied with the degree of product differentiation and the degree of similarity in firm productivity.

We have made a preliminary attempt to connect changes in trade costs and productivity. The expansion in new trade partners and new goods did not guarantee faster growth in per capita income. Indeed, the opposite may have held in sectors with high degrees of product differentiation and uniformity in firm productivity. As the fixed costs of establishing new goods in new markets came down, new entrants with lower productivity than incumbents expanded market share. This process underlies the seemingly paradoxical acceleration in openness beginning in the 1890s and Belgium's lackluster productivity

[29] The uptake in ring spinning frames lagged that of its European competitors in low and medium value goods (Saxonhouse and Wright 2004).

performance in the same period. Rather than acting as a driver of growth, globalization actually delayed Belgium's second Industrial revolution.

Can we generalize from these results? It has become a cliché to claim that deeper integration reallocates resources more efficiently. But the pathways underlying this process cannot be taken for granted. In the presence of entry costs, a type of race can ensue between the positive selection effects of shifting resources and the negative effects due to declining trade costs, or, more broadly, technology vs geography. The bottom line is that globalization may not always show up in the growth numbers. Our findings echo Rodrik's (2011) observation that, sooner or later, the process of international integration comes up against diminishing marginal returns. If so, we have uncovered another way in which the second globalization echoes the first.

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Appendix 1
Background Information on Belgian Foreign Trade

General information

The *Tableau général du commerce extérieur* distinguished between all goods shipped (*commerce général*), which included re-exports and goods in transit, and items produced exclusively in Belgium (*commerce spécial*). For the latter, we recorded trade in manufactured goods, which represented about 50 percent of all exports in 1900 and 20 percent of all imports, at five-year intervals beginning in 1870 and until 1910.[30] The degree of overlap in the types of trade, while certainly not trivial, declined over the period. The attraction of concealing goods, either as re-exports or special goods from the authorities diminished during the period under investigation, because custom duties came down. But the same fall in duties would have encouraged "disguised transit", the incentive for merchants to declare their goods intended for re-export as imports for domestic consumption, and subsequently claim the same goods as exports of domestic origin (in order to avoid red tape and the delays associated with leaving goods in transit).[31] Horlings (2002, p. 120) reports that most disguised transit comprised low-taxed, low-value bulk and crude commodities, rather than processed and manufactured goods that are our interest. Altogether, Federico and Tena (1989), measuring the accuracy of trade statistics using exports and imports from source and destination countries, score Belgium only slightly below the figure of the average European country.

Classification: Items, categories, and countries

Our classification of products follows that recorded in the *Tableau.* The level of detail of the products listed in Table A1 corresponds to the SITC four or five-digit level. A recurrent problem with this type of exercise is the ability to distinguish genuinely new products from new titles given to existing products, and other products listed in a new separate entry but were in fact previously folded into another group. For clearly identified new products, like streetcars made with copper this concern was immaterial, but in broader classifications, like cotton yarn, this problem was unavoidable. To minimize double counting, beginning with the 1870 product listing, we labeled as existing items those 'new products' with similar titles, and other supposedly new goods whose export or import values were of the same order of magnitude as previously recorded established

[30] We leave a full treatment of imports to further research.

[31] To avoid delays, merchants were willing to pay customs duties. Unlike items in transit, re-exports passed through the national trade framework.

products. For example, when the 1880 return subdivided *tissus de coton unis* into *tissus de coton unis, croisés et coutils pesant 3 kilogr et plus les 100 mètres carrés, écrus,* and *tissus de coton unis, croisés et coutils pesant 3 kilogr et plus les 100 mètres carrés, blanchis,* we counted these as one new product. This procedure reduced the number of products by roughly 10 percent. For 1910, we recorded 171 distinct products or categories exported. Over all years in our sample, the *Tableau* reported 202 distinct export products and 205 distinct import products.

Table A1 classifies goods into four categories of product differentiation, with category 1 the least differentiated; Figure A1 plots the value of exports in each category. There was strong growth in categories 3 and 4. This expansion coincides with the attention given by the reports of the trade consuls in the *RC* to highly differentiated goods.

With regard to export destinations and import sources, we had two considerations. We defined countries according to their 1910 borders. For instance, New South Wales was recorded as Australia. But since we also needed information on GDP, we treated Newfoundland as part of Canada. In total, we had 69 countries listed as export destinations in 1910 based on the original sources. Table A2 presents the summary statistics of our dataset for imports and exports. The number of import sources was smaller than export destinations since imports of manufactured products were mainly from European countries. Until the mid-1890s, unit values of manufactured imports actually exceeded that of exports; thereafter the trend was reversed.

Unit values

The spike in average unit values in Table A2 merits discussion. The *Tableau*, like other nineteenth-century international trade sources, recorded official prices. This shortcoming is minimized because prices were adjusted annually, although their reliability varied across commodities. For some of the early years, many goods were declared in value only. The sources of the official prices and the nature of their revisions are unclear. Horlings (2002, p. 114) presumes they were wholesale prices rather than c.i.f. or f.o.b prices. Despite these drawbacks, his own recalculation of trade values concentrated on the period before mid century. Until 1845, Horlings (2002, p. 117) reduced export prices by the order of 6 percent, but "during the remainder of the century the revision of price data caused a change of between 1 and 3 percent of import and export values." A drawback is that recorded prices do not vary with destination or source, again a common feature of historical trade statistics especially those collected on the European continent.

Table A3 gives unit values at the industry level. It presents a more nuanced picture of the increase in unit values after 1890. The price rise would appear to conflate the entry of capital-intensive firms producing high-quality-high-value added items, as in Yi (2003), and the entry of poor performers with high marginal costs, or both. For textiles, export prices in 1905 were only slightly higher than they were twenty years earlier, and this was the case for paper and glass products, and pottery as well. But machine and metal prices more than doubled. At the same time, there was also a spike in average unit values because of big-ticket items, including the boats, cars, streetcars, and railroad wagons that Belgium began exporting toward the end of the century.

The Theil index of international trade

The Theil index of international trade measures the product diversification of international trade. The index is often decomposed into within and between components. The former is equivalent to changes in concentration along the intensive margin (defined here as the set of commonly traded goods over a certain period); the latter captures changes in the extensive margin (defined as newly traded or disappearing goods and/or trade partners).[32]

The panels in Figure A2 present Theil indexes and its components for all possible combinations of export products and destinations, and for destinations and products only. The indexes decline in value, indicating that exports were becoming more diversified, although after 1905 there is a small movement toward concentration.[33] The extensive margin (the light shaded area) is initially larger than the intensive margin (the dark shaded area), and then declines over time. This is not surprising since, sooner or later, all trade folds into trade of existing product lines and with established markets. That said, the tendency in overall diversification seems to be driven by the adding and dropping of products and markets. Note that, for all three indexes, the extensive and intensive margins have a gradual pattern which is consistent with the presence of differential trade costs by

[32] This paragraph follows Cadot et al. (2012). Export concentration measured at the intensive margin represents inequality between the shares of active export lines. Conversely, diversification along the intensive margin means convergence in export shares.

[33] In an influential paper, Imbs and Wacziarg (2003) found a U-shape pattern of diversification. At low levels of income, countries' production is highly concentrated in a narrow range of products. As technology diffuses and skill levels accumulate, product diversification intensifies. At high levels of income, countries revert to specialization.

product and by country. A strict Ricardian model would predict abrupt changes in the contribution of new products to overall exports.

Appendix 2
Data Sources

Common border: López-Córdova and Meissner (2003) and standard maps using historical border definitions.

Common language: Standard official languages.

Distance: Great circle distances between capitals or major cities. See López-Córdova and Meissner (2003) and Gleditsch and Ward (2001).

Diplomatic representation: Representatives in Belgium from *Almanach de Gotha* (various years); Belgian diplomats abroad *Recueil Consulaire* (various years).

MFN Treaties: Dates and sources given in the working paper of López-Córdova and Meissner (2003) and Pahre (2007).

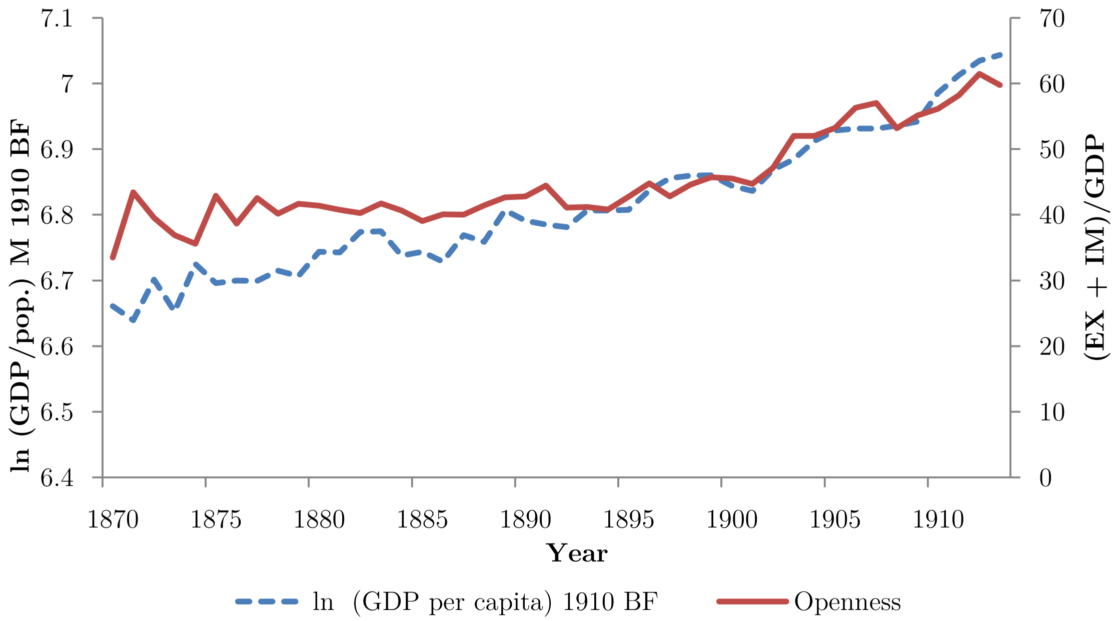
Monetary regime and Gold Standard: Dates and sources given in the working paper of López-Córdova and Meissner (2003) and Officer (2014).

Population: Maddison (2014). Supplementary information from the Statesman's *Yearbook* (various years).

Production, labor productivity: Data for 20 industries in Gaddisseur (1980, 1997).

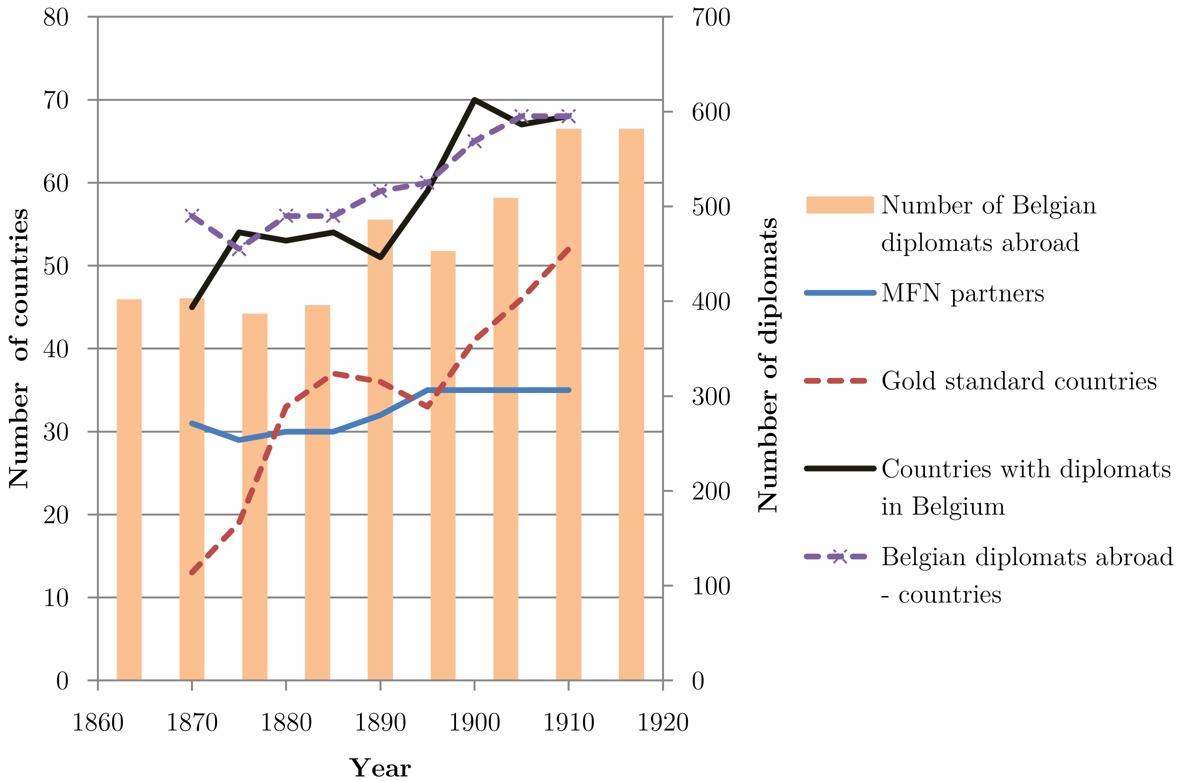
Trade values: Unless otherwise stated, bilateral trade values, products, and destinations from *Tableau*.

Figure 1 Trade Openness and Real GDP per capita, 1870-1913



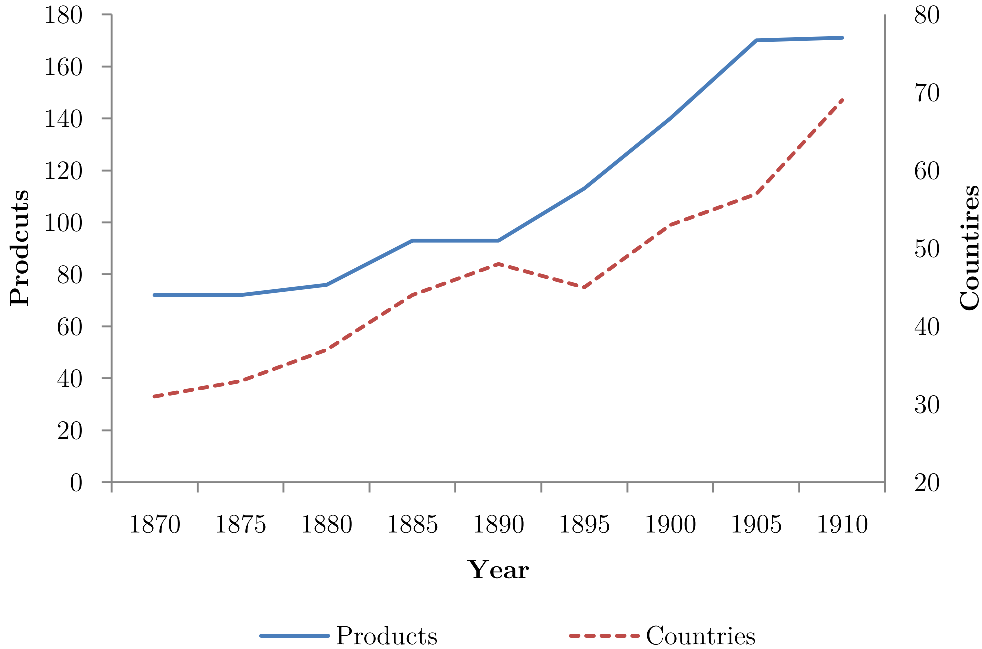
Notes: Openness is defined as nominal exports plus imports divided by nominal GDP.
Sources: Trade values from Horlings (1997); GDP and GDP per capita, Smits, Woltjer, and Ma (2009).

Figure 2 Diplomatic Representation and Other Trade Costs



Sources: See appendix for details.

Figure 3 Export Products and Destinations, 1870-1910



Notes and Sources: See appendix for details. *Tableau*, various years.

Figure 4A Export Shares by Industry, 1870-1910

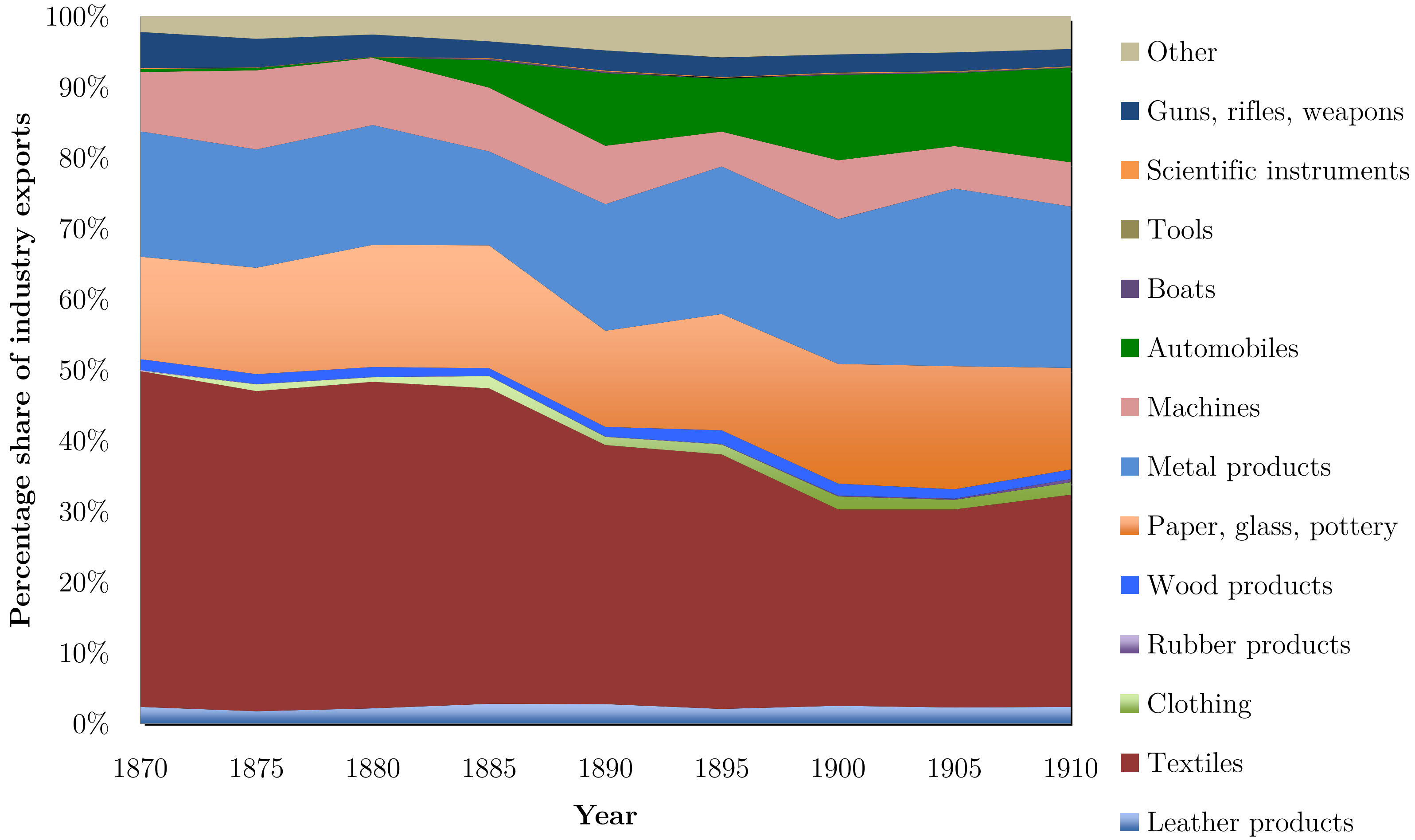
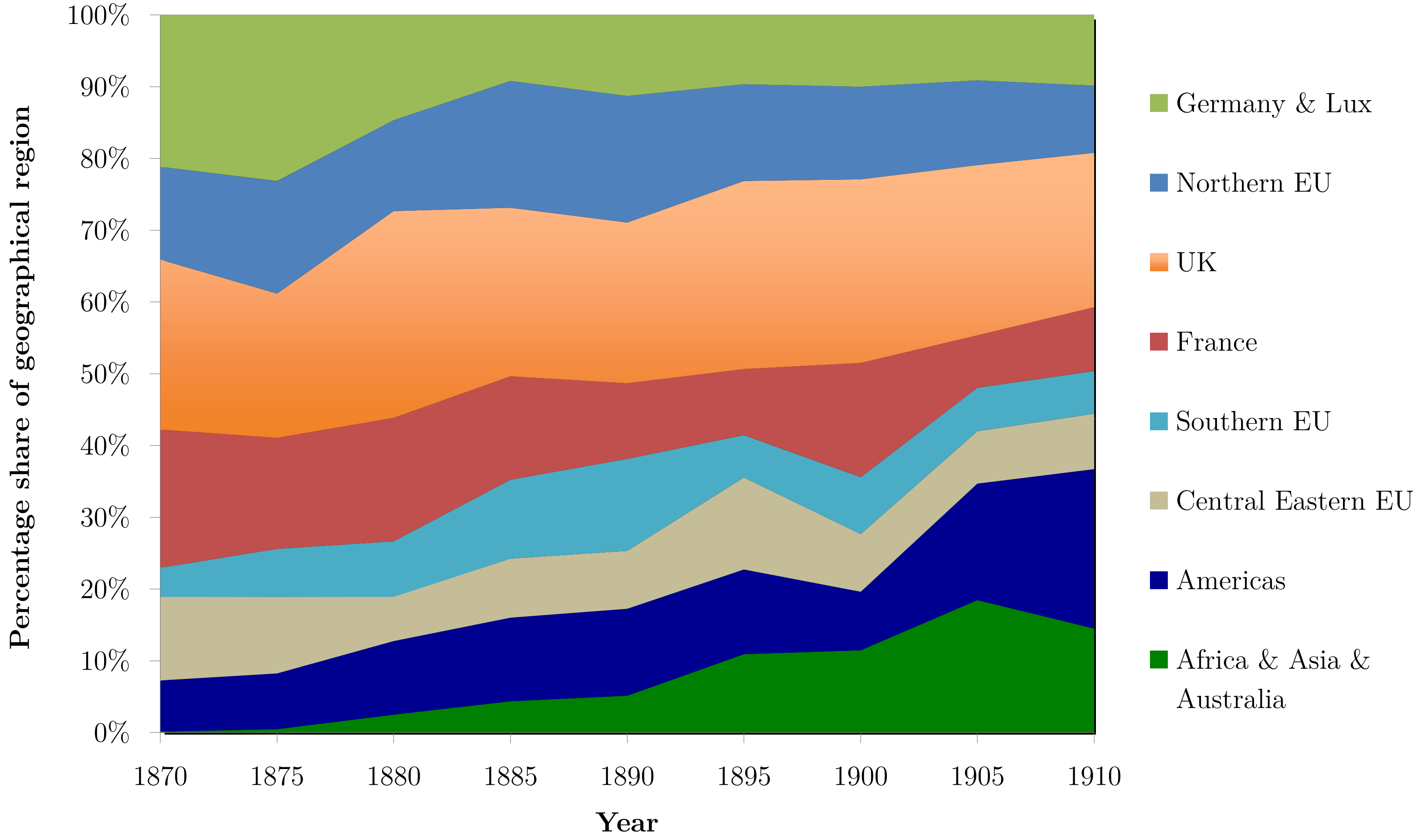
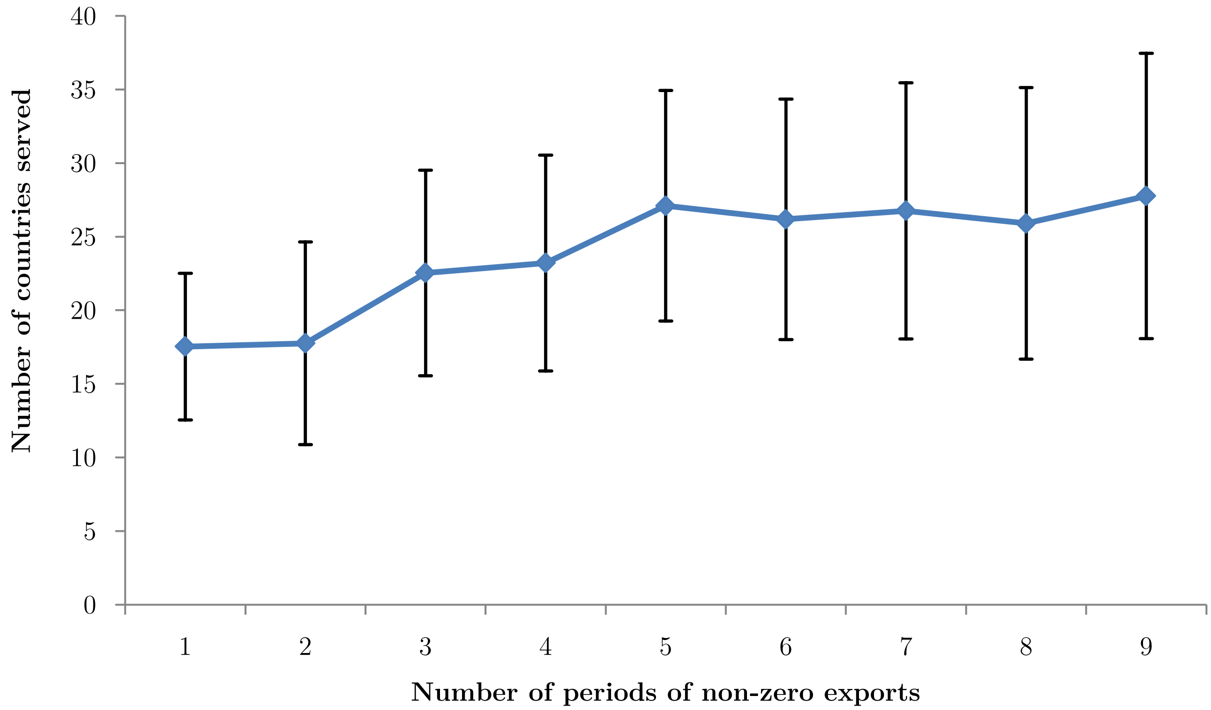


Figure 4B Export Shares by Destination and Source, 1870-1910



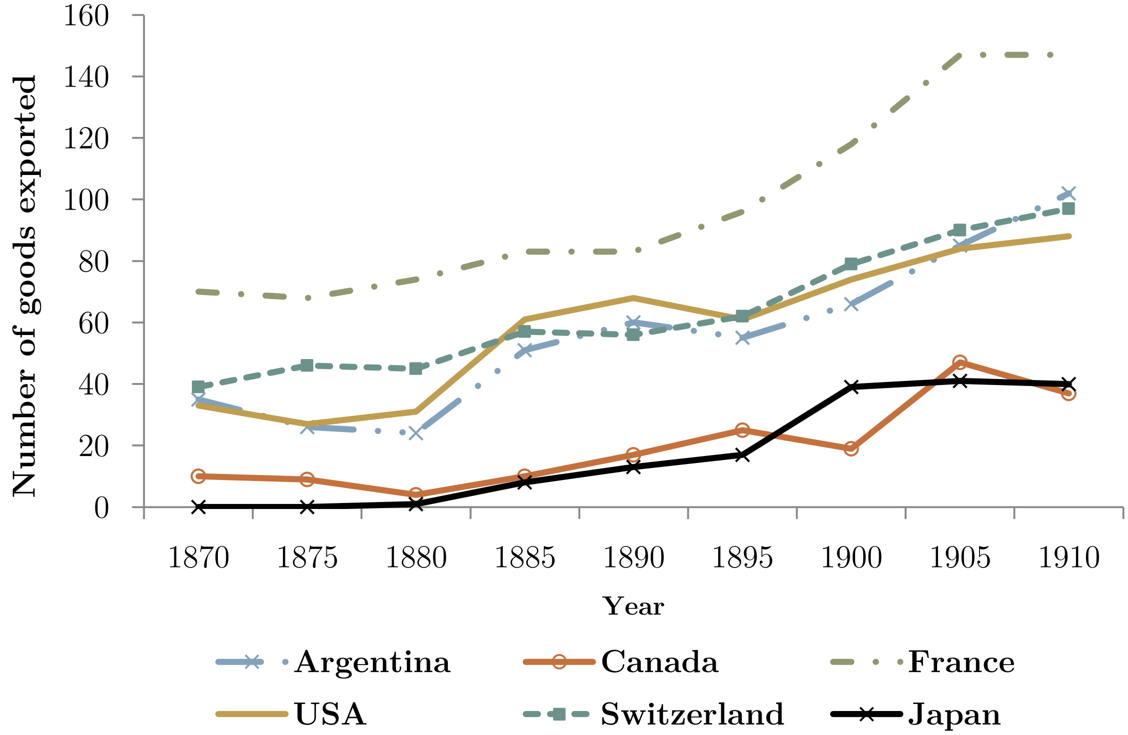
Source: *Tableau*, various years

Figure 5 Number of Countries Served, by Time with Positive Exports



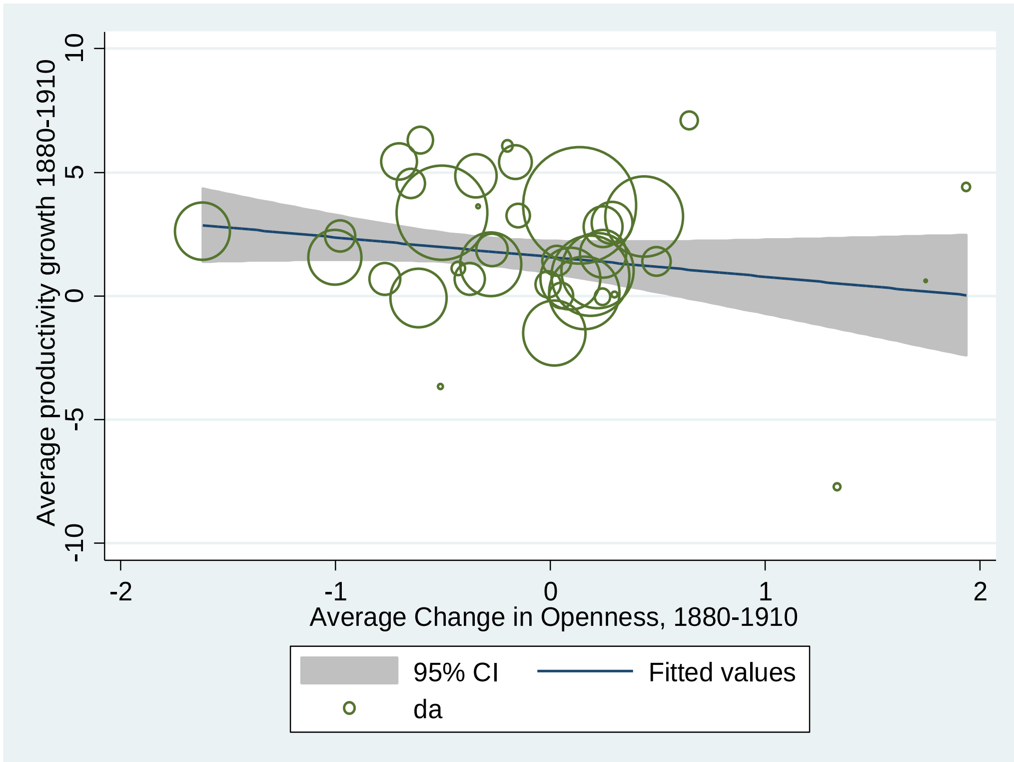
Notes and sources: The line plot shows the average number countries served for a good which has had a "spell" of the given length of non-zero exports. The averages are from a weighted regression of the number of countries served on a set of year indicators and good dummies. Weights are the total value of exports of the good. Robust confidence intervals were used to form the error bounds. Trade values from the *Tableau*, various years.

Figure 6 Number of Unique Goods Exported, 1870-1910, Selected Countries



Source: *Tableau*, various years.

Figure 7 Average Productivity Growth and Average Openness, 1880-1910.



Notes and source: For regression details see text and footnotes. The 'circles' represent industry size proportional to total exports in 1880. Labor productivity is from Gaddiseur (1980, 1997). Openness (exports/output) is calculated by industry from *Tableau*.

Figure 8a Firm Size Distribution, Metals

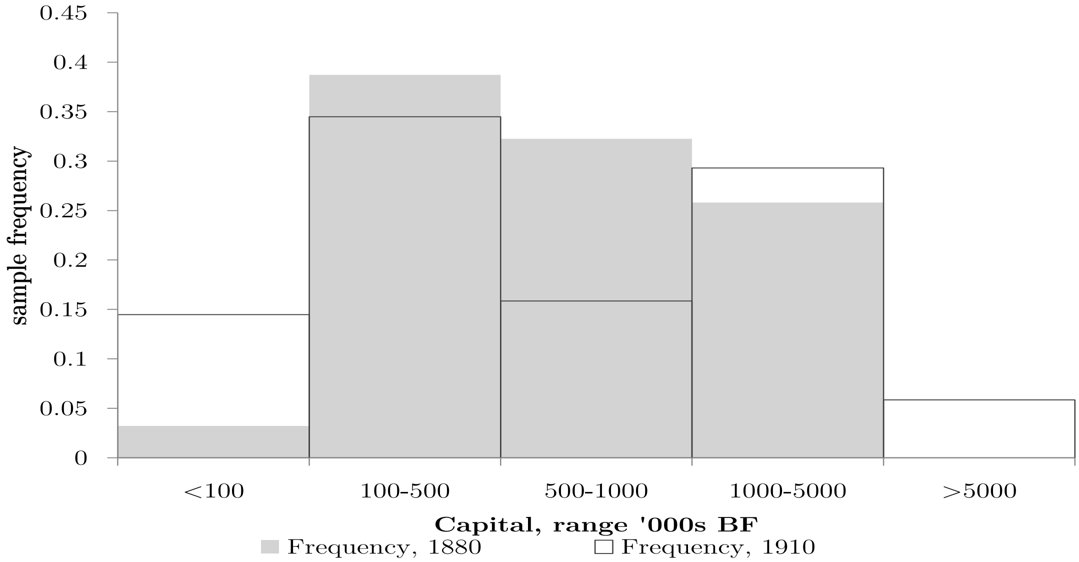
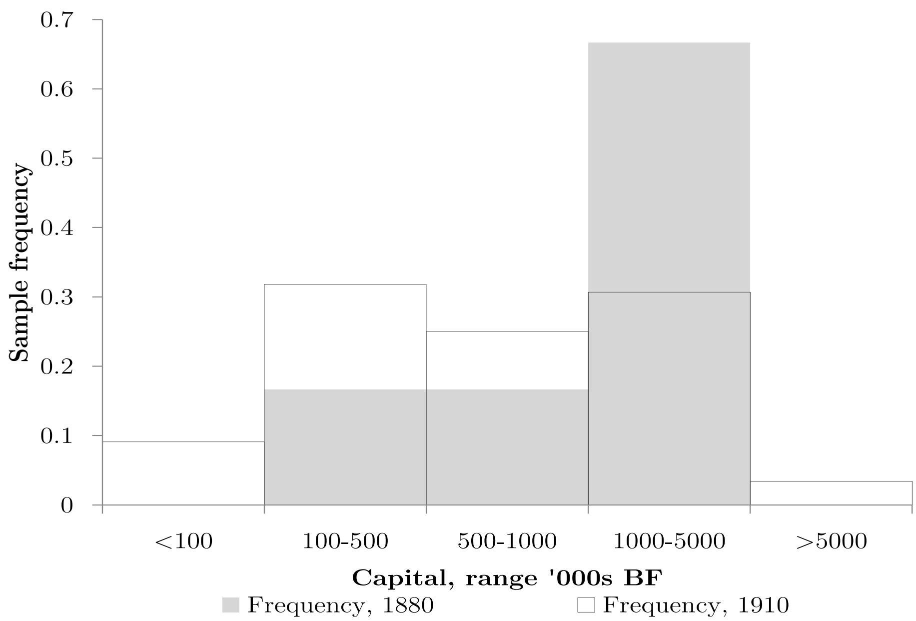
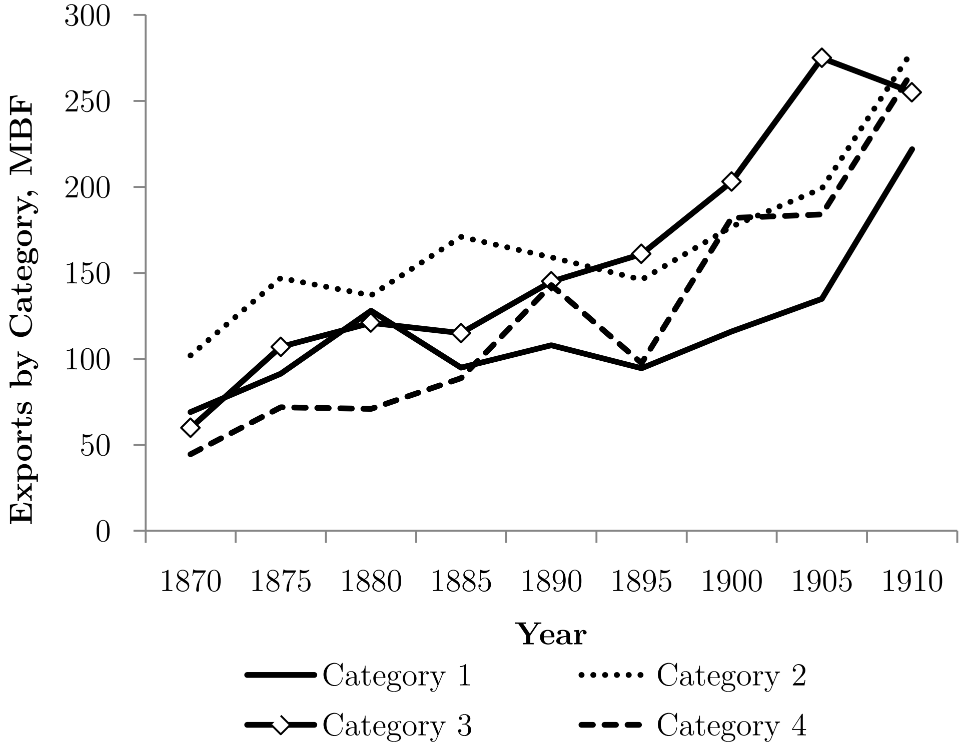


Figure 8b Firm Size Distribution, Textiles



Source: *Annuaire Statistique,* various years.

Figure A1 Value of Exports by Category



Notes and source: See text for definition of categories. *Tableau*, various years.

Figure A2 Theil Indexes for Exports

Notes and source: Light shaded area is extensive margin; dark shaded area, intensive margin. See text for details. T*ableau*, various years.

Table 1 Determinants of Total Exports, Intensive Margin, and Extensive Margin of Belgian Exports, 1870-1910

	Total Exports	Extensive Margin (N)	Intensive Margin (X/N)
ln(distance)	-0.63***	-0.26***	-0.41***
	[0.08]	[0.03]	[0.06]
Shared border	-0.05	0.08	-0.03
	[0.14]	[0.09]	[0.15]
Pegged exchange rate	0.77***	0.45***	0.29**
	[0.15]	[0.08]	[0.13]
Shared language	-0.22	0.06	-0.19
	[0.14]	[0.09]	[0.13]
MFN treaty	0.41**	0.12	0.23*
	[0.16]	[0.07]	[0.12]
Colony of another country	-0.43*	-0.63***	-0.13
	[0.25]	[0.14]	[0.17]
Belgium has diplomatic rep. in country	0.68***	0.44***	0.30**
	[0.23]	[0.11]	[0.14]
Partner has diplomatic rep. in Belgium	0.84**	0.90***	0.74***
	[0.33]	[0.22]	[0.21]
ln (population) of trade partner	0.47***	0.28***	0.33***
	[0.04]	[0.02]	[0.03]
Number of observations	639	639	639
Psuedo R-squared	0.8	0.64	0.61
Method of estimation	PPML	PPML	PPML

Notes: Dependent variable in column 1 is total exports to country *d*. Dependent variable in column 2 is the number of items in which Belgium exports to country *d*---a measure of the extensive margin of exports. Dependent variable in column 3 is the total value of exports divided the number of items in which Belgium exports to country *d*---a measure of the intensive margin of exports. Time dummies included but not reported. Sample includes 1870, 1875,…,1910. Robust standard errors are reported in brackets. *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1. See appendix for sources.

Table 2 Determinants of Total Exports by Level of Differentiation

	Category 1	Category 2	Category 3	Category 4
ln(distance)	-0.88***	-0.82***	-0.47***	-0.32**
	[0.10]	[0.07]	[0.07]	[0.16]
Shared border	-0.02	-0.13	-0.41**	0.74***
	[0.13]	[0.19]	[0.20]	[0.17]
Pegged exchange rate	1.19***	0.72***	0.84***	0.42
	[0.20]	[0.16]	[0.15]	[0.29]
Shared language	-1.28***	-0.22	0.02	0.32*
	[0.17]	[0.22]	[0.17]	[0.17]
MFN treaty	0.69***	0.76***	0.38**	-0.18
	[0.21]	[0.18]	[0.16]	[0.25]
Colony of another country	0.25	-0.81***	-0.27	-1.24**
	[0.29]	[0.28]	[0.23]	[0.50]
Belgium has diplomatic rep. in country	0.84***	0.52*	0.59***	0.84**
	[0.27]	[0.27]	[0.18]	[0.39]
Partner has diplomatic rep. in Belgium	0.80**	1.20***	1.00***	0.37
	[0.38]	[0.39]	[0.30]	[0.39]
ln (population) of trade partner	0.47***	0.43***	0.51***	0.45***
	[0.04]	[0.04]	[0.04]	[0.05]
Number of observations	639	639	639	639
Method of estimation	PPML	PPML	PPML	PPML

Notes: Dependent variable in each column is the total value of exports exported to country d at a given level of differentiation. Method of estimation is Poisson PML. The least differentiated goods (Category 1) include labor-intensive manufactures and manufacturing inputs such as leather, thread. Category 2 includes semi-skilled industrial goods and textiles such as glass, paper and some cloth and fabric. Category 3 includes semi-skilled or high skilled manufacturing goods with substantial capital intensity including elaborate fabrics and clothes, finished metal and fine glass. The most differentiated goods include high unit value capital intensive manufactures such as tramways, ships, machines and machine tools.Time dummies included but not reported. Sample includes 1870, 1875,…,1910. Robust standard errors clustered over destinations are reported in brackets. *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1. See appendix for sources.

Table 3 Distance Coefficients by Sector

	Coeff. on ln(distance)	Robust Std. Error		Coeff. on ln(distance)	Robust Std. Error
Wool Thread	-2.03***	[0.14]	Glass	-0.53***	[0.09]
Linen Thread	-1.69***	[0.16]	Wool Fabric	-0.46***	[0.09]
Leather Goods	-1.32***	[0.19]	Instruments	-0.40***	[0.13]
Rubber	-1.29***	[0.15]	Wood Products	-0.34***	[0.10]
Zinc Laminating	-1.29***	[0.15]	Cotton Fabric & Other	-0.33***	[0.09]
Linen Fabric	-0.91***	[0.13]	Crude Steel	-0.33***	[0.07]
Cotton Thread	-0.86***	[0.14]	Books, Newspapers, Printing	-0.30*	[0.16]
Furniture	-0.84***	[0.13]	Weapons	-0.26***	[0.07]
Lead Manufacture	-0.78***	[0.13]	Machinery (Trams etc)	-0.25	[0.17]
Paper Products	-0.75***	[0.11]	Finished Steel	-0.11	[0.14]

Notes: Dependent variable in each row is total value of exports of industry k to country d. Method of estimation is Poisson PML. Time dummies, item dummies, and other gravity controls are included but not reported. Sample includes 1870, 1875,…,1910. Robust standard errors clustered over destinations are reported in brackets. *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1

Table 4 Determinants of Intensive Margin (Total Value/Number of Goods) for Belgian Exports by "Level of Differentiation", 1870-1910

	Category 1	Category 2	Category 3	Category 4
ln(distance)	-0.69***	-0.49***	-0.26***	-0.22***
	[0.07]	[0.08]	[0.06]	[0.08]
Pegged exchange rate	-0.02	-0.26	-0.42**	0.52***
	[0.16]	[0.24]	[0.18]	[0.17]
Shared border	0.78***	0.52***	0.49***	0.13
	[0.15]	[0.15]	[0.16]	[0.19]
Shared language	-1.01***	0.19	-0.04	0.1
	[0.17]	[0.28]	[0.15]	[0.16]
MFN treaty	0.47***	0.72***	0.16	-0.1
	[0.15]	[0.14]	[0.14]	[0.16]
Colony of another country	0.23	-0.49	-0.36**	-0.42
	[0.24]	[0.37]	[0.18]	[0.44]
Belgium has diplomatic rep. in country	0.51***	0.31	0.15	0.53
	[0.19]	[0.23]	[0.16]	[0.34]
Partner has diplomatic rep. in Belgium	0.80**	1.08***	0.98***	0.59**
	[0.32]	[0.33]	[0.26]	[0.27]
ln (population) of trade partner	0.37***	0.33***	0.41***	0.37***
	[0.03]	[0.03]	[0.03]	[0.04]
Number of observations	639	639	639	639
Method of estimation	PPML	PPML	PPML	PPML

Notes: Dependent variable in each column is the ratio of the value of exports to the number of goods exported to country d at a given level of differentiation. Method of estimation is Poisson PML. Least differentiated goods (Category 1) include labor-intensive manufactures and manufacturing inputs. Category 2 includes semi-skilled industrial goods and textiles. Category 3 includes semi-skilled or high skilled manufacturing goods with substantial capital intensity. The most differentiated goods include high unit value capital intensive manufactures such as tramways, ships, machines and machine tools. Time dummies included but not reported. Sample includes 1870, 1875,...,1910. Robust standard errors clustered over destinations are reported in brackets. *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1. See appendix for sources.

Table 5 Determinants of the extensive margin (number of products exported) by level of differentiation.

	Category 1	Category 2	Category 3	Category 4
ln(distance)	-0.27***	-0.28***	-0.23***	-0.30***
	[0.04]	[0.04]	[0.03]	[0.04]
Pegged exchange rate	0.08	-0.01	0.15	0.06
	[0.11]	[0.10]	[0.10]	[0.10]
Shared border	0.44***	0.47***	0.49***	0.39***
	[0.09]	[0.09]	[0.08]	[0.09]
Shared language	-0.02	0.09	0.02	0.15
	[0.10]	[0.10]	[0.09]	[0.11]
MFN treaty	0.11	0.18**	0.09	0.08
	[0.08]	[0.08]	[0.07]	[0.08]
Colony of another country	-0.47***	-0.81***	-0.52***	-0.77***
	[0.15]	[0.15]	[0.14]	[0.17]
Belgium has diplomatic rep. in country	0.42***	0.50***	0.41***	0.42***
	[0.11]	[0.11]	[0.11]	[0.12]
Partner has diplomatic rep. in Belgium	0.93***	0.88***	1.00***	0.73***
	[0.24]	[0.21]	[0.22]	[0.25]
ln (population) of trade partner	0.27***	0.25***	0.30***	0.30***
	[0.02]	[0.02]	[0.02]	[0.02]
Number of observations	639	639	639	639
Method of estimation	PPML	PPML	PPML	PPML

Notes: Dependent variable in each column is number of items exported to country d within a given level of differentiation. Method of estimation is Poisson PML. Least differentiated goods (Category 1) include labor-intensive manufactures and manufacturing inputs. Category 2 includes semi-skilled industrial goods and textiles. Category 3 includes semi-skilled or high skilled manufacturing goods with substantial capital intensity. The most differentiated goods include high unit value capital intensive manufactures such as tramways, ships, machines and machine tools. Time dummies included but not reported. Sample includes 1870, 1875,…,1910. Robust standard errors clustered over destinations are reported in brackets. *** p-value < 0.01, ** p-value < 0.05, * p-value < 0.1. See appendix for sources.

Table 6 Productivity, Exports and Output, OLS and Instrumental Variable Regressions

	OLS	OLS	OLS	OLS	IV	OLS
Change in openness	-0.79**	---	---	---	---	---
	[0.33]					
Change in openness x Cat.1	---	-2.01	---	---	---	---
		[1.04]*				
Change in openness x Cat.2	---	-5.01	---	---	---	---
		[1.05]***				
Change in openness x Cat.3	---	-1.8	---	---	---	---
		[0.63]***				
Change in openness x Cat.4		1.25	---	---	---	---
		[2.54]				
Change in nominal exports	---	---	-1.88**	-0.1	0.02	---
			[0.83]	[0.62]	[1.12]	
Change in real output	---	---	0.30***	---	---	---
			[0.10]			
Reduced form: Change in predicted exports	---	---	---	---	---	-0.01
						[0.12]
First Stage						
Predicted change in exports					0.13***	
					[0.04]	
Predicted change in exports lagged value					0.10***	
					[0.04]	
F-test					8.94***	
Cragg-Donald Wald					10.62	
Observations	39	39	39	39	39	39
R-squared	0.06	0.47	0.23	0.001	0.03	0.0006
Estimation	OLS	OLS	OLS	OLS	OLS/ IV	OLS

Notes: Dependent variable in each row is average annual growth rate of labor productivity in industry g. Method of estimation is OLS. Observations are weighted by their export values in 1880. A constant is included in each regression but not reported. Sample includes two periods for each industry which cover 1880-1895 and 1895-1910. Furniture had no exports in 1880. It is excluded from the sample since the growth rate of exports is not defined. Robust standard errors clustered over destinations are reported in brackets. *** p-value<0.01, ** p-value < 0.05,* p-value<0. See appendix for sources.

Table A1: Comprehensive List of Goods Exported
and Degree of Differentiation

0 - semi-raw goods, 1 - processed goods (raw),
2 - semi-skilled manufacture, 3 - semi/high skilled manufacture,
4 - capital intensive highly differentiatied goods

SITC code	**Item No.**	**Item**	**Category**
613	1	Peaux tannées, corroyées et autrement préparées	1
613	2	Peaux. Parchemin.	1
851	3	Peaux ouvrées. Chaussures	2
831	4	Peaux. Ouvrages de cuir et de peau. Ganterie	1
831	5	Maroquinerie	2
831	6	Peaux. Ouvrages de cuir et de peau. Autres.	1
651	7	Fils de laine non tors et non teints	1
651	8	Fils de laine tors et teints	1
651	9	Fils de laine peignée, non tors non teints	1
651	10	Fils de laine peignée, simples teints	1
651	11	Fils de laine peignée, retors non teints	1
651	12	Fils de laine peignée, tors ou teints	1
651	13	Fils de poils du chèvre, etc., non tors et non teints	1
651	14	Fils de poils du chèvre, etc., tors ou teinte	1
651	15	Fils de poils	1
651	16	Fils de soie	1
651	17	Fils de coton écrus et blanchis	1
651	18	Fis de coton teints et ourdis	1
651	19	Fils de coton mélangé d'au moins 20% de laine, coton dominant	1
651	20	Fils de lin, de chanvre et de jute non tors et non teints	1
651	21	Fils de lin, de chanvre et de jute tors et teints	1
651	22	Fils préparés pour la vente en détail. Fils de coton mesurant plus de 65,000 mètre	2
651	23	Fils préparés pour la vente en détail. Autre de toute espèce à l'exception du fil de soie	2
654	24	Tissus de laine. Châles, écharpes et cachemires de l'inde	2
654	25	Tissus de laine. Châles et écharpes de laine	2
654	26	Tissus de laine. Coatings, duffels, calmoucks et autres tissus lourdes	2
654	27	Tissus de laine. Draps, Casimirs et tissus similaires	2
654	28	Tissus de laine; Tapis et tapisseries de laine	2
654	30	Tissus de laine pesant moins de 200 grammes par mètre carrée	2
654	31	Tissus de laine. Passementerie	2
654	32	Tissus de laine. Rubanerie	2
654	33	Tissus de laine. Tous autres.	2
654	34	Tissus de soie. Passementerie	2
654	35	Tissus de soie. Rubanerie	2
654	36	Tissus. Tulles, dentelles et blondes de soie	2
654	37	Tissus de soie	2

652	38	Tissus de coton, écrus	2
652	39	Tissus de coton blanchis	2
652	40	Tissus de coton teints	2
652	41	Tissus de coton imprimés	2
652	42	Tissus de coton unis, croisés et coutils pesant 3 kilogr, plus les 100 mètres carrées, fabriqués en tout ou en partie avec des fils teints	2
652	43	Tissus de coton unis ou croisés pesant moins de 3 kilogr les 100 mètres carrés, croisés et coutils pesant 3 kilogr, plus les 100 mètres carrées, écrus	2
652	44	Tissus de coton. Velours de coton. Façon de soie, écrus	2
652	45	Tissus de coton. Velours de coton. Façon de soie, teints	2
652	47	Tissus de coton. Velours de coton autres, écrus	2
652	48	Tissus de coton. Velours de coton autres, teints	2
652	50	Tissus de coton. Piqués, basins, façonnés, damassés et brillantes	2
652	51	Tissus de coton mélangé de soie, le coton dominant en poids	2
652	52	Tissus. Tulles, dentelles et blondes de coton	2
652	53	Tissus de coton. Passementerie	2
652	54	Tissus de coton. Rubanerie	2
652	55	Tissus de coton non dénommés	2
654	56	Tissus de lin, de chanvre et de jute. Toiles unies et croisées. Écrues	2
654	57	Tissus. Tulles, dentelles et blondes de lin	2
654	58	Tissus de lin, de chanvre et de jute blanchis et imprimés	2
654	59	Tissus de lin, de chanvre et de jute teintes	2
654	60	Tissus de lin, de chanvre, de jute autres que toile unies et croisées: Passementerie	2
654	61	Tissus de lin, de chanvre, de jute autres que toile unies et croisées: Rubanerie	2
652	62	Tissus. Tulles et dentelles de lin	2
654	63	Tissus de lin, de chanvre et de jute autres	2
655	64	Tissus. Broderies à la main	2
656	65	Tissus. Toiles cirées de toute espèce	2
654	66	Tissus. Tresses de paille de toute espèce	2
656	67	Tissus. Toutes sortes, non dénommées	2
858	68	Habillements, lingerie et confections. Lingerie de toute espèce	3
848	69	Habillements, lingerie et confections. Chapeaux non garnis	3
848	70	Habillements, lingerie et confections. Chapeaux garnis pour femmes	3
848	71	Habillements, lingerie et confections. Chapeaux garnis pour hommes	3
842	72	Habillements	3
841	73	Habillements, lingerie et confections. Vêtements pour hommes	3
845	74	Habillements, lingerie et confections. Bonneterie de coton	3
845	75	Tissus de laine. Bonneterie	2
845	76	Tissus de lin, de chanvre, de jute autres que toile unies et croisées: Bonneterie	2
845	77	Habillements, lingerie et confections. Bonneterie de soie	3
845	78	Habillements, lingerie et confections. Bonneterie autre	3
845	79	Habillements, lingerie et confections. Cols et manchettes en tissus de laine	3
845	80	Habillements, lingerie et confections. Objets confectionnés en tout ou en partie non compris parmi ceux désignés ci-dessus	3

621	81	Caoutchouc ouvré	1
635	82	Balais communs	2
635	83	Futaies montées ou démontées	1
635	84	Bois ouvrés	1
642	85	Papiers à meubler	2
642	86	Papiers autres	1
642	87	Papiers. Autres	1
892	88	Produits typographiques. Livres en feuilles et en brochés	3
892	89	Produits typographiques cartonnés et reliés	3
892	90	Produits typographiques. Journaux et publications périodiques	4
892	91	Produits typographiques autres	3
661	92	Pierres polies et sculptées	4
666	93	Potteries. Faiences	4
666	94	Potteries. Porcelains	4
666	95	Potteries. Porcelaines	4
666	96	Potteries. Terre cuite, tuiles vernissés ou émaillées et tuiles à emboitement	2
666	97	Potteries. Terre cuite, tuiles autres	2
666	98	Potteries. Carreaux pour pavement et constructions, carreaux et pavés ceramiques en terre fine	1
666	99	Potteries. Carreaux pour pavement et constructions, carreaux en ciment comprimé	1
666	100	Potteries. Carreaux pour pavement et constructions, carreaux en faience ou en porcelaine	1
666	101	Potteries. Carreaux pour pavement et constructions, de tout espèce: autres	1
666	102	Potteries communes	2
664	103	Verreries. Glaces brutes	2
664	104	Verreries. Glaces	2
664	105	Verreries. Glaces étamées	2
664	106	Verreries. Ordinaires	2
664	107	Verreries. Fines	3
664	108	Verreries. Verres de vitrage mats sans dessins	2
664	109	Verreries. Verre de vitrage	3
664	110	Verreries. Verres de vitrage autres	3
665	111	Bouteilles, fioles, boubonnes, etc. en verre blanc ou demi blanc	2
665	112	Verreries. Communes. Bouteilles ordinaires	2
665	113	Boubonnes, dames-jeannes ou touries	2
665	114	Verreries. Communes	2
664	115	Verreries ordinaires. Bouteilles	2
664	116	Verreries ordinaires autres	2
665	117	Gobeleterie	2
664	118	Verrerie non dénommée	2
684	119	Métaux. Aluminium brut	3
684	120	Métaux. Aluminium battu, étiré ou laminé	3
682	121	Cuivre et nickel battus, étirés et laminés	3

682	122	Cuivre et nickel ouvrés	3
687	123	Métaux. Étain battus, étirés ou laminés	3
687	124	Étain ouvré	3
672	125	Fer. Ouvrages de fonte	3
672	126	Fer. Fer battu, étiré et laminé. Fils	3
672	127	Métaux. Fer battu, étiré ou laminé. Poutrelles	3
672	128	Fer. Fer battu, étiré et laminé. Rails	3
676	129	Métaux. Acier en barres, feuilles ou fils. Poutrelles	3
677	130	Acier en barres, feuilles et fils	3
676	131	Métaux. Acier en barres, feuilles ou fils. Tôles	3
677	132	Métaux. Acier fondu brut en barres feuilles ou fils. Autres	3
672	133	Fer. Fer battu, étiré et laminé. Tôles	3
672	134	Fer. Fer battu, étiré et laminé. Autres	3
672	135	Fer de fer. Clous	1
672	136	Fer. Ouvrages de fer. Ancres et chaînes pour la marine	3
678	138	Fer et acier. Fils d'acier clairs ou galvanisés, pour la fabrication des câbles et des cordes	2
679	139	Métaux. Acier fondu brut	1
679	140	Fer et acier. Fils ou verges de fer ou d'acier	2
672	141	Fer et acier. Ouvrages spécialement dénommés au tarif officiel	3
694	142	Métaux. Acier ouvré. Clous	1
677	143	Acier ouvré	3
679	144	Fer et acier. Autres ouvrages. Ronces artificielles	1
679	145	Fer et acier. Autres ouvrages. Ronces artificielles	1
672	146	Fer de fer. Autres.	1
672	147	Métaux. Fer cuivré, nickelé, plombé ou zingué non ouvré	0
672	148	Métaux. Fer blanc ouvré	3
683	149	Fer-blanc. Ouvré	3
683	150	Métaux. Nickel ouvré	3
685	151	Métaux. Plomb battu, étiré ou laminé	3
685	152	Plomb ouvré	3
686	153	Zinc ouvré	3
728	157	Machines et mécaniques et outils. Courroies pour machines en cuir en caoutchouc	4
728	158	Machines et mécaniques et outils. Courroies pour machines en toute autre matière	4
728	159	Machines, mécaniques et outils: machines mécaniques non dénommées en aluminium	4
728	160	Machines et mécaniques de fonte	4
728	161	Machines et mécaniques de fer et d'acier	4
728	162	Machines et mécaniques de fer et de bois	4
728	163	Machines et mécaniques de cuivre et de toute autre matière	4
791	164	Machines, mécaniques et outils: voitures pour chemins de fer et tramways en fonte	4
791	165	Machines, mécaniques et outils: voitures pour chemins de fer et tramways en fer et acier	4
791	166	Machines, mécaniques et outils: voitures pour chemins de fer et tramways en bois	4
791	167	Machines, mécaniques et outils: voitures pour chemins de fer et tramways en cuivre	4

783	168	Voitures. Vélocipèdes	4
784	169	Voitures. Vélocipèdes. Parties et pièces détachées	4
781	170	Voitures	4
785	171	Voitures automobiles. Parties	4
781	172	Voitures. Motocycles et tous véhicules de l'espèce, autres que les voitures automobiles. Complets	4
781	173	Voitures. Motocycles et tous véhicules de l'espèce, autres que les voitures automobiles, parties utres que les voitures automobiles. Parties	4
781	174	Voitures autres de toute espèce excepté les voitures pour les chemins de fer et tramway. Complets	4
781	175	Voitures autres de toute espèce excepté les voitures pour les chemins de fer et tramways, parties	4
793	176	Navires et bateaux	4
793	177	Navires et bateaux. Toiles à voiles	4
793	178	Navires et bateaux. Ancres et chaines	4
793	179	Navires et bateaux. Bois pour mâts, vergues et espars	3
793	180	Navires et bateaux. Autres agrès et apparaux	3
695	182	Machines, mécaniques et outils en fonte	4
695	183	Machines, mécaniques. Outils en fer et en acier	4
695	184	Machines, mécaniques. Outils en bois	4
695	185	Machines, mécaniques. Outils en cuivre	4
898	186	Instruments de musique	4
872	187	Instruments de chirurgie, de précision	4
885	188	Montres et fournitures pou montres	4
885	189	Montres. Boîtes de montres	4
885	190	Fournitures pour montres	4
891	191	Armes à feu portatives. Armes de guerre	4
891	192	Armes	4
891	193	Armes à feu portatives. Pistolets, revolvers	4
891	194	Armes blanches	4
891	195	Armes Bois de fusils, finis ou non finis	4
891	196	Armes. Bouches à feu, mortiers, obusiers, etc.	4
891	197	Armes non dénommées	4
726	198	Caractères typographiques	4
657	199	Cordages	2
657	200	Filets et autres ustensiles pour la pêche maritime	2
695	201	Mercerie et quincaillerie	3
821	202	Meubles	4
896	203	Objets d'art et de collection	4
891	204	Poudre à tirer	2
695	205	Ustensiles et objets de ménage en fonte, en fer ou en acier émaillés	4

Table A2 : Exports and Imports: Destinations, Sources, Numbers of Products, and Unit Values

		Full sample	**1870**	**1875**	**1880**	**1885**	**1890**	**1895**	**1900**	**1905**	**1910**
Exports	Total number of countries	74	31	33	37	44	48	45	53	57	69
	Total number of products	202	72	72	76	93	93	113	140	170	171
	Average unit values	55.74	5.91	5.44	5.4	4.34	4.78	3.1	14.8	85.7	144.4
	Total Value of Sample Exports (m BF)	---	275	417	458	470	555	499	679	795	1020
	Sample Value as a Share of Total Exports	---	44	47	51	52	50	50	52	53	60
Imports	Total number of countries	42	18	20	14	21	20	20	23	26	28
	Total number of products	205	75	74	77	95	94	118	148	182	178
	Average unit values	33.9	15.7	11.8	10.3	9.3	11	7.4	14.2	45.2	63.5
	Total Value of Sample Imports (m BF)	---	115	171	169	157	184	194	315	360	456
	Sample Value as a Share of Total Imports	---	13	13	12	16	14	15	20	16	18

Source: *Tableau*, various years.

Table A3 Unit Values by Industry

Industry		Full sample	1870	1875	1880	1885	1890	1895	1900	1905	1910
Leather Goods	Average Unit Values	31.11	5.00	5.00	4.60	11.76	24.71			27.65	67.55
	Number of observations	19	1	1	1	2	2	0	0	6	5
textiles	Average Unit Values	20.09	14.28	12.75	10.59	11.08	11.34	8.08	27.30	28.23	27.36
	Number of observations	254	17	17	18	19	19	26	36	50	52
Clothing	Average Unit Values	33.25								38.90	32.17
	Number of observations	20	0	0	0	0	0	0	0	8	11
Rubber	Average Unit Values	13								13	14
	Number of observations	2	0	0	0	0	0	0	0	1	1
Wood	Average Unit Values	0.15								0.12	0.16
	Number of observations	4	0	0	0	0	0	0	0	1	3
Paper, Glass, Pottery	Average Unit Values	1.62	2.02	2.03	2.00	2.05	1.85	1.69	1.22	1.30	1.45
	Number of observations	143	10	10	12	12	12	12	19	26	30
Metal	Average Unit Values	1.16	1.09	1.00	0.82	0.63	0.59	0.43	0.45	1.84	1.68
	Number of observations	99	7	7	7	8	8	9	9	19	25
Machines	Average Unit Values	2.42	2.27	2.09	2.10	1.67	1.70	1.60	1.85	3.52	2.97
	Number of observations	34	3	3	3	3	3	3	3	7	6
Cars, tramways, etc	Average Unit Values	639.35				1.68	1.87	1.75	1.95	825.15	1091.10
	Number of observations	36	0	0	0	3	3	3	3	12	12
Boats	Average Unit Values	332.99	320	320	320	160.25	160.25			633.21	276.13
	Number of observations	13	1	1	1	2	2	0	0	3	3
Tools	Average Unit Values	1.20				0.86	1.21	1.19	1.32	1.31	1.23
	Number of observations	20	0	0	0	3	3	3	3	4	4
Instruments	Average Unit Values	38.94							113.82	26.63	35.61
	Number of observations	10	0	0	0	0	0	0	1	5	4
Arms	Average Unit Values	8.88								8.16	9.60
	Number of observations	14	0	0	0	0	0	0	0	7	7
Other	Average Unit Values	3.79	2.77	2.80	2.80	2.80	2.80	2.73	2.57	6.36	4.29
	Number of observations	36	3	3	3	3	3	3	3	7	8

Source: *Tableau*, various years.