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The spread of the industrial revolution in continental Europe: Why and how? the case of France, Belgium, Netherlands and Prussia

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Abstract

This paper seeks to examine and present the expansion of the industrial revolution in continental Western Europe and the resulting transformation of the economies of France, Bel-gum, Netherlands and Prussia from the era of French Revolution until the first half of the 19th century. It is pointed out that the perspective of our research is primarily and mostly synthetic and, to a lesser extent, analytical and penetrating. Our approach was guided by the aim of providing a concise overview of the different industrialization processes in West-ern European countries.

Keywords: Industrial Revolution; France; Belgium; Netherlands; Prussia; Economic Development

1. Introduction

England was a pioneering European industrial country. From the middle of the 18th century, it played a leading role in the gradual transformation of the traditional agricultural economy and society into an industrial urban society. Consequently, the productive model of industrial capitalism, characterized by continuous economic growth and technological innovations, gradually dominated Western Europe and the United States (USA) (O' Rourke and Willianson, 2017; Stearns, 2021).

The historiographical debate surrounding the understanding and interpretation of the industrial revolution in continental Europe is particularly rich, as it is characterized by a plurality of approaches: Should the nation-state serve as the primary unit of analysis? Do countries within a specific region share similar characteristics? Or should the approach be thematic, examining the structural and institutional configuration of the European economy? (see e.g. Henderson, 1972; Pollard, 1981; Kemp, 1985; Rostow, 1991; Aldcroft and Ville, 1994; Crouzet, 2001; North, 2000; North, 2006; North; 2010; Mokyr, 2008; Hoppit, 2011; Berend, 2012).

Undeniably, a pluralistic interpretative approach to the revolutionary phenomenon —both at the nation-state level and at the thematic level, with an emphasis on the economic, political, and social dimensions— softens historiographic contrasts and promotes a synthetic perspective. Besides, the political and social circumstances, along with the military rivalries of the 19th century, especially the Napoleonic Wars and the Congress of Vienna, contributed to the strengthening of the nation-state in terms of economic development and influence (Chapman, 1998; Vick, 2014).

2. France's economy prior to the 1789 Revolution: Confronting the an-cien régime

Social science researchers use the French Revolution as a conventional starting point of the modern era. The reasons are obvious, but mainly because the demands of the revolutionaries and the processes that followed the spark of the Revolution were directed against every component of the old regime –economic, social, political, ideological

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(Tsakalogiannis 2009, pp. 19-20). Similarly, through the dynamic of his work, Adam Smith, one of the most important representatives of the Scottish Enlightenment and the author of the significant book "An Inquiry into the Nature and Causes of the Wealth of Nations", turned against the old regime, especially the economic one (Smith, 1776; Patronis, 2018).

What, then, were the characteristics of the old regime, against which the French Revolution was directed and which, among other things, hindered the liberalization of the French society and the rapid industrialization of its economy?

Undoubtedly, by the standards of the 18th century, France was an advanced country, like most Western European countries, relatively rich and with its culture dominant in the intellectual trends and developments of the time. Demographically, in 1800, the grande nation had about twice the population of Britain (Fontana, 2006, p. 157) and this demographic superiority was properly utilized by the political leadership of the country so that France became the protagonist in European diplomatic and military developments. Clearly, the goals of establishing and maintaining a colonial empire were redefined, due to the loss of most of its colonies in the American continent. However, French participation in international trade was important due to its proximity and antagonism with England (Smith, 2023).

In addition, the scientific and technological progress of France was remarkable. In the natural sciences, French advancements surpassed those of the British, an advantage that was greatly highlighted by the French Revolution, at least in the field of mathematics and physics. Of course, intellectual cultivation and technical inventions alone did not constitute the elements that established England as the leader of the first industrial revolution. Even in the social sciences, the British lagged far behind the French until the middle of the 19th century —a period of French intellectual dominance that shaped and largely sustained eco-nomic science a pre-eminently Anglo-Saxon discipline. After all, it was the industrial revolution that solidified economics' undisputed primacy (Hobsbawm, 1992, pp. 51-52).

On the other hand, and in comparison, to England, and given that understanding the industrialization of European countries, particularly France due to its size, necessitates a comparative approach, many reasons explain France's delayed industrialization, like the nation-al effort during the Napoleonic wars. During most of the 18th century, France maintained a traditional proto-industrial, structure based primarily on the organized artisanal trades of the cities, which operated under detailed regulations and strict internal discipline. At the same time, agricultural handicrafts co-existed, particularly in Flanders and Normandy, where the production of textiles was largely carried out on behalf of the merchant-producers who were located in the city, as well as steel undertakings in the Marne valley.

New forms of manufacturing were gradually established after 1780, following the corresponding developments in England. However, these early steps of industrialization, which before 1789 positioned France as England's most promising student, applied only to a relatively small part of an economy that remained largely rural and traditional (Patronis, 2019, pp. 481-483; Landes 2009, pp. 157-158).

The traditional social and agricultural structure that characterized French society did not undergo significant changes until 1789. The production process in the agricultural sector was entirely under the control of the peasants, who had not modernized farming methods, and the products that they produced were entirely dependent on the area and potential expansion of arable crops, rather than labor productivity or soil efficiency (Miller, 1997, p. 44). As a result, the low productivity in agriculture and the huge inequality of income between the relatively few landowners and the majority of the population exacerbated the impoverishment of the rural world due to unsustainable taxation (Patronis, 2019, p. 483). Typical are the economic figures of the time, 10% of the population collected 50% of the income, while 70% of the population earned only 25% of the income (Berend, 2012, p. 42).

The persistence of this form of agriculture and the strong feudal remnants posed significant obstacles to any attempt at radical economic change. Aristocrats were not interested in investing in improvements to the production process, while peasants lacked the necessary capital and means of production to do so independently. The purchasing power of the aristocracy was primarily directed toward the consumption of luxury goods and ser-vices. Likewise, a significant portion of public revenue was allocated to such counterproductive expenditures, which yielded no multiplier benefits for society, as well as to inelastic expenses required for the maintenance of the armed forces and the continuation of wars (Kemp, 1985, pp. 51-54). It is noteworthy that France, throughout the 18th century, maintained the largest army in Europe which was twice the size of Russia's and nearly four times the size of England's (Maddison, 2006, p. 83).

On the other hand, the French bourgeoisie, both in this period and in previous centuries, was an amorphous entity with heterogeneous elements and not a coherent social class, with common interests and strategy, as was the case of England. Within its ranks, there are both industrial and commercial entrepreneurs who sought to expand their business ac-tivity, as well as members who adopted the consumption patterns of the aristocracy or invested in land ownership to gain

greater social prestige and get rid of the stigma of their humble origins. At the same time, the rigid structure of the French economy was a disincentive for extensive capital investment in the industrial, manufacturing sector, and part of the bourgeoisie turned to sectors with a higher rate of return, such as commerce (Lindemann, 2014, pp. 92-93; Markov and Soboul, 1990, p. 16).

The decline of the French countryside and the structural inefficiencies of the economy's operating framework clearly indicated the opposition between the need for the development of productive forces and the antiquated socio-political regime. In order for France to be able to develop its capitalist economy, the functioning of the agricultural economy would have to be radically modified and the country freed from the feudal system. This change could be carried out through two diametrically opposite paths depending on who controlled the crucial factor of production, that of the land. If land remained in the hands of the feudal lords, large-scale landowners would progressively evict the peasants and the collectives and lease the lands to rich farmers, that is, gradually the peasant-capitalist model would develop as it prevailed in England. The second path assumed that the peasants would be freed from all obligations to the aristocracy and would become the sole and main owners of the lands where they worked. The second option was implemented after the French Revolution, dismantling the old regime, transforming France into a country of small-scale farming households (Rubin, 1994, pp. 125-126).

3. The French shift: Industrialization process at the first half of the 19th century

The contribution of the French Revolution to the industrialization of the French economy, at least at the level of forming a favorable institutional framework, has its starting point in August 1789. The abolition of privileges on August 4 and 5 and the adoption by the Constituent Assembly of the "Declaration of the Rights of Man and of the Citizen" on August 26 brought about radical changes in the nature of labor relations, in the protection of inventions and in the thorough regulation of the market. Corresponding policies of liberalizing labor relations as well as securing technological achievements were also adopted in the following years (1791). Equally important were the initiatives undertaken by Jean-Antoine Chaptal who served as Minister of the Interior from 1800-1804 and ardently supported the development and improvement of French industry through a particular blend of policy that combined a naturalist perspective with necessity of state intervention and protection of domestic industries (Horn, 2006, pp. 169-194).

Arguably, by catalyzing the shackles of the old regime the French Revolution created favorable conditions for the long-term industrial development of the Western Europe as a whole (Allen, 2021, pp. 154-155). However, temporarily and mainly during the period of political instability and the Napoleonic Wars, it functioned as a restraining force in the development of the French economy. The severance of trade ties with overseas territories was a serious blow to the most dynamic sector of the economy under the "old regime". Although continental markets were open to traders and speculators who followed the course of the Revolutionary and Napoleonic armies, their revenues did not adequately offset the loss-es from transcontinental trade. In addition, the ongoing needs of war and the consequences of political conflict, especially in the 1790s, limited the production of luxury goods consumed primarily by the aristocracy, while at the same time industrial development and pro-duction in England was advancing rapidly. The trade embargo and the continental system, as a policy option, could not keep British goods out of continental Europe or at least strengthen, in the area of demand, the presence of French industry (Kemp, 1985, pp. 55-56; O' Rourke, 2006, p. 144-147).

Therefore, the fear of intensified British competition caused an organized protective re-action by the state apparatus, in order for the underdeveloped, in relation to the English, textile and mining industries to leverage available technology and access state funding. After 1815 the bourgeoisie consolidated its social influence and its share of produced wealth, and agricultural production increased at a slow but steady pace. But since the French economy was still dominated by the agricultural sector and much of the growing purchasing power was concentrated in the middle class, industry had no choice but to adapt to this situation. Thus, industrial production was still oriented towards satisfying the demands of the wealthiest consumers by emphasizing quality rather than low production costs and investing in skilled craftsmanship rather than machine technology. Such quality products also ensured prestige abroad and attracted buyers from other European countries increasing the industry's share of total national income (Aminzade, 1981, pp. 11-14).

Consequently, in its early stages, the industrialization of the French economy proceeded in a different way compared to that of England. Large-scale investments in modern mass production units constituted the exception as new techniques were adopted on a fragmentary basis without necessarily bringing about significant changes in the traditional structure. Exceptions include the region of Alsace, which not only made significant use of capital equipment based on the English model, but further technical innovations were implement-ed, especially in the textile sector (Patronis, 2019, pp. 489-490; Fohlen, 1975, pp. 20-21).

Significant structural changes in the French economy appeared in the 1830s and 1840s, under the adequate political and economic conditions. France experienced a period of political calm from 1815 onwards, and at the same time its economy gradually assimilated the changes that had taken place since the time of the Revolution and adjusted accordingly. The business-friendly state policy of the period 1830-1848 as well as the continued increase in income and demand favored the productive expansion of the textile sector, where the first signs of rapid industrialization appeared (Landes, 2009, pp. 170-183). Therefore, additional investments were required in supporting sectors of the economy such as transport, trade and the production of capital goods. The increased technological independence, which was based on the contribution of British immigrants and the educational system of technical education and industrial training, and the railway (Table 1), which initially required large amounts of capital and then cumulatively enhanced the demand for heavy goods, played an unquestionably catalytic role (Braun and Franke, 2022; Bonhoure and Bris, 2019, pp. 2-3; Borchardt, 1976, pp. 42-46).

Table 1 Length of railway line (in kilometers)

	Austria	**Belgium**	**France**	**Netherlands**	**Germany**
1835	-	20	141	-	6
1840	144	334	410	17	469
1845	728	577	875	153	2143
1850	1357	854	2915	176	5856
1855	1588	1333	5037	311	7826

Source: B. R. MITCHELL (1975), European historical statistics, 1750- 1970, p. 581.

These developments prepared the way for a new model of capitalism for which banking finance, industrial capital and the organization of large-scale enterprises were essential components. Attracted by the ideal, in their view, conditions, capitalists, such as the Rothschilds, contributed with investments in government securities and public projects to the economic growth of France. At a rate which depended on the resistances imposed by the traditional environment, the nature of the economy began to change, or, more precisely, alongside the traditional agricultural sector and the family capitalism of small and medium-scale industry, a more modern and dynamic domain was introduced that matched the English pattern of development (Kemp, 1985, pp. 59-63; Supple, 1973, pp. 321-323; Table 2). It is noteworthy, however, that the urbanization –as an indicator of industrialization– of France, remained for several more years at low levels, as according to the time series of Maddison (2006, p. 248), in 1890 only 26% of the total population of France lived in cities of more than 10,000 inhabitants.

Table 2 Number of machines, locomotives, steam engines, production and consumption of coal (France, 1830-1862)

Year	**Number of machines**	**Horse - power**
1830	625	10000
1839	2450	33000
1848	4114	50000
1852	5200	60000
1862	16080	75500
Year	Locomotives	Steam vessels - Steam engines
1840	405	263
1845	903	446
1850	3056	501
1852	3907	552
Year	Production of coal (thousands of tons)	Consumption of coal (thousands of tons)

1789	230	450
1827	1691	2226
1840	3003	4257
1860	8304	14270

Source: CL. FOHLEN (1975), "France 1700-1914" in C. CIPOLLA (eds.). The fontana economic history of Europe. The emergence of industrial societies, Part 1. Volume 4 of Fontana economic history of Europe, Glasgow, pp. 48-52; B. R. MITCHELL (1975), European historical statistics, 1750-1970, London, p. 360.

For the following decades, from the middle of the 19th century until the start of World War I, French secondary and tertiary sector of the economy through a process of gradual accumulation played an increasing role in the national economy (Table 3). The industrial structure was extremely differentiated and included firms of many sizes and very uneven efficiency even within the same industry. In heavy industry there were a number of giant enterprises that were highly competitive with their English counterparts. On a global level, from 1850 to 1870, France, together with Germany and the USA, were among England's main competitors (Becuwe et. al., 2015, pp. 3-8; Burns, 1983, pp. 34-35).

Table 3 Composition of GDP and active population of France (1820-1896)

	GDP (%)			**Active population (%)**		
France	**Primary**	**Secondary**	**Tertiary**	**Primary**	**Secondary**	**Tertiary**
1820	45,7	37,6	16,7	-	-	-
1856	41,9	35,5	22,6	48,9	25,6	25,5
1896	33,6	39,9	26,5	43,4	27	29,7
1911	31,7	39,3	29	. 42	32,4	25,6

Source: G. L. FONTANA (2006), "The economic development of Europe in the nineteenth century (II): demographic dynamics and social change; the role of agriculture" in A. DI VITTORIO (eds.). An economic history of Europe: From expansion to development (1st ed.), London & New York, pp. 139.

4. Belgium enters the era of industrialization

The area of present-day Belgium, until the end of the 18th century, was a patchwork of kingdoms, duchies, principalities, independent cities and other sovereign state formations that each had their own laws, courts, currency and, above all, customs barriers. Due to these man-made limitations and in combination with natural limitations (e.g. poor road quality, limited raw materials –such as high-quality wool, etc., insufficient exploitation of available raw materials), the Belgian territory before the industrial and the French Revolution consisted of a fragmented collection of small markets each with its own network of professionals and degree of autonomy (Landes, 2009, pp. 150-158). Thus, it is not a paradox that before receiving the influences of the industrial revolution, Belgium was a typical proto-industrial agricultural economy where the proto-factories, beyond their productive purpose, functioned as boosters of the farmers' income (Mokyr, 1974, pp. 365-366).

But what were the factors that contributed to the rapid industrialization of Belgium and its emergence as one of the most important industrial centers of the 19th century?

A first general comment that could be made is that in the case of Belgium what stands out most is that it combined the industrial growth that characterized England with the political changes that defined France. In other words, Belgium received the effects of the industrial revolution and the French Revolution due to the simultaneous influence of its two largest neighbors' countries (Clark, 1984).

More specifically, in Europe in the 18th and 19th centuries, the discovery and exploitation of coal mines largely determined the rate of industrialization of the economy (Table 4). Belgium was certainly not an exception to this trend, on the contrary it was a confirming case of it (Fernihough and O'Rourke, 2021, pp. 1137–1141; Allen, 2011, pp. 364–365). The provinces with the highest GDP per capita in 1819 –Hainault (Hainot) and Liège– were two of the richest coal regions. Certainly, the abundance of relatively cheap energy and mineral wealth was not a sufficient condition. The necessary available human resources were utilized both for the adoption of mining techniques and for the improvement

of production, especially in the manufacturing sector. At the same time, in a small country like Belgium, the role of the bourgeoisie, especially the business elite, and of the state is catalytic, as it is geographically located between two large countries, England and France, which are both competitive economies and available markets for the absorption of Belgian products (Buyst, 2018, pp. 79-80).

Table 4 Output of Coal in thousands of metric tons (1831-1860)

	Belgium	**France**	**Germany**	
			Hard Coal	Brown coal
1831	2305	1760	1700	-
1835	2639	2506	2100	-
1840	3930	3003	3200	700
1845	4919	4202	4400	1200
1850	5821	4434	5100	1800
1855	8409	7453	9900	2900
1860	9161	8304	12348	4383

Source: B. R. MITCHELL (1975), *European historical statistics, 1750- 1970,* London, p. 360.

The rise and homogenization of the Belgian bourgeoisie took place roughly from the end of the 18th century until the middle or third part of the 19th century. In part, there was a direct causal relationship between the two phenomena, industrialization and economic development, with the formation of the bourgeoisie. As a result of economic changes and political pressures in the late 18th century and throughout the 19th century (French Revolution, Liège Revolution 1789, Brabant Revolution 1789, Dutch Regime period 1815-1830, Revolution of 1830), the political administration had to deal with the emerging industry (Table 5) and bourgeoisie as the basis on which economic growth would rest and Belgian GDP would progressively increase. The most typical example of this approach is the policy of the Dutch government, which ruled Belgium from 1815 to 1830. It initially sought to restore the damage done to the interests of the Belgian aristocracy by the French Revolution, but it soon found that the economic Belgium's outlook was based primarily on industry rather than agriculture and proceeded to implement liberal business and industry policies (Clark, 1984, pp. 171-175).

Table 5 Structure of GDP in Belgium (1808/12 - 1870)

	1808/1812	**1836**	**1850**	**1870**
Agriculture	30	20	21	14
Industry	29	37	38	49
Services	41	42	41	37
Total	100	100	100	100

Source: J. L.VAN ZANDEN, A. VAN RIEL (2004), The strictures of inheritance: the Dutch economy in the nineteenth century, Princeton, p. 192.

An overview at the economic developments of the period from 1794 to the middle of the 19th century will crystallize the picture of the transformation of the Belgian economy. In 1794, French troops conquered the Belgian provinces and later annexed them to the French Republic. The early years of French rule were chaotic due to the economic mismanagement, arbitrary taxation, the violent imposition of new legal systems and the downgrading of Brussels from a capital to a provincial town. However, by the end of the century, Belgian industry began to reap the rewards of easy access to the large French market and protection from British competition. This favorable environment created the right conditions for Belgian industry to experiment with new technologies. By 1812, the province of Liège had become a center for the production of capital goods (spinning machines). Unlike wool production, no major technological breakthroughs and applications occurred in the iron industry during the French period (1795 to 1814). Well protected by the French customs and later by the continental blockade, the Walloon iron industry was not threatened by the considerable economic advantage of the corresponding British industry (Buyst, 2018, pp. 80-81).

In 1814 the provinces of Belgium separated from France and joined with the Northern Netherlands to form the United Kingdom of the Netherlands. For many Belgian industrialists and manufacturers, the collapse of the Napoleonic Empire was a brake on the upward path they had been charting until then. The French customs shifted further south, and the large French market had been suddenly closed. Many factories went bankrupt, others, however, responded to the challenge by adopting the technological innovation of the time. In the early 1820s, the cotton and woolen industries used the profits of the past to introduce, on a large scale, looms and cutting machines. Also, the use of steam became more widespread during this period. At the level of production organization, the mechanical spinning and weaving of cotton was brought together under one production unit. Only Manchester preceded Ghent in adopting vertically integrated cotton production systems (Van Leeuwen et al., 2021, pp. 57-58).

The independence of Belgium in 1830 created serious problems for the cotton industry of Ghent. During the previous decade, the Dutch East Indies had become a crucial market for the Belgian cotton industry. To "punish" the rebellious provinces and support the expansion of the Dutch cotton industry, the Dutch government imposed high tariffs on Belgian imports into its colonies. In addition, intense British competition in international markets made it difficult for the Belgians to claim a significant market share. As a result, by the early 1830s, Ghent's cotton industry showed signs of stagnation. However, the high profits of the 1820s allowed it to respond to economic difficulties by accelerating the process of further industrialization. By the 1850s, Belgium was among the most highly urbanized countries (Table 6), exhibiting high average annual growth (Table 7) and its industry stood on the verge of the railway era, with three main active industrial centers that largely corresponded to the proto-industrial centers: a) the cotton center in the Ghent area, b) the wool processing and production center in the province of Liège, and c) the center of heavy industry in the Wallonia region (Buyst, 2018, pp. 82-83; Mokyr, 1974, pp. 366-367).

Table 6 Percentage of the population residing in urban areas for selected European countries, 1850-1890

Country	**1850**	**1860**	**1870**	**1880**	**1890**
Austrian - Hungary (a)	9	10,2	10,9	13,7	16
Belgium (b)	32,6	34,8	36,9	43,1	47,7
France	25,5	28,9	31,1	34,8	37,4
Germany	26,8	29,4	32,5	35,6	39,4
United Kingom (c)	50,2	54,6	61,8	67,9	72

Source: L. A. CRAIG, D. FISHER (1997), *The integration of the European economy (1850-1913)*, New York, p. 53.

- The urban population for Austria is cities with 10 000 or more inhabitants;
- The urban population includes cities with 5000 or more inhabitants;
- The figures for the United Kingdom include England and Wales only.

Table 7 Average annual compounded rates of growth (%); and rank

	1820-1870		**1870-1913**	
	(%)	**Rank**	**(%)**	**Rank**
Austria - Hungary (GNP)	0,72	11	1,3	7
Belgium (GDP)	1,94	1	1,19	8
France (GDP)	1,02	6	1,53	6
Germany (GNP)	1,1	5	1,72	4
Netherlands	1.47	3	1.02	10

Source: L. A. CRAIG, D. FISHER (1997), *The integration of the European economy (1850-1913)*, p. 46.

5. The transformation of the Dutch economy in the first half of the 19th century

In recent decades the rate of industrialization of the Dutch economy, following the English model of the industrial revolution, has been the subject of extensive debates and opposing approaches among researchers, economists, historians and economic historians (see e.g. Mokyr, 2000, pp. 503-520; De Vries and Van der Woude, 1997, pp. 279-334;

Van Zanden, 2004, pp. 132-167). The interest in the debate arises justifiably as the Netherlands throughout the 16th and 17th centuries was a protagonist in European economic, political and technological developments (Prak and Van Zanden, 2022, pp. 147-160). The Eighty Years' War (1568-1648) was an early form of civil rebellion which led to the formation of a liberal, social and state structure based on constitutional principles, the free market of land, capital and labor as well as relative religious freedom. At the end of the 17th century, the Dutch merchant fleet had a carrying capacity of 568,000 metric tons, a size equivalent to the combined capacity of the merchant fleets of Britain, France, Spain, Portugal and Italy. Without a doubt, the Dutch Golden Age initiated the modern European transformation and the Netherlands (Table 8) became "the first region of Western Europe to escape the Malthusian growth model and experience a sustainable economic growth" (Berend, 2012, pp. 25-35).

Table 8 GDP per capita (Price in dollars, 1990 exchange rate)

Country/Year	1600	1700	1820	1870	1913
Austria	837	993	1,218	1,863	3,465
Belgium	976	1,144	1,319	2,697	4,220
France	841	986	1,230	1,876	3,485
Germany	777	894	1,058	1,821	3,648
Italy	1,100	1,100	1,117	1,499	2,564
Netherlands	1,368	2,110	1,821	2,753	4,049
Switzerland	880	1,044	1,280	2,202	4,266
UK	974	1,250	1,707	3,191	4,921

Source: A. Maddison, (2006). The World Economy, Volume 1: A Millennial Perspective. The OECD Development Centre, Paris, p. 264.

The historiographical debate about the intensity of the industrialization of the Dutch economy does not, of course, coincide with the one concerning the French case, as the political and economic structures in the Netherlands differed greatly from the ones in France. Therefore, the debate does not revolve around the remnants of the "old regime" but pertains, indicatively, the rate of assimilation of technological developments, the impact of the Napoleonic Wars and the slow business development. However, alongside the divergences in historical approaches, there are also convergences. One such convergence is the view that the industrialization of the Netherlands during the 19th century was based on the legacy of the proto-industrial structures of the Dutch Golden Age (Van Leeuwen et al., 2021, pp. 58; Van Zanden and Van Riel, 2004, pp. 135-137).

In the 1820s the province of North Holland was the center of Dutch industrial activities with high employment rates in peat extraction and the establishment of numerous production and processing units for agricultural products such as butter and cheese. Amsterdam and its trading facilities in particular played a key role —on the one hand, in importing raw materials for the domestic beverage, food and tobacco industries, and on the other hand, in functioning as transit and export trade centers. Meanwhile, with the spread of the above industries, the shipbuilding sector and its industries experienced significant growth. At the same time, the relatively high standard of living in the western provinces led to the flourishing of retail-oriented industries, while glassware and housewares were manufactured in the Utrecht industries. In addition, the textile industry in Haarlem and shipbuilding in Den Helder flourished in the same areas. In the east of the country, there was a concentration of industrial units producing textile products for which the northern provinces of the Netherlands and neighboring Germany acted in a dual way, both as local suppliers of flax and as consumer markets (Van Leeuwen et al., 2021, pp. 58; Van Zanden and Van Riel, 2004, pp. 135-137).

From the 1850s the structure and characteristics of Dutch industry changed significantly compared to the 1820s (Table 9) and Dutch secondary sector remained a crucial sector of the Dutch economy throughout the 19th century (Table 10). These changes were attributed both to the economic policies of William I during the period of the United Kingdom of the Netherlands (1815–1830) and in the subsequent division of the kingdom with the independence of Belgium. Initially, William I's reforms sought economic homogenization of the kingdom by stimulating industry in the south through establishing an investment bank and boosting export trade by creating a successor company to the bankrupt Dutch East India Company. The result of these policies has been criticized on the grounds that it functioned as a booster for the economy of the Belgian provinces and as a hindrance to the economy of the Dutch provinces. Subsequently, the dissolution of the kingdom was most felt in the textile sector and acted as a booster for the Dutch economy. Before the dissolution, Dutch merchants almost exclusively bought cloth from Ghent to resell in Indonesia. After the division they

turned to Dutch producers, strengthening the new textile centers in Overijssel and Gelderland as well as the older ones in Haarlem, Amsterdam, Tilburg and Leiden (Van Leeuwen et al., 2021, pp. 59-60; Van Zanden and Van Riel, 2004, pp. 136-139).

Table 9 Steam engines installed in the Netherlands (made in the Netherlands or Elsewhere), 1831/35-1846/50

	Dutch Machines			**All Machines**		
	Number	**Total Horse-power**	**Average Horse-power**	**Number**	**Total Horse-power**	**Average Horse-power**
1831/35	8	89	11,1	29	403	15
1836/40	28	313	11,2	55	667	13,1
1841/45	34	420	12,4	69	1063	18,4
1846/50	63	533	8,5	120	1837	22,9

Source: J. L.VAN ZANDEN, A. VAN RIEL (2004), The strictures of inheritance: the Dutch economy in the nineteenth century, p. 138.

Table 10 Structure of GDP and employment in Netherlands (1836 - 1909)

GDP					
	1836	1850	1870	1890	1910
Agriculture	22	26	30	21	19
Industry	32	26	24	32	31
Services	46	48	46	47	50
Total	100	100	100	100	100
Employment					
	1849	1870	1889	1909	
Agriculture	40	39	37	30	
Industry	31	31	32	34	
Services	29	30	32	35	

Source: J. L.VAN ZANDEN, A. VAN RIEL (2004), The strictures of inheritance: the Dutch economy in the nineteenth century, p. 192.

6. The German area facing the challenge of the industrial revolution: The case of Prussia

The French Revolution and the subsequent military victories of the democratic French triggered the questioning of the "old regime" in most countries of Europe. The cases of Prussia and the other German states are not considered as an exception. Certainly, the break with the past was not as violent as in France. The eradication of feudal institutions was slow and gradual, but with significant differences between the German states. The Western German, which were both geographically and culturally close to France, freed the peasantry from feudal burdens as early as the 1790s. Prussia, on the other hand, recognized the need for reform only after its defeat by Napoleon in 1806 (Acemoglu et. al., 2009, pp. 12-16). Larger than the other German states and with a population of over 10 million, Prussia developed during the first half of the 19th century and until the Franco-Prussian War to the leading power of "European" Germany. In Prussia, the disengagement from the "old regime" went hand in hand with both the expropriation of agricultural lands for the benefit of the peasants and the granting of land to the large landowners. As a consequence, during the first decades of the 19th century, a large proportion of peasants lost their land and became free laborers, while the large landowners gained even more land and invested their capital in hiring laborers and purchasing capital goods. Thus, agrarian reform played a decisive role in the transformation of the agricultural economy and in the creation of a surplus that was channeled into other productive sectors (Berend, 2012, pp. 100-102; Kemp, 1985, pp. 82-83).

Arguably, the changes triggered by the French Revolution and the Napoleonic Period cannot explain the profound transformation of the Prussian economy. Contemporary historiographical trends (Kopsidis and Bomley, 2014; Kopsidis and Bomley, 2017, pp. 732-734) based on institutional approach argue that there were the appropriate long-term

institutional conditions that turned Prussia and then Germany (1871) into an important economic pole and which can be summarized as follows: a) by 1800 a stream of bourgeois, smaller in size compared to the French bourgeoisie, had formed in Prussia, which was emanating from the adoption of liberal economic policies, in this way the reform of 1806 is explained, b) willing Prussian reformers, influenced by the liberal current of the time, adapted the perspective of Adam Smith (1776) to the peculiar conditions of the Prussian economy by developing an innovative model of self-sustaining economic development based on the agricultural economy, with significant concessions to the landed gentry and with the simultaneous transformation of the peasantry into a large, free peasant class, and c) the absence of political democratization in Prussia between 1791 and 1848 enabled Prussian reformers and the bureaucratic elite to implement the "dictatorship of modernization" in the first half of the 19th century and thus impose their program for radical modernization despite the opposition of the established elites, who sought to preserve the "old regime" (see Table 11 and Table 12. The data in these tables display the increase in governmental spending and net capital investment in the industrial, transport, and commercial sectors).

Of course, the creation of a coherent and stable national economy ran into the loose alliance of the numerous German states, principalities and independent cities. The situation clearly improved after the Congress of Vienna in 1815, which contributed to the creation of the German Confederation, a confederation of 39 sovereign German states. The next step was the gradual formation of a common market, first by the abolition of internal tariffs within Prussia in 1818, and then by the conclusion of a series of agreements with other German states in 1821-1833, which joined the customs union called 'Zollverein' (List, 1909, pp. 62-73; Allen, 2023, pp. 63-64). Notably, similar attempts for regional economic integration took place in Austria from the late 18th century (Komlos, 1983). The Zollverein, beyond its latent political significance, played a decisive role in the industrialization of the German states (Tsakalogiannis, 2009, pp. 282-283). The connection is linear: the customs union led the German states to seek stabilizing exchange rates, stable exchange rates expanded trade relations, expanded trade relations required better and more efficient communications and transportation. As a result, the railroad developed rapidly (Table 1) accelerating German industrialization and subsequently its own expansion (Keller and Shiue, 2014; Tilly and Kopsidis, 2020, pp. 87-104).

Table 11 Composition of Prussian governmental spending, 1821-1866 (%)

Spending	**1821**	**1829**	**1838**	**1847**	**1849**	**1856**	**1866**
Military	27	26	31	28	29	27	29
Debt	13	14	13	8	8	11	11
Commercial (a)	16	16	16	19	27	30	31
Administrative	44	44	40	44	36	32	29

- Includes spending on mines, forests, Crown lands, railroads, postal services, and expenditures by the ministries of Commerce and Industry.
- Source: R. TILLY (1966), "The political economy of public finance and the industrialization of Prussia, 1815-1866", in The Journal of Economic History, Vol. 26, no 4, p. 492.

Table 12 Net Real Capital Investment in Prussia, 1816-49 (by Sectors in millions of marks at 1913 prices)

Period	**Agriculture**	**Non - agricultural buildings**	**Transport**	**Industry**	**Total**
1816-22	86,5	28,7	7	2,8	125
1822-31	70,4	18,7	8,8	5,1	103
1831-40	109,6	52	22,5	5,6	189
1840-9	59,9	69,2	73,7*	7	209

* Of which 60,9 million invested in railroads.

Source: C. P. KINDLEBERGER (1985), A financial history of Western Europe, in The Journal of Economic History, London, p. 192.

Simultaneously with the above conditions and parameters, intense British competition served as a powerful catalyst for the industrialization of the German regions. From the beginning of the 19th century, due to English economic policy and

their technological and qualitative superiority (North, 2000, pp. 248-264), English products (chemicals) had flooded the markets of Central Europe, markets which were vital space for the German states. Although there were many proposals and requests for the adoption of tariff protection measures, the more perceptive German businessmen realized that they would have to adopt British techniques and practices. Therefore, they turned to their governments asking for the assurance of know-how and technology comparable to English, the development of a research-friendly education system, the provision of tax breaks and subsidies, liberal licensing policies for new factories and the restriction of the action of guilds, whose policy prevented the creation of a free and competitive market. The above requests of the businessmen met the strong reaction of other social and professional groups, such as the representatives of the trade guilds/cooperatives, whose professional interests were affected, and the military, that followed with great reflection and concern the social tensions caused by the industrial revolution in England (Horn et al., 2010, pp. 109).

It is useful and informative to examine the competing claims between supporters and critics of industrialization regarding the adoption or not of illiberal economic policies. The obvious reason is the presence and action of powerful guilds within the Prussian economy (Ogilvie, 2019, pp. 463, 533-536).

In Prussia, in the years 1810-1811, the favorable mercantilist provisions of direct subsidies, monopolies and protective tariffs were abolished. The new policies aimed to move existing factories from the cities to the countryside, where cheap hydropower, raw materials and labor would allow Prussian entrepreneurs to compete internationally without significant government aid. Bureaucrats offered free advice on the latest technological developments and the government invested in road construction (Kocka, 1981, pp. 456-458). Tariffs within Prussian territory were completely abolished, while on imports of goods from other states the duties were higher than in smaller and medium-sized states, but much lower than in Austria, Russia, France and England. However, after 1815 guild mobilization, supported by conservative circles close to King Friedrich Wilhelm III, threatened to overturn the industrialist-friendly reform program. The pressure to adopt an anti-industrial policy was maintained until the mid-1820s, but it was ultimately not adopted due to the increasing dependence of the Prussian economy on tax revenues paid by industries (Horn et al., 2010, pp. 112-113).

In this diverse way, with bottom-up market forces and politicians addressing critical issues, German Europe, and especially Prussia, was pushed toward industrialization. Although most German states initially opposed modernization and industrialization, Prussia did not and led the way.

7. Conclusion

The modernization and industrialization of the national economies of European states was not a uniform process. In the French economy significant structural changes were evident from the 1830s and 1840s, under the adequate political and economic conditions. At a rate that depended on the resistances imposed by the particularly strong traditional environment, the nature of the economy changed, or, more specifically, alongside the traditional agricultural sector and the family capitalism of small and medium-scale industry, a more modern and dynamic secondary sector was introduced to suit to the English model of development and took off the French economy from 1850 onwards.

In the case of Belgium what stands out most is that it combined the industrial growth that characterized England with the political and social changes that defined France. A country with rich coal deposits utilized the available human resources both for the adoption of mining techniques, which were already applied in England, and for the development of the secondary sector. Meanwhile, in a small country like Belgium, the role of the bourgeoisie, especially the business elite, and the state is catalytic, as it is geographically located between two large countries, England and France, which are at the same time competitive economies as well as available markets for Belgian products. The industrialization of the Netherlands during the 19th century was built on the legacy of the pre-industrial structures of the Dutch Golden Age. From the 1850s, the structure of Dutch industry changed significantly compared to the 1820s. These changes were partly at-tributed to the economic policies of William I during the period of the United Kingdom of the Netherlands (1815–1830) and the subsequent division of the kingdom with the in-dependence of Belgium.

In the German area and especially in Prussia, the detachment from the "old regime" and the transformation of the economy have their foundations in two basic conditions. The first and most important condition concerns the groundbreaking institutional reforms in the economic field which were adopted by the bureaucratic elite and a narrow core of the bourgeoisie. The second condition concerns the accelerating role played by the French Revolution and the Napoleonic Period in the adoption and implementation of the above reforms. In the context of institutional interventions and the catalytic role that institutions play in the evolutionary course of an economy, the Zollverein, beyond its latent political importance, significantly strengthened the industrialization of the German states, facilitating the development

of trade, investment and final consumption. However, in addition to the institutional changes and the creation of the Zollverein, the intense British competition was also a powerful catalyst for the industrialization of the German regions.

Compliance with ethical standards

Disclosure of conflict of interest

The author declares no conflict of interest.

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