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Abstract

This paper examines a novel negative impact of trade tariffs and the costs they induce by documenting how protectionism reversed the long-term improvements in education and the fertility transition that were well under way in late 19th-century France. The Méline tariff, a tariff on cereals introduced in 1892, was a major protectionist shock that shifted relative prices in favor of agriculture and away from industry. In a context in which the latter was more intensive in skills than agriculture, the tariff reduced the relative return to education, which in turn affected parents' decisions about the quantity and quality of children. We use regional differences in the importance of cereal production in the local economy to estimate the impact of the tariff. Our findings indicate that the tariff reduced enrolment in primary education and increased birth rates and fertility. The magnitude of these effects was substantial, with the tariff offsetting the increasing trend in enrolment rates and the decreasing one in birth rates by a decade.

JEL Classification: J13, N33, O15

Keywords: Education, Fertility, protectionism, France

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1 Introduction

The debate concerning trade policies remains heated. Existing theories argue that trade restrictions raise consumer prices, result in a lack of capital, and affect firm dynamics, thus reducing welfare and growth. At the aggregate level, the evidence seems to support a positive effect of increased openness on growth and welfare, although conflicting theoretical predictions and the difficulty of measuring openness can explain the different patterns observed across countries. Microeconometric evidence confirms many of the theoretical results, indicating, for example, that removing trade barriers leads to greater product variety and induces innovation, even if such gains are likely to be associated to costs, notably in terms of employment for certain categories of workers.[1] Data on a number of trade liberalisation episodes during the postwar period have been used to identify the gains from trade. Instead, instances of a major switch to protectionism are rare. Moreover, although the effect of trade on a wide variety of outcomes has been well-studied, the literature on its implications for births and schooling is scant.[2] This paper uses historical data for France to document the impact of protectionism in the form of an increase in agricultural tariffs on fertility and education.

Our focus is an emerging, but still mainly agrarian, economy: France in the late 19th century. This period is of particular interest as it witnessed a wave of demands for protectionism across Europe. Following a massive increase in cereal exports from the Americas and Russia, cereal prices in Western Europe plunged, resulting in a major income loss for cereal producers. As was the case in other European countries, political pressure to impose tariffs on cereal imports grew in France during the 1880s and resulted in the adoption of the so-called Méline tariff in 1892, a tariff on grain imports that halted the fall in cereal prices and led to substantial wage increases in the agricultural sector; see O'Rourke (1997). We argue that, in a context of falling birth rates and rising education, the tariff implied a change in the relative price of agricultural and manufacturing goods that affected the incentives both to bear children and to educate them, thus resulting in changes in fertility and enrolment rates.

In order to understand how protectionism impacts education and fertility we develop a simple small open economy model inspired by Galor and Mountford (2008) who consider an open-economy setup in which parents derive utility from both the number of children that they have and from the level of education of their offspring. Since schooling is costly -either because it takes parental time or because it prevents child labour-, parents face a trade-off between fertility and investment in children's education, i.e. a quantity-quality trade-off as in Becker and Tomes (1976). This trade-off depends crucially on the returns to education and hence on any aggregate variable that affects it. We follow Galor and Mountford (2008) and consider a two-sector economy with a manufacturing and an agricultural sector, and in line with historical evidence assume that human capital is more productive in the former than in the latter. A tariff on agricultural goods thus increases wages in farming and hence the employment share of the sector, reducing the relative return to education and leading to lower investments in human capital. To compensate for lower children quality, parents respond by increasing their quantity, and the tariff results in higher fertility rates. Crucially, the impact

[1] See, for example, Broda and Weinstein (2006), Goldberg, Khandelwal, Pavcnik, and Topalova (2010), Autor, Dorn, and Hanson (2013), and Bloom, Draca, and Van Reenen (2016) for microeconomic analyses, and Winters (2004) for a review of the literature on trade and growth.

[2] The few exceptions are Schultz (1985), Galor and Mountford (2008), Chakraborty (2015), Atkin (2016) and Anukriti and Kumler (2019). See below for a discussion.

of the tariff depends on the initial importance of cereal production, with the effect being stronger the higher agricultural productivity is *relative* to productivity in manufacturing.

To take the model to the data, we use France's division into administrative districts and exploit the heterogeneity in the impact of the treatment across districts. In the late 19th century these districts differed greatly in the importance that agriculture, and in particular cereal production, had in the local economy. We use two measures of the relative importance of cereal production which capture the intensity of the policy. The first one is based on actual cereal production, and is simply the share of employment in cereal production just before the switch to protection. Our second policy variable is a measure of the potential for cereal production. Because the model predicts that what is key is relative productivity, we compute it as the ratio between the suitability for cereal production and the potential for manufacturing. The former is obtained from agro-climatic measures, while manufacturing potential is captured by the distance to the location where the steam engine was first used in France.[3]

Three variables measure outcomes at the district level: enrolment in primary education, which at the time catered for children aged between 6 and 13, the crude birth rate and the fertility rate. We estimate the impact of the tariff by multiplying our measures for relative cereal productivity by a dummy for the years when the Méline tariff was in operation, a strategy used, for example, by Edmonds, Pavcnik, and Topolova (2010) and Topalova (2010) to examine the impact of trade policies. Our estimates hence capture the differential impact of the tariff on districts where cereal production accounted for a large share of economic activity, rather then the overall national-level impact.

Using data for the period 1872 to 1913, we find that enrolment rates were negatively affected by the introduction of the tariff while birth rates and fertility rose, consistent with the theory. By the 1870s France had almost completed its fertility transition and achieved high enrolment rates in primary school, implying that protectionism reversed in both cases a decades-long trend. A number of robustness exercises indicate that results are not driven by potential confounding factors such as religious conservatism or the diffusion of different cultural norms on fertility and education caused by the arrival of migrants. Moreover, the economic magnitude of the effects is large. For the average district, the tariff reduced enrolment rates by 5.4 percentage points, which roughly amounts to the gains made in the previous decade, while the estimated impact on birth rates was of the same magnitude (but opposite sign) as the reduction implied by the national trend over 11 years.

The paper is related to several strands of the literature. There is a vast literature on the effects of trade policy but only a limited number of papers have focused on education and fertility, all using contemporary data. In a closely related analysis, Atkin (2016) considers the impact of openness on education by looking at the establishment of export-oriented low-skill-intensive factory openings in Mexico in the 1980s and 1990s, and finds that factory openings resulted in a reduction in schooling. His results that openness reduces education are consistent with our finding that protectionism has the same effect. What is important is not whether

[3] Agro-climatic measures have been recently used to consider the importance of different crops for long-run economic outcomes; see Nunn and Qian (2011), Galor and Özak (2016), and Mayshar et al. (2019). Our measure of potential for industrialization has been proposed by Franck and Galor (2021), who argue that industrialization depends on the geographical diffusion of new technologies and show that distance to where the first steam engine was used is indeed correlated with industrialization in France during the second half of the 19th century.

the economy becomes more or less open per se, but rather whether the policy increases the returns to low-skill activities, something that in the case of late 20th century Mexico occurred as the economy opened up and in that of late 19th century France was driven by agricultural protectionism.

The recent wave of trade liberalization in India has provided a ideal context to examine the role of trade policy. Edmonds, Pavcnik, and Topolova (2010) examine the effect of openness on district enrolment rates and child labour. They find smaller increases in school attendance in rural districts where the structure of production was such that the policy implied a larger reduction in effective tariffs and argue that the reason is probably the underlying poverty-schooling relationship: a larger tariff shock implies falling prices of local production and hence a slower reduction in poverty (relative to the national average), leading to slower education growth. The effects of trade policy on fertility have barely been studied, with the exception of Chakraborty (2015) and Anukriti and Kumler (2019) which focus on how tariffs affect sex ratios. The latter also consider the impact on liberalisation on fertility rates and find that districts which were more affected by tariff reductions exhibited a slower decline in fertility. Although apparently in contrast to our results, the evidence for India can be reconciled with ours by noting that the change in relative prices induced by a tariff has an income and a substitution effect. Both Edmonds, Pavcnik, and Topolova (2010) and Anukriti and Kumler (2019) find that in rural India the income effect dominates, while our results indicate that in late 19th-century France, like in Atkin's study, the substitution effect drove observed outcomes.

The hypothesis that trade can be a crucial determinant of education and fertility, and consequently of growth, was first put forward by Galor and Mountford (2008). They develop a growth model where opening up to trade gives countries incentives to *specialise* in education or population, thus leading to more schooling and lower fertility in one economy and to the opposite in its trading partner.They test their model on a cross-section of countries and find that while in the OECD a greater share of trade in GDP is associated with lower fertility and higher human capital formation, it is positively correlated with fertility and negatively with education in non-OECD economies. Our analysis complements these results by focusing on a historical policy shock, while the use of data for a single economy removes concerns about unobserved country heterogeneity.

A large body of evidence has tried to identify the determinants of the demographic transition; see Easterlin (1976) for a discussion. Although our analysis is not concerned with this episode, which in France had started almost a century before the Méline tariff was introduced,[4] some of this literature proposes an approach closely related to ours by trying to identify variables that affect the cost of having children. Notably, Schultz (1985) argues that the fertility transition in Sweden, which took place in the 1880s, was largely the result of changes in international agricultural prices that raised the relative wage in female-intensive occupations. Exploiting differences across Swedish counties in the intensity of these activities, he finds that the increase in relative female wages explains a substantial fraction of the observed fertility changes. Our paper shares with this work its emphasis on how terms of trade shocks that affect relative wages in a country can lead to rapid fertility responses.

France is an interesting case to study as it was the first country to experience the fertility transition, well before any of the other early industrialisers, and several recent articles have

[4]See Chaunu (1972), Van de Walle (1980), Weir (1984) and Bardet and Le Bras (1988) for evidence.

used French district-level data similar to the one in this paper. Both Murphy (2015) and Diebolt, Menard, and Perrin (2017) explore the determinants of French fertility in the 19th century. Their results indicate the importance of education, particularly that of females, but also of cultural factors in bringing about the fertility decline. De La Croix and Perrin (2018) take a different approach by building a detailed model of the determinants of education and fertility, and they perform structural estimations aimed at quantifying to what extent observed patterns can be explained by rational choice rather than social norms. Daudin, Franck, and Rapoport (2019) consider the role of internal migration as a vehicle for the transmission of cultural norms, and using exogenous variation in transportation costs show that migrants from low-fertility regions helped diffuse low-fertility norms. These articles indicate the importance of certain microeconomic factors in explaining fertility and education in 19th-century France. Our analysis focuses instead on a major aggregate shock, providing evidence that macroeconomic policy impacts fertility and education.

The paper is also related to two debates in economic history. On the one hand, historians of education have documented a "lost decade" in education in France in the 1890s; see Prost (1968). The decline in primary enrolment rates after decades of increase has been hard to explain, and our argument implies that protectionism was a possible cause. On the other, we add to an extensive literature documenting the impact of late 19th century protectionist policy on economic outcomes. Following Bairoch (1972), numerous studies have found that protectionism was associated with higher growth rates, generating the so-called tariff-growth paradox; see O'Rourke (1997), O'Rourke (2000), Jacks (2006) and the survey in Lampe and Sharp (2013).[5] Here we take a different approach; rather than exploiting cross-country differences, we document that *within* France the districts that benefited the most from the tariff were also those where it had the strongest effect on births and children's education. Our results then imply that, even if it had important short-run benefits, the Méline tariff is likely to have had a considerable medium-term cost in the form of increased birth rates and reduced schooling.

The rest of the paper is organised as follows. Section 2 provides the historical background to our study in terms of agricultural protectionism, educational attainment and fertility. Section 3 develops a two-sector model of the household's decision concerning the number of children and education and discusses possible theoretical mechanisms. Section 4 describes the econometric specification, and the next two sections present the data and the empirical results. Section 7 concludes.

2 Historical background

Nineteenth century France was an emerging economy. The country had experienced its industrial revolution in the middle of the century, yet the economy remained predominantly agricultural. Agriculture accounted for 38% of French GDP and for 50% of employment in the 1870s, with these shares declining by 10 percentage points by the eve of the First World War. These figures are in line with those in other Western European countries at the time, with the exception of Great Britain.[6]

[5] See also Dormois (2009) who uses industry-level data to document the negative impact of industrial tariffs on European industry.

[6] In 1870, France's neighbour employed only 22% of the labor force in agriculture and the sector's output was 19%, with both shares declining to 10% by 1910 (Crafts, 1984, p. 53-4). The French data for output are

Contrary to the US or Denmark, agriculture was not an engine for the growing industrial sector. In these countries, incremental innovations in agriculture were a trigger for new technological progress, for example through the development of refrigeration,[7] a pattern not observed in France. Agriculture was therefore the laggard sector. Although there are no direct quantitative measures of the lack of technological innovation, there is a consensus among historians that farmers were slow in adopting new techniques to improve the efficiency of cereal harvesting, the consequence of which was a highly seasonal demand for unqualified labor during the harvesting period.[8] Notably, farmers were slow in increasing the use of chemical fertilizers, a novel input at the time and an important technological improvement that increased cereal yields. Between 1880 and 1910 the use of fertilizers increased by only 20% in France, while it rose by 40% in Germany, and by 55% in Belgium and the Netherlands (Bairoch, 1989, table 2). The consequence was a low level of productivity in agriculture. In contrast to other countries, labor productivity in French agriculture did not improve during the period 1870-1913, and neither the capital-labour ratio nor the capital-land ratio matched the levels attained in Britain.[9]

Historians have blamed this laggardness on farmers' 'low appetite' for education and for technological progress; see Weber (1976) and Barral (1968). Economic historians, on the other hand, have argued that farmers preferred diversifying their saving portfolio rather than investing in increasing the return to a single crop, and that local capital market segmentation created credit constraints in rural areas that prevented technological investments.[10] Whatever its cause, a major consequence of this low appetite for technology in agriculture was a low demand for education in agricultural jobs. Despite scant quantitative evidence on educational achievement by sector, the 1906 census provides evidence of an educational gap between agriculture and manufacturing. Of those working in agriculture –self-employed or salaried– 20.3% were illiterate, compared to 9.3% of the workforce in industry. The share of illiterates was particularly high among the self-employed peasants and farmers (22%), in sharp contrast with the 7% rate of illiteracy found among self-employed entrepreneurs and managers of small firms in industry.[11]

Agriculture was therefore badly hit by the expansion of international trade in agricultural commodities triggered by the growing use of steamships to transport cereal across the Atlantic ocean starting in the 1870s. The subsequent development of domestic railway networks in Argentina and the US, between 1870 and 1913, allowed devoting an ever-growing surface of land to the cultivation of cereals, see Bignon et al. (2015). The price gap between the Americas and Europe together with a steady reduction of freight rates allowed the export

from Toutain (1987), who provides figures for the nominal value of agricultural production and nominal GDP (column V3 p. 102ff and V41 p. 150ff), and Golob (1944, p. 18).

[7]See Goodwin et al. (2002) on how refrigeration transformed the US agricultural sector and Henriksen and O'Rourke (2005) and Henriksen et al. (2011) on Denmark, where output growth was largely driven by the country becoming the main supplier of dairy products to U.K. In France a notable exception is the development of the beet-sugar industry in the 1850s and 1860s. Postel-Vinay (1991) shows, nevertheless, that this effort towards a more technology-intensive agricultural sector was halted in the 1870s.

[8]See Augé-Laribé (1950) and Barral (1968) on technology and Sicsic (1992) and Magnac and Postel-Vinay (1997) on employment patterns.

[9]See Dormois (1996), O'Brien and Keyder (2011, p. 97-100), Crafts (1984) and Sicsic (1992).

[10]See Hohenberg (1972) and Heywood (1982) on diversification and Postel-Vinay (1991) on capital market segmentation.

[11]The data are from panel D in *tableau* VI, p. 11, of the Statistical yearbook, the Statistique générale de la France (1911).

of the growing cereal output to Europe, thus increasing market integration; see Jacks and Pendakur (2010).[12] In a context in which the world price of grains fell by a third, this "grain invasion" resulted in deflationary pressure in France, with agricultural prices declining faster than other prices; see Kindleberger (1951) and O'Rourke and Williamson (1999).

In a context of low effective tariff duties on imports, especially on agricultural products (Nye, 2007), declining domestic cereal prices reduced farmers' revenues and generated a generalised discontent in the countryside. Calls for protectionist policies grew. Initially, the political climate was such that the alliance between free-traders and industrialists in Parliament prevented the approval of major tariffs.[13] The elections of October 1889 changed the composition of parliament and support for protectionism grew, eventually leading to a tariff on cereals to fight competition from the Americas. The so-called Méline tariff was approved by the French parliament in January 1892.[14] The tariff has been argued to be the single most important piece of economic legislation adopted during the Third Republic, with major political and economic implications (Golob, 1944).

Its adoption represented the end of a thirty-year period of free trade that had started with the signing of the 1860 free-trade treaty with England, a milestone in the historiography of French attitudes towards international trade; see Bairoch (1972). The tariff is viewed as a crucial piece of legislation that consolidated the republican political regime by adding farmers to the voters supporting the ruling parties (Plessis, 1993; Dormois, 2012). It was also perceived as a regime change in the media. Protectionism made the headlines of newspapers, putting a constant pressure on lawmakers and politicians. This media pressure was reinforced by a strong lobbying of the representative of professional associations; see Golob (1944) and Cadier-Rey (1997). As we document though text analysis of daily newspapers (see Appendix 1), protectionism drew growing media attention up to the introduction of the tariff. Thereafter the number of occurrences remained constant, with the press closely following changes in the tariff up to World War I.

Tariffs were introduced ad valorem: for each 100 kilos of cereals, the tariff increased the import price by 5 francs in 1892, which amounted to about 25% of the import price; see Figure 1 and Golob (1944, p. 204). The economic magnitude of the tariff was substantial. Levasseur (1911, vol. II p. 585) estimates that the Méline tariff, if applied earlier, would have increased the cereal prices in 1889 by 80%. Moreover, the law allowed for the tariff to be adjusted regularly to take into account variations in the world price of cereals; Augé-Laribé (1950) and Golob (1944). For example, in 1894, as import prices continued to decline, the wheat duty was increased from 5 to 7 francs per hundred kilograms.

Figure 1 depicts the evolution of the import price of wheat. Between 1871 and 1891 the import price had fallen by 35%, reaching a value of 22 francs per 100 kilos by 1892. The import price continued to fall in the years immediately following the introduction of the tariff, with

[12]See also North (1958), Harley (1988), and Federico and Persson (2007), amongst others.

[13]See Dormois (2012). In the 1880s, farmers' lobbying led to the introduction of a tariff on wheat, with a dual rate depending on whether the country of origin was granted the 'most-favored nation' clause or not. All of France's major trading partners were granted this clause resulting in low de facto tariffs; see Bassino and Dormois (2010).

[14]The tariff is named after Jules Méline, MP, several times agriculture minister and Prime Minister from 1896 to 1898. Méline, a staunch defender of agriculture, proposed to parliament the adoption of a tariff on cereals, which became known as the "Méline tariff". Méline justified the tariff by telling lawmakers that "suddenly came the development of the means of transportation and communication, the rapid decrease in freight costs, in a few years placing these great markets at our door"; quoted in Golob (1944, p. 182).

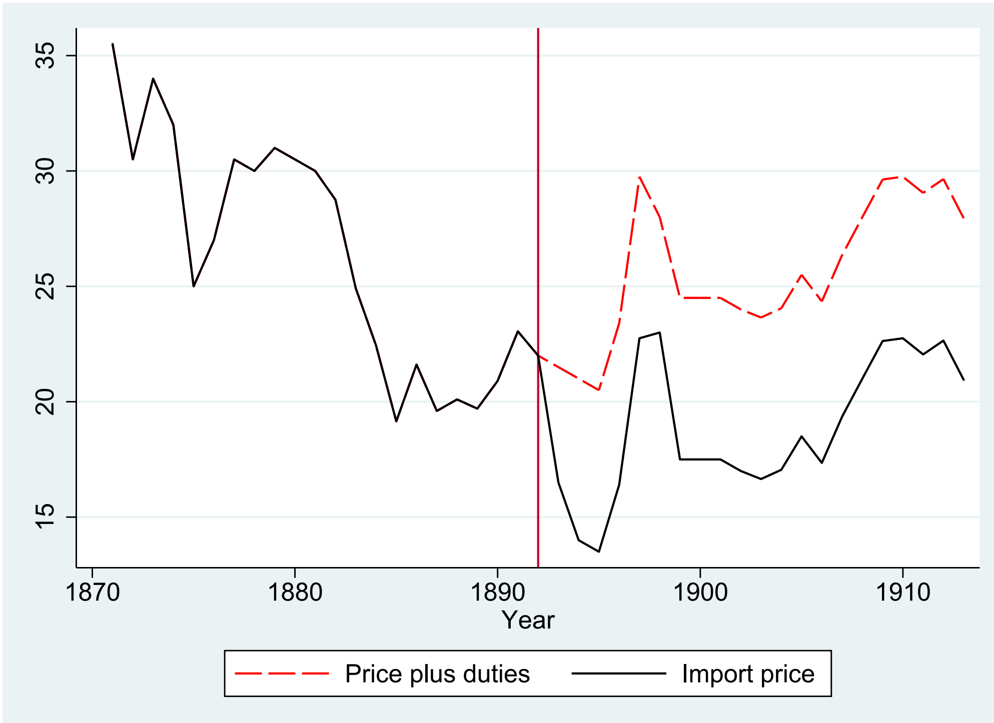

Figure 1 – Import price of wheat (francs per 100 kg.): France, 1872–1913. Source: INSEE (1951) table VIII p. 208* and Golob (1944).

the lowest price being reached in 1895. With an import price of 13.5 francs that year, the 7 franc tariff implied a massive increase in the market price of cereals. Over the following two decades, import prices fluctuated around 19 francs, with the duties increasing the price by an average of 37 percent and substantially stabilizing the domestic price; see Augé-Laribé (1950) and Lhomme (1970) as well as Appendix 1.

The impact of the tariff was enormous. Economist Daniel Zolla (1903, p. 26-33) noted that the tariff "succeeds in limiting the reduction in prices compared to England or Germany". Zolla, computes the difference in the price of wheat in London and France in late 1892, with the price leveling at 10 francs in England against 15 francs in France. Using a model that allows him to construct a counterfactual with free trade in cereals, O'Rourke (1997) documents that the Méline tariff protected farmers' revenue from most of this decline by increasing domestic prices by 26.5%. In a country in which the agricultural labour force represented 50% of the working population, the tariff implied that actual French grain output was twice as large as it would have been in the absence of protection. Moreover, despite cereals being a staple of the French diet,[15] the overall effect of the reduction in world prices plus the tariffs was an increase in the average real wage, largely driven by the wages of farmers who were made better off compared to the rest of the population.

The tariff was introduced at a time in which major socio-political changes had already changed the demographic landscape in France. Despite low demand from the agricultural sector, educational attainment in France had grown massively throughout the 19th century, as

[15] See, for example Postel-Vinay and Robin (1992) and Weir (1993)

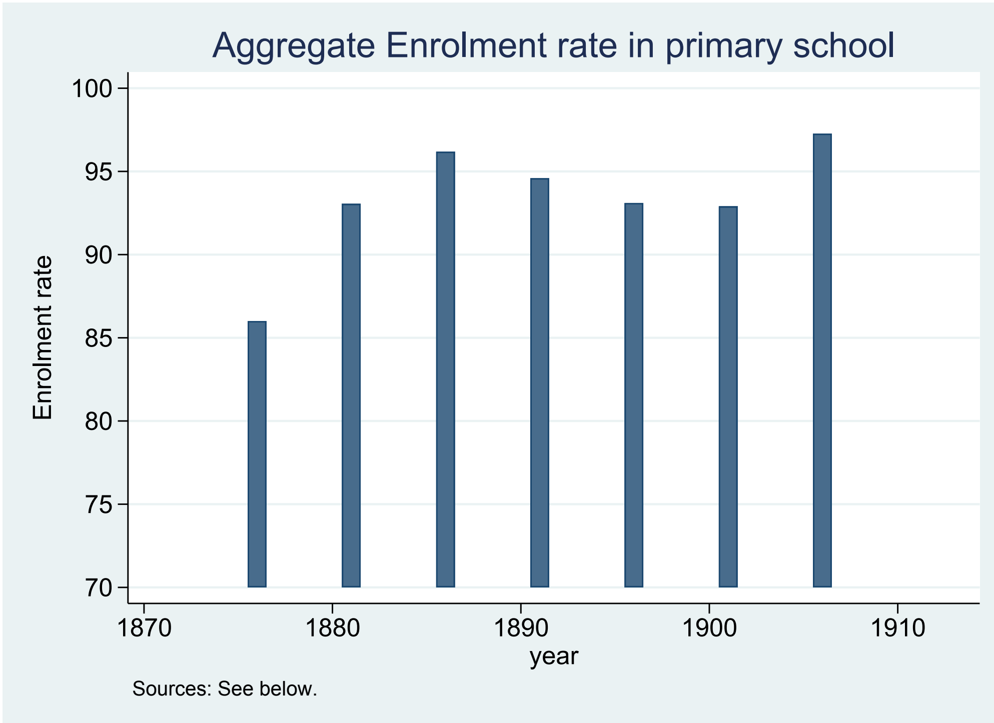

Figure 2 – Aggregate Enrolment Rate in primary school, France 1876-1906

a result of both demand and supply-side forces. The supply of education facilities for primary schooling started increasing in the 1830s, largely out of political and religious motives, and a general perception that education mattered for citizenship.[16] Successive legislation fostered access to schooling. In 1833 it became compulsory for the municipality of any town of at least 500 inhabitants to provide a primary school for boys, with the requirement being extended to all villages in 1850, and in 1867 to a school for girls.[17] As a consequence, the number of schools increased from 10,000 in 1830 to 80,000 by the early 1880s and hovered around this number afterwards.[18] Moreover, although free schooling was not required by law until 1881, throughout the period 1870-1913 school expenses were mainly financed by the State or through local taxes, and, in the 1870s, considerable efforts were made to make the quality of teachers more uniform across the country, thus resulting in a virtually free and homogeneous supply of schooling across the country.[19]

At the same time, a growing demand for education was partly driven by the prospects offered by the two main waves of innovation in French manufacturing. The first took place in the mid-19th century as the textile and steel industries developed, the second started at the very end of the 19th century, notably in chemistry and electricity production; see O'Brien and Keyder (2011) and Crafts (1984). Cultural and social factors may also have played a role, in particular the decrease in religiosity caused by the French Revolution; see Squicciarini (2020).

[16]See Furet and Ozouf (1980).

[17]Those laws are named after the minister who sponsored them: Guizot in 1833, Falloux in 1850, Duruy in 1867 and Ferry in 1881-1882.

[18]Sources are Ministere de l'instruction publique (1876) and Statistique générale de la France (1915).

[19]See Grew and Harrigan (1991) and Prost (1993).

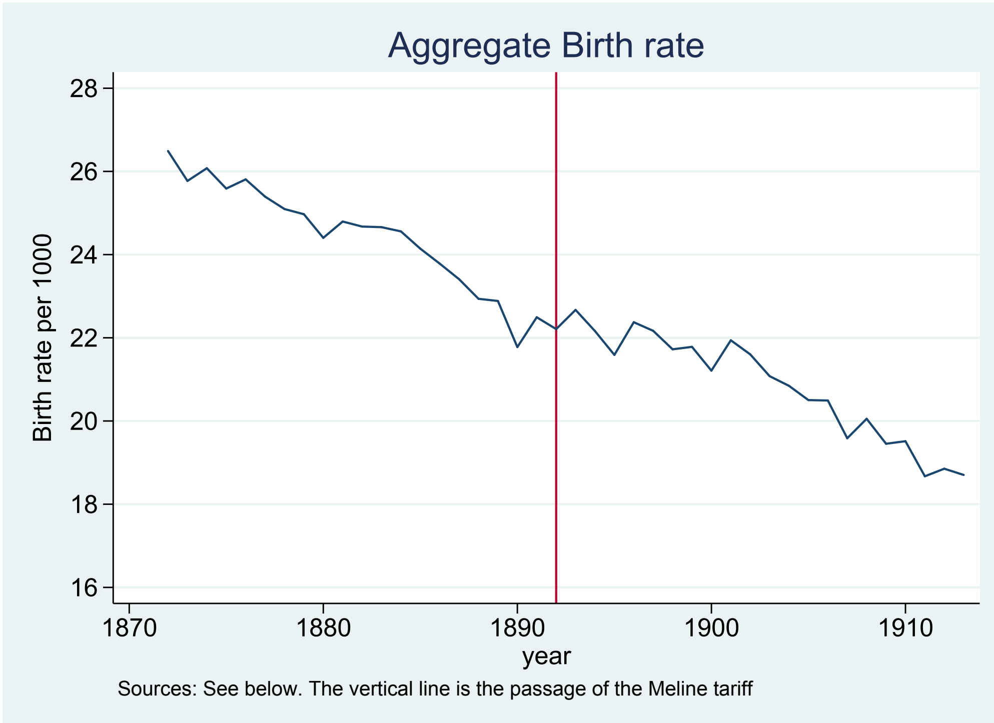

Figure 3 – Aggregate Birth Rate, France 1872-1913

Towards the end of the 1870s enrolling children in primary schooling was the cultural norm across the country; see Prost (1993). The number of pupils per school was stable between 1871 and 1913, hovering in the range of 60 to 70, which indicates that most establishments were in fact one-class schools. Schools were evenly dispersed across the country, mostly located in villages, implying a (relatively) easy access to schools by pupils. Prost (1968) has shown that by the time schooling was made compulsory in 1882 a large share of pupils were already schooled, as can be seen from the primary school enrolment rates in Figure 2.[20] Despite increasing educational attainment throughout the century, historians have been puzzled by the 'lost decade' at the end of the century. Prost (1993) shows that between the census of 1886 and that in 1896, the national enrolment rate in primary education fell by 3.9% for girls and 4.4% for boys, and that this decline was particularly marked in South-West France (see also Figure A.1 in the appendix). Surprisingly, the literature seems to have ignored the fact that this decline coincided with the introduction of the Méline tariff.

The 19th century also witnessed a sustained decline in birth rates. As it is widely acknowledged, France was the first country to experience a fertility transition.[21] The second half of the 18th century exhibited the usual pre-transition birth rate of around 40 children per thou-

[20] The well-known Ferry law forbade religious education and local dialects from public schools, made learning (but not schooling) compulsory between the ages of 6 and 13, and made education free in public schools.Grew and Harrigan (1991) present quantitative evidence that the Ferry laws in 1881-2 had no impact on overall enrolment rates, since all they did was to induce a substitution between private (catholic) schools and public schools.

[21] See Guinnane (2011) for a discussion in an international context and Figure A.3 in the appendix for the long-run trend.

sand individuals. Birth rates started to decline around 1790, almost one century before the fertility transition took place in England and Germany.[22] In contrast to other countries where the late 19th century exhibited major changes in fertility behaviour, in France the period just before the introduction of the Méline tariff consists of two decades of substantial stability, with birth rates continuing their long-run decline. There is nevertheless a slowdown of the trend after 1892, as can be seen in Figure 3 where we report the crude birth rate computed at the national level. The birth rate fell by 2.5 children between 1872 and 1882 and by 1.9 children between 1882 and 1892, yet in the next decade it declined by only 0.7 children. This slowdown, as well as the reduction in enrolment rates described above, seem to have coincided with the introduction of the tariff.

3 The determinants of education and fertility decisions

In order to understand the way in which tariffs affect fertility and education investments, we explore two possible mechanisms that help us guide our empirical analysis. In both cases, the production side of the economy features two goods, an agricultural good and a manufacturing good, both of which are traded, and parents decide on the number of children and their education. The first setup we examine presents a traditional Beckerian quantity-quality trade-off, the second considers child labour. As we will see, both mechanisms provide similar predictions on the effect of the tariff and are not mutually exclusive.

3.1 A quantity-quality trade-off model

3.1.1 Technologies and preferences

Consider a two-sector model inspired by Galor and Weil (2000) and Galor and Mountford (2008). As in the original model, the key decision is the choice by households of the number of children and their education in response to economic incentives, but we consider a static setup and abstract from the determinants of growth. The economy produces two goods, an agricultural good and a manufacturing good. The former is produced using land, T, and labour, L_{at}, according to the following technology

$$Y_{at} = (AT)^{1-\alpha} L_{at}^{\alpha}, \tag{1}$$

where Y_{at} is agricultural output, A is agricultural productivity, and $0 < \alpha < 1$. The manufacturing good is also produced through a Cobb-Douglas technology of the form

$$Y_{mt} = K^{1-\alpha} \left(h_t L_{mt}\right)^{\alpha}, \tag{2}$$

where Y_{mt} is manufacturing output, K is a fixed factor in the sector (potentially capital, but we abstract from its accumulation), h_t is the average human capital of workers and L_{mt} employment in the sector. The manufacturing good is the numeraire, while the agricultural good has an exogenously given price p_t that will be the source of the shock we consider.

[22] The reasons for this early transition are still not fully understood. It has been argued that the unique and spectacular reduction in mortality that took place in France in the second half of the 18th century could have been a trigger, while other authors have emphasized the role of wealth and the changes in inequality that followed the French Revolution; Wrigley (1985a), Wrigley (1985b), Guinnane (2011) and Cummins (2013).

Assuming we are in a small open economy, we suppose that $p_t = p_t^w(1+\eta_t)$, where p_t^w is the world price of agricultural goods and η_t is a tariff on those goods. The key assumption in the model is that human capital increases productivity in the manufacturing sector but not in agriculture. Although this is an extreme assumption, it is intended to capture in a simple way the idea that the return to education is higher in manufacturing.

The two sectors pay workers their marginal value product. Under our assumption that education has no impact on agricultural productivity, the income of a farmer is simply the wage w_{at}. In contrast, human capital increases manufacturing productivity, implying that an agent with h_t efficiency units of labour receives a potential income of $h_t w_{mt}$, where w_{mt} is the wage per efficiency unit of labour in manufacturing. Workers can move costlessly across sectors, and this will determine the allocation of labour, so that a share q_t is employed in agriculture and $1 - q_t$ in manufacturing.

We turn next to households' preferences and constraints. An individual lives for two periods. She is born at $t-1$ and is educated by her parents. In period t she is an adult and has a time supply of one unit, which she can allocate to work or child-rearing. At the end of the period she consumes. We suppose that an individual cares both about the number of offspring and their income. In particular, we assume that the utility of an agent born at time $t-1$ is given by

$$U_{t-1} = (1-\gamma)\ln c_t + \gamma \ln\left(n_t Ey(e_t)\right), \tag{3}$$

where c_t is her own consumption when she is an adult, n_t the number of children she has (which are born at t), and $Ey(e_t)$ denotes the expected income of her offspring, which depends on the amount of education they have received, e_t.[23] We assume that a constant fraction of consumption is allocated to the agricultural good and the rest to the manufacturing good.[24]

Children require a time investment from their parent, which has two components. There is a fixed time cost of bearing each child, given by τ^q, and a cost that depends on the education investment in each child and which takes the form $\tau^e e_t$. The parent's budget constraint is then given by

$$c_t = y_t\left(1 - \tau^q n_t - \tau^e e_t n_t\right), \tag{4}$$

where y_t is the potential income of the parent, i.e. the income she would have received if she had devoted all her time to work. Potential income takes the value w_{at} if she works in agriculture and $w_{mt}h(e_{t-1})$ if she works in manufacturing. The human capital production function is assumed to be given by $h(e_t) = \beta e_t^\theta$, where $\beta > 0$ and $\theta \in (0,1)$, implying that $h(e_t)$ exhibits diminishing returns to the education investment by parents.[25]

We suppose that when taking the education decision, parents expect that with probability q_{t+1} their children will work in agriculture and with probability $(1-q_{t+1})$ in manufacturing. The resulting expected potential income of the child is then $Ey(e_t) = q_{t+1}w_{at+1} + (1 -$

[23] Since parents are not alive when their offspring's income is realised, we have chosen not to use an expected utility model. However, it is possible to show that such a model would deliver equivalent results, notably equation (9) below.

[24] It would be straight forward to derive such a result from a Cobb-Douglas utility function with two goods. We abstract from such decision in order to concentrate on the key aspects of the model. See Galor and Mountford (2008) for a similar model with an allocation of consumption over two goods.

[25] This expression implies a log-log relationship between wages and e_t, in contrast with Mincerian wage equations that estimate log wages as a linear function of years of education. Note however that e_t is parental investment and not years of education, and the model could be extended so that e_t determines years of education in a way that is consistent with standard empirical specifications.

$q_{t+1})h(e_t)w_{mt+1}$. Clearly, the higher the agricultural wage and agricultural employment are, the lower the return to education will be, thus reducing the incentive of parents to forgo consumption in order to increase the education of their children. This mechanism will drive our results.

3.1.2 Solving the model

An individual born at time $t-1$ makes two sets of decisions, she first decides in which sector to work, then she makes the fertility and education choices. We start by solving for the latter. The problem she faces is given by

$$\begin{aligned} \max_{c_t,n_t,e_t} U_{t-1} &= (1-\gamma)\ln c_t + \gamma \ln\left(n_t Ey(e_t)\right) \qquad (5)\\ s.t. \quad c_t &= y_t\left(1-\left(\tau^q+\tau^e e_t\right)n_t\right)\\ Ey(e_t) &= q_{t+1}w_{at+1}+(1-q_{t+1})h(e_t)w_{mt+1}\\ h(e_t) &= \beta e_t^{\theta}\\ e_t &\geq 0, n_t>0, 1-\left(\tau^q+\tau^e e_t\right)n_t>0. \end{aligned}$$

The first constraint gives the consumption of the parent, where y_t is the income of the parent; the second one defines the offspring's expected income and the third their human capital. The last line requires that education, fertility and consumption are non-negative.

The first-order conditions yield the following expressions for education and fertility:

$$\frac{1-\theta}{\theta}e_t^* + \frac{q_{t+1}w_{at+1}}{(1-q_{t+1})w_{mt+1}}\frac{(e_t^*)^{1-\theta}}{\beta\theta} = \frac{\tau^q}{\tau^e}, \qquad (6)$$

$$n_t^*\left(\tau^q+\tau^e e_t^*\right) = \gamma. \qquad (7)$$

The first equation implicitly defines the optimal education investment e_t^* as a function of the share of employment in manufacturing. This equation captures, as in Galor and Weil (2000), the fact that the education investment in children depends on the way it impacts the expected income of the offspring. That is, the education decision at t is determined by the return to education at $t+1$, and, as argued by Galor and Mountford (2008), this will depend on the relative size of the two sectors and on the wages paid by each. The second equation gives the quantity-quality trade-off faced by parents, implying that any shock that reduces optimal education investments results in an increase in optimal fertility, n_t^*.

Before we fully solve the model, note that it is straight-forward to show that $\partial e_t^*/\partial q_{t+1} < 0$ and $\partial n_t^*/\partial q_{t+1} > 0$, implying that a higher agricultural employment share reduces education and increases fertility. Similarly, a higher relative wage in agriculture, i.e. higher w_{at+1}/w_{mt+1}, results in more births and lower education investments.

The full solution of the model requires solving for wages and employment. In the absence of mobility costs across sectors, income is equalized across sectors and labour market equilibrium is given by the expression $w_{at} = w_{mt}h(e_{t-1})$, which yields the equilibrium values of wages and employment. We are interested in the impact of an increase in the price of the agricultural good, and in the appendix we show that a higher value of p_t increases the wage rate in agriculture, leading to a flow of labour into that sector. In order to simplify the analysis, we assume that $\alpha = 0.5$, which yields explicit analytical solutions so that we can write agricultural employment as

$$q_{t+1} = \frac{ap_{t+1}^2}{ap_{t+1}^2 + h(e_t)}, \tag{8}$$

where $a \equiv AT/K$ captures the productivity of agriculture relative to that in manufacturing, so that larger values of a result in a higher share of agricultural employment q_{t+1}.

We can now rewrite equation (6) as

$$\frac{1-\theta}{\theta} e_t^* + \frac{ap_{t+1}^2 (e_t^*)^{1-\theta}}{\beta\theta} = \frac{\tau^q}{\tau^e}, \tag{9}$$

and, using the fact that $p_{t+1} = p_{t+1}^w(1 + \eta_{t+1})$, we can express the equilibrium given by (6) and (7) as

$$\begin{aligned} e_t^* &= e\left(p_{t+1}^w, \eta_{t+1}; a\right), \\ n_t^* &= n\left(e_t^*\right), \end{aligned}$$

where $n\left(e_t^*\right)$ is a decreasing function and $e\left(p_{t+1}^w, \eta_{t+1}; a\right)$ is decreasing in both p_{t+1}^w and η_{t+1}. In a context of free trade (i.e. $\eta_{t+1} = 0$) and falling world prices of agricultural goods, these two equations imply that education will be increasing and the number of children falling over time.

Suppose now that a tariff is introduced at time t and that individuals expect it to be permanent. For any world price at $t+1$, the domestic price of agricultural goods will be higher than it would have been in the absence of the tariff. It is then possible to show that n_{t+1} will be higher and e_{t+1} lower than they would have been had tariffs remained at zero.[26] Moreover, $d(de_t/d\eta_{t+1})/da < 0$ and $d(dn_t/d\eta_{t+1})/da > 0$, implying that the impact of the tariff is stronger the higher a is, i.e. the higher the productivity of agriculture is relative to that in manufacturing. From equation (8), a higher a also implies that a greater share of the population was employed in agriculture before the tariff was introduced; hence locations which had a high initial employment share in agriculture experience the largest changes in our two variables of interest. The model thus implies that a permanent increase in the tariff on agricultural goods leads parents to reduce the educational investment per child and to increase the number of children they bear. This effect is stronger in regions where *relative* agricultural productivity is high or, equivalently, where the share of the population employed in agriculture *before* the policy shock was large.

It is important to emphasize that what is relevant for the impact of the tariff is not whether agriculture is very productive, but rather whether it is very productive *relative to manufacturing*, as captured by a. It is hence possible for the regions that have the highest agricultural output per capita to have low shares of agricultural employment if they also have a very productive manufacturing sector, which would result in a weak impact of the policy.

[26]See Appendix 2. This does not imply that $n_{t+1} > n_t$ and $e_{t+1} < e_t$, as the evolution of the two variables also depends on how world prices are changing. The tariff simply results in an n_{t+1} (e_{t+1}) that is higher (lower) than that implied by the trend of world agricultural prices in the absence of the tariff.

3.2 Child labour

Child labour was prevalent in 19th century France,[27] and hence it is possible that the tariff affected parents' trade-off between higher consumption if their children worked and the future skill level of these offspring. A considerable literature, starting with Rosenzweig and Evenson (1977), has modelled child labour, and some of its insights can be used to illustrate how this could have been a potential mechanism driving the impact of the tariff. To account for child labour suppose that children are productive as soon as they are born. Each child is assumed to be endowed with $\rho < 1$ units of time, and her education requires a time investment by the child herself, not by the parent. Children are assumed to work in the same sector as their parent but to produce only a fraction $\lambda < 1$ of the parent's output. The budget constraint of the parent is then

$$c_t = y_t (1 - \tau^q n_t) + \lambda y_t (\rho - \tau^e e_t) n_t, \tag{10}$$

where the second term captures output by the household's children.

In the appendix we solve the model with child labour and our earlier specification for the utility function, which depends on the number of children and their expected potential income. When child labour is used in both sectors, the equilibrium decisions are equivalent to those previously obtained, with the model implying a quantity-quality trade-off despite the fact that only the child's time is used in education[28] The equilibrium quantities differ from our earlier results only in the cost of children -which is now lower since they increase household income- and hence imply the same comparative statics with respect to the tariff.

In the period we are considering, child labour was employed only (or mainly) in agriculture. The successive introduction of legislation concerning child labour implied that by the early 1870s children under 12 years of age could not work in industry, while there was no regulation of child agricultural work, largely because it would have been impossible to monitor; see Heywood (2002). We hence consider also the case in which child labour is only productive in agriculture. For manufacturing households, optimal education and fertility are given by a corner solution, as children spend all their time at school since there is no opportunity cost. Education investments are hence higher and fertility is lower in manufacturing than in agricultural households. Denoting by e_t^s and n_t^s the optimal decision in sector $s = a, m$, average education and number of children are then given by $\overline{e}_t = q_t e_t^a + (1 - q_t) e^m$ and $\overline{n}_t = q_t n_t^a + (1 - q_t) n^m$, respectively. These magnitudes depend not only on q_{t+1} (which determines the education and fertility chosen by those in agriculture, e_t^a and n_t^a) but also on the relative weight of the sectors at the time at which the decisions are taken, q_t. The larger the current share of agricultural households, the lower average education and the higher average fertility are. In this setup, the tariff will not have an impact on the decisions of households in the manufacturing sector; it will nevertheless reduce average education and increase average fertility both through its impact on the decisions of households in agriculture and through the proportion of households currently working in each sector.

Lastly, the impact of tariffs can also arise when parents care about the number of children they have but not about their future income or education. In the appendix we consider the

[27] See, for example, Heywood (2002).

[28] This result is standard in models with child labour. See, for example, Rosenzweig and Evenson (1977) who suppose that parental utility depends on the number of children and their education and discuss how the shadow price of children depends on the latter.

case where the utility function takes the form $U_{t-1} = (1-\gamma)\ln c_t + \gamma \ln n_t$. Supposing that children are productive in agriculture but not in manufacturing, parents in the two sectors will make different choices. For those in manufacturing, there is, as above, no opportunity cost of education, and hence they will choose the highest possible level. For parents in agriculture, education provides no benefit and has a cost in terms of forgone consumption, leading to no education. The education decisions of each type of household are then unaffected by the tariff, yet average education will change with η_t as a higher tariff implies more agricultural workers and hence a higher proportion of households that choose not to educate their children.

3.3 Additional considerations

The various scenarios that we have considered all imply that the introduction of a tariff tends to raise fertility and reduce education. In the case of the Beckerian model, this effect is stronger in locations with higher relative productivity of agriculture, which in turn is associated with a higher (pre-tariff) share of agricultural employment. The model with child labour implies different behaviours of parents across sectors, and hence the impact of the policy is stronger where the share of agricultural employment is higher. The latter will in turn be determined by the relative productivity of agriculture and manufacturing.

It is important to understand to what extent these results depend on key assumptions. In particular, we have made two important assumptions about mobility. As far as sectoral mobility is concerned, we suppose costless mobility between agriculture and manufacturing, but our results hold with no or limited mobility.[29] To see this, note that equation (6) implies that e_t^* depends both on relative employment and relative wages; if labour were immobile so that the tariff only affected relative wages, equivalent results would be obtained operating through these rather than q_{t+1}, as shown in the appendix. The model also assumes no mobility across locations in response to the tariff. Although clearly internal migration took place and part of it could have been due to the increased attractiveness of cereal production, we will see in the data below that migrants were not the main cause of observed changes in education and fertility. Hence the framework of a closed economy is a good approximation of the reality of late-19th-century France; see Dormois (1996).

A key aspect of our model is that the particular form of the utility function we assume implies that our results are solely driven by the relative return to education and are unaffected by parental income. Alternative specifications would make the model richer and, in particular, allow parental income to have an effect on our two variables of interest. A common approach is to allow for the presence of subsistence consumption which implies that if incomes rise in response to the tariff, the constraint imposed by subsistence consumption is less important and expenditure in children increases, raising both education and fertility. A negative income shock would have the opposite impact. Income effects may have been present during our period of study, and could have had a differential effect depending on the importance of cereal production, with real incomes rising in rural areas and falling in large cities where the only effect was the higher price of a key component of the diet. But, crucially, income effects imply that education and fertility move together following a change in tariffs. They

[29] There is a long-standing debate about the degree of mobility of farmers into industry in France; see Sicsic (1992) for a review of the literature and evidence of a comovement of agricultural and manufacturing wages that indicates considerable sectoral mobility. See also Baudin and Stelter (2019) for a model of education and fertility decisions with costs of mobility.

would hence reinforce the effect on one and weaken that on the other outcome variable when combined with the effect we identified in our model arising from the change in the return to education.

Lastly, with a different functional form for the utility function it is possible to obtain a substitution effect whereby higher parental wages shift the allocation of time away from children and towards market production. This effect is often used to explain how rising wages for women led to the increase in female market work and reduction in births, an argument put forward by Schultz (1985) in his analysis of the triggers of the Swedish fertility transition. As before, such an effect implies the co-movement of education and fertility following a change in tariffs.

4 Empirical specification

Inspired by the analysis above, our empirical specification consists of the following two equations:

$$B_{it} = \alpha_0 + \alpha_1 C_i * M_t + \eta_i + \delta_t + \delta_{1i} t + \epsilon_{it}, \tag{11}$$
$$E_{it} = \beta_0 + \beta_1 C_i * M_t + \mu_i + \gamma_t + \gamma_{1i} t + \upsilon_{it}, \tag{12}$$

where B_{it} and E_{it} are respectively the birth rate (or fertility) and education in district i at time t. We introduce district fixed effects (η_i, μ_i) and year fixed effects (δ_t, γ_t), while the coefficients δ_{1i} and γ_{1i} capture the impact of district-specific time trends affecting fertility and education. M_t is a dummy for whether the Méline tariff is in operation at time t and C_i is a proxy for the relative capacity for cereal production, thus the larger C_i is, the stronger we expect the effect of the tariff to be.[30] The coefficients of interest are α_1 and β_1, which capture the differential impact of the tariff across districts with different cereal intensity. The model above leads us to expect $\alpha_1 > 0$ and $\beta_1 < 0$.

Note that our specifications imply that we define the policy shock as the adoption of the tariff rather than the evolution of cereal prices. The reason for this is that both fertility and education are forward-looking decisions, based on the expected relative price of cereal rather than on the actual price at the moment in which the decision is made. In contrast, cereal prices, as those of any agricultural product, fluctuate from year to year and hence long-term decisions will not necessarily vary with current prices. We see the adoption of the Méline tariff as having been perceived as a once-and-for-all regime change that increased support to cereal production. As we have discussed above, this is consistent both with the evidence on the effect of the tariff on price differentials with England and with media coverage of the tariff.

The time structure of the impact of a policy is crucial when there are pre-existing trends, as discussed by Wolfers (2006). Although the effect of the tariff on prices is immediate, fertility and education are likely to respond with a lag because bearing children and educating them take time, but also because both variables are affected by social norms resulting from past

[30] Note that we cannot identify the non-interacted effect of the variables M_t and C_i, as the impact of the former cannot be distinguished from that of the year fixed-effects and the latter is collinear with the district fixed effects.

behaviour that may slowdown the reaction to the policy. We will thus consider a further specification which takes the form

$$B_{it} = \alpha_0 + \alpha_1 M_t * Exp_t + \alpha_2 C_i * M_t * Exp_t + \eta_i + \delta_t + \delta_{1i} t + \epsilon_{it}, \quad (13)$$

$$E_{it} = \beta_0 + \beta_1 M_t * Exp_t + \beta_2 C_i * M_t * Exp_t + \mu_i + \gamma_t + \gamma_{1i} t + \upsilon_{it}. \quad (14)$$

where Exp_t denotes the number of years of exposure to the policy, and we expect the coefficients α_2 and β_2 to be positive, indicating that households take time to adjust their fertility and education to the policy. We introduce $M_t * Exp_t$ not interacted with C_i in this specification since it is collinear neither with the year fixed effects nor with the time trends which are district specific.[31]

5 The data

5.1 Education and birth rates

Although France has relatively good historical data, the difficulty lies in the unit of observation that we are interested in: the district or *département*, which we term 'department' in the remaining of the paper. These were the regional administrative units at the time, and are still the main administrative units in France with most of them covering the same areas and having the same names as in the late 19th century, although the number has slightly increased.

We use several sources to compile our data on education, birth rates and fertility. The first is the *Annuaire Statistique de la France*, a statistical yearbook which provides annual regional data on live births, total population, the number of students enrolled in primary education, as well as the number of schools. To create measures of fertility, enrolment and attendance, we use the census or *Recensement Général*, which is available for the years 1872, 1876, 1881, 1886, 1891, 1896, 1901, 1906, and 1911, and provides data on population by age and gender.

Crude birth rates by department are defined as the number of live births per 1,000 inhabitants, while the fertility rate is computed as the ratio of live births to the number of women aged between 15 and 45 in 1,000s. Demographers have raised concerns about a number of observations given in the census as in certain years the various measures available are not consistent with each other. Corrections of these data have been proposed to take into account this concern and we use those to calculate the birth rate, in particular those by Van de Walle (1974) and Bonneuil (1997).

Our measure of educational investment are enrolment rates in primary education, a measure that includes both public and private schools. Data are available for the overall number of students enrolled in primary education and for those aged 6 to 13, the difference between the two being presumably older students.[32] We focus on 6 to 13 year olds. The data are also available separately for boys and for girls, so we compute both overall and gender-specific enrolment rates. It is conceivable that the tariff had different effects across the genders, as found by Edmonds, Pavcnik, and Topolova (2010) for India.

[31] An alternative specification, based on Wolfers' analysis of divorce laws, allows for a different impact of the tariff in different years. Our results are robust to such specification, where we allow for changes in the impact of the policy every three or five years.

[32] See Grew and Harrigan (1991) for an introduction to the data and Luc (1985) for a discussion of the method used by the French education ministry to survey the enrolled.

To obtain enrolment rates for those in the relevant age group we use the population aged 6 to 13, which is available on all census years except 1911, hence the last observation (1906 census) includes individuals born in 1900, i.e. 8 years after the tariff was introduced. In a number of cases the enrolment rate we obtain is over 100 percent.This can be due to discrepancies in the reported age of children but also to the fact that, as discussed above, the population data by age group is not always reliable yet no correction is available for this age group, resulting in measurement error.

Two control variables will be used throughout our analysis. The sex ratio is often seen as a determinant of fertility and birth rates as it is a measure of the tightness of the marriage market, with a higher ratio reducing the constraints on female marriage and/or the age at which women marry thus increasing the number of children; see for example Becker et al. (2010). We hence compute the sex ratio defined as the number of males aged 15 to 45 divided by the number of females of the same age. We also compute the number of primary schools per 1000 children aged 6 to 13 and use it as a control in our regressions.[33] Given the expansion of education that took place over the period, we can use this variable to control for the supply of schools which could have affected educational investments. It is, however, possible that the increase in the number of schools was a response to greater demand. Although our reading of the political discourse at the time is that the increase in the number of schools was mainly supply-driven, we will nevertheless also consider specifications in which this potentially endogenous variable is not included.

We start our sample in 1872 and if possible we compile data up to 1913, yielding a 41-year period with half of the observations pre-dating the Méline tariff and half of them occurring after the policy was in place. We exclude from our sample Alsace and parts of Lorraine due to their annexation by Prussia in 1871, as well as Corsica for which there is no data on agricultural employment, thus reducing our sample to 85 departments. Four observations are missing for *Meurthe et Moselle* between 1872 and 1875, as the department was a merge of the two remaining parts of former departments that were no longer part of France following the 1870 war (departments 54 and 57). Our sample hence contains at most 3566 observations, all of which are available for birth rates. For fertility and enrolment rates the quinquennial availability of censuses reduces our samples to around 600 observations.

5.2 Policy variables and descriptive statistics

Our policy variable is the interaction between a dummy for the Méline tariff and a time-invariant measure of the importance of cereal production in the department's economy, C_i. Our core measure for C_i is the share of employment in cereal production in total employment in the department in 1892, which we term the *cereal share*. As we have seen, the employment share in cereals, q_t, is determined by AT/K, hence the employment share *before* the tariff was introduced can be used as a proxy for the latter since it is unaffected by the policy change. It captures how important cereal production was in the local economy. Data on the share of employment in cereal production are not available, hence we use as a proxy the product of the share of agricultural employment in total employment in 1891, obtained from the census, and the share of the value of cereal production in total agricultural production in 1892. Information on the production of various crops comes from the *Statistique Agricole*

[33]Both variables are available for census years only.

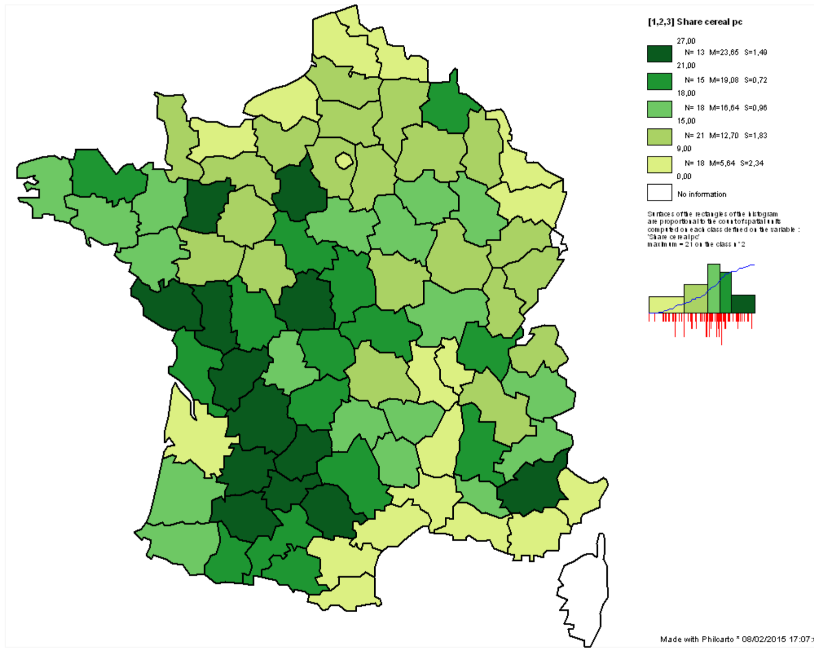

Figure 4 – Employment share in cereal production, France 1892

Reading of the legend: In the 13 departments in the darkest shading the cereal employment share was in the 21%-27% bracket, with an average of 23.6%. The share of employment in cereal production is proxied by the product of the share of agriculture in employment and the share of cereals in agricultural output. Own calculations; see text for sources.

Annuelle, as compiled by Toutain (1993).[34]

Our proxy for the share of employment in cereal production averages almost 15%, and varies between 26% and 0.07%, with *Lot*, *Tarn et Garonne* and *Dordogne* being the departments with the highest shares and *Seine* that with the lowest. Note, however, that not all departments with a low employment share in cereals were rich, urban regions. The third lowest cereal share is that of *Bouches-du-Rhône*, at 3.5%, a relatively poor region with high employment in agriculture but whose climate and geography are not suitable for cereal production. Figure 4 represents the spatial distribution of our proxy for the share of employment in cereal production. It is important to note that we are not measuring the volume of cereal production, which was highest in departments such as *Seine-et-Marne*, but rather the relative importance in the local economy of this type of production. As a result, most of the Northern departments that produced high volumes of cereal but where agriculture represented only a small share of total employment exhibit low values of the cereal share, although there are some exceptions, such as *Eure et Loire*.

A concern with this measure is that employment in the production of cereals could be affected by unobserved factors that may also impact fertility and human capital accumulation.

[34]Note that since cereals are generally less labour intensive than other crops, our proxy will be overestimating employment in cereal production. The resulting measurement error will tend to bias our coefficients of interest towards zero, implying that our estimates represent a lower bound of the true effect; see Maddala (1977) on the *attenuation bias*.

For example, traditional mores could slowdown structural and social change, implying both a greater importance of agriculture relative to industry and stronger fertility norms. We hence construct a second proxy for AT/K based on the suitability of a department for cereal production obtained from agro-climatic measures. Agro-climatic measures have been recently used to consider the importance of different crops for long-run economic outcomes and we follow this approach.[35] We use data on potential crop yields from the FAO's Global Agro-Ecological Zones (GAEZ) data and information on the caloric content of various cereals to compute a measure of cereal suitability based on the crop that provides for each department the highest caloric yield (in billion of kcal/ha; see the appendix for further details).

While this measure captures the capacity of the department for cereal production, the model predicts that the impact of the policy depends on cereal productivity relative to manufacturing productivity, yet we cannot use standard measures of manufacturing productivity which suffer from the same potential endogeneity problem as employment. We therefore use as a proxy a measure of potential industrialization suggested by Franck and Galor (2021). The steam engine was first used in France in Fresnes-sur-Escaut in 1732, and Franck and Galor show that the distance between a department's capital and Fresnes-sur-Escaut is an exogenous predictor of the ability to industrialize in the second half of the 19th century. The assumption behind their argument is that industrialization was strongly linked to the diffusion of new technologies; greater distance implies a slower adoption of new forms of power-generation and hence, at a given point in time, a smaller size of the manufacturing sector. We hence use the inverse of the distance between the capital city of a department and Fresnes-sur-Escaut as a proxy for manufacturing productivity. We can then define the variable *relative productivity* as the ratio of potential cereal yield to potential industrialization and use it to measure the intensity of the policy shock. The cereal employment share and relative productivity are strongly correlated, with a correlation coefficient of 0.25, and a regression of the former on the latter yields a positive and highly significant coefficient, indicating that the employment structure in 1892 was largely determined by comparative advantage as determined by geography and the climate.[36] Compared to the cereal share, relative productivity has the advantage of being based on exogenous geographical, geological and climatic factors; however, it captures less precisely the actual importance of cereal production in the local economy at the time of the shock. Because of this, most of our analysis will focus on the cereal employment share, although as we will see results are qualitatively equivalent when we use relative productivity.

Table 1 presents some descriptive statistics. Both birth rates and fertility rates are high although declining throughout the period, with the average in the sample being 89 children per thousand women. The average enrolment rate is 83%, and it varies between 46 and 105%, with the variation being both over time and across departments. Just over half of the national population was employed in agriculture, the employment share going up to 79% in certain departments. As we can see in the table, cereal production was an important activity in France, accounting for over a quarter of overall agricultural output, but with large differences across departments, ranging from only 3.6% to 44%. Cereal suitability also varies considerably, but less so than the share of cereals in agriculture (the coefficients of variation are, respectively, 0.11 and 0.29), indicating that aspects other than agro-climatic factors are

[35]See Nunn and Qian (2011), Galor and Özak (2016), and Mayshar et al. (2019).

[36]We have chosen not to use relative productivity as an instrument for the cereal share as it does not satisfy the exclusion restriction. Cereal suitability and distance to Fresnes-sur-Escaut are likely to affect education and fertility directly and not only through the cereal employment share.

important in determining the share of cereals. The last two variables reported in Table 1 are the two standard controls that will be included in our regressions: the sex ratio, which has an average close to one, and the number of schools per 1000 children aged 6-13. The variation in the latter is large, with certain departments having almost ten times as many schools per child as others by 1906.

6 Empirical results

6.1 Birth rates and fertility

Table 2 reports the regression results for birth rates and fertility rates. We consider equivalent specifications for both variables, although the sample size is much larger for the former than for the latter which are constrained by the availability of censuses. Our first two regressions are for birth rates. The first column simply includes a dummy for the introduction of the policy (*Meline*) interacted with the share of employment in cereal production in the regression for birth rates, as well as a department-specific linear time trend. The variable has an insignificant coefficient, indicating that if we impose a common effect over the 20 years following the introduction of the Méline tariff we are unable to identify its effect. As argued by Wolfers (2006), when the underlying process is trended, the way in which the time structure is modelled becomes crucial. The second column hence considers the impact of the number of years during which the policy has been in place (*Exposure*). The coefficient on *Exposure* interacted with the share of cereals is positive and highly significant, indicating that protectionism increased birth rates in departments with a high share of cereal employment and that the effect grew over time. This seems to imply that households increased the number of births gradually in response to protectionism, either because fertility is partially determined by slow-changing social norms or because households took time to learn that the shock was large and permanent.[37]

The next four columns examine birth and fertility rates and include our standard controls, the sex ratio and the number of schools per 1000 children. These variables are available for census years only, hence the sample for birth rates is reduced considerably. In both specifications the coefficients on the tariff interacted with the share in cereal employment are positive, and are more significant when we allow for an increasing effect over time, indicating, as before, a growing impact of the policy. As expected, the sex ratio has a positive impact; it is only significant in the case of fertility rates, which is consistent with the fact that this measure considers births per woman rather than for the population as a whole. We find that a greater number of schools is associated with a higher birth rate, while in the case of the fertility rate the coefficient is small, negative, and not significant. The positive coefficient can be explained by the fact that, while a lower cost of education results in greater educational investments, it has an ambiguous impact on fertility as lower school costs imply children are cheaper -for a given education investment- and hence tends to increase their number. Lastly, note that, as we argued above, it is possible that the supply of schools was a response to increased demand; in the appendix we show that our coefficients of interest are barely affected when we remove this variable (see Table OA.2 in the appendix).

The economic magnitude of these effects is large. Consider a department with the average cereal employment share, 14.8% (this is roughly equal to the median, which is 15%). Our

[37]When we consider a specification in which we allow the coefficients to differ every 3 or 5 years, we obtain equivalent results indicating that the impact grows over time.

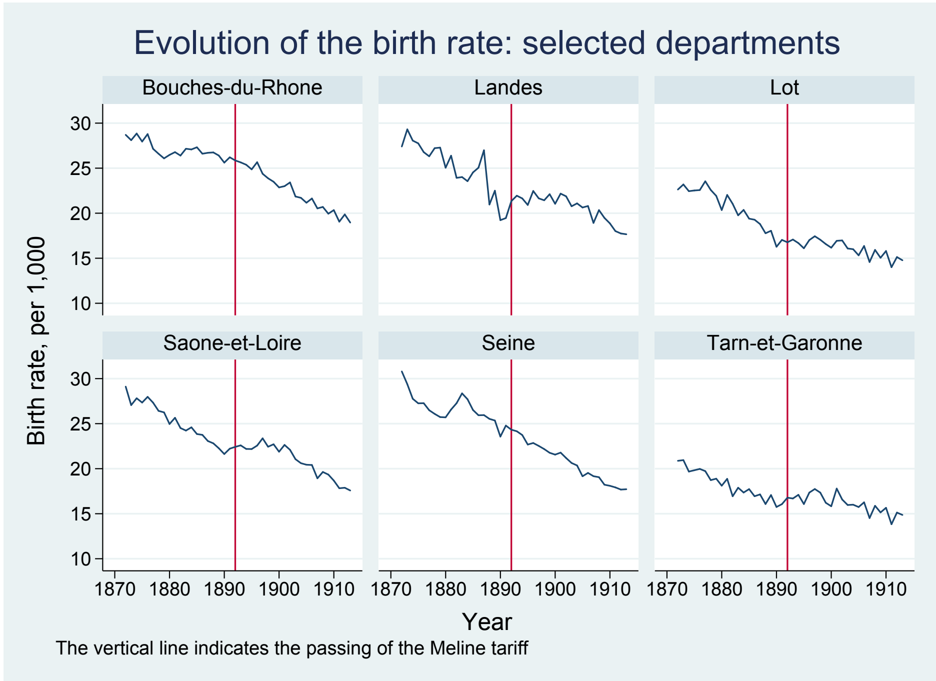

Figure 5 – The evolution of the birth rate in selected departments, 1872-1913

preferred specification for birth rates (Table 2, column 2), indicates that in such a department the tariff increased the birth rate by 1.2 births after a decade and by 2.3 births after 20 years, with the latter amounting to 57% of the standard deviation observed in the data.[38] It is interesting to compare the impact of the policy with that of the time trend, since the former partly offset the decline in births that had been taking place since the late 18th century. Table A.3 in the appendix reports estimates from regressions of the national-level birth rates on a time trend and a dummy for the period post-1892, and the resulting time trend implies that 11 years were needed to reduce the birth rate by 2.3 children. The high population shares of urbanised areas imply that the aggregate effect was weaker, with regressions for national-level birth rates implying that the tariff was equivalent to a 3.5 to 5-year delay in the trend (see Table A.3). The moderate nation-wide effect is due to both the differential effects across departments and the less precise estimation obtained when imposing a common time-trend for all of France.

In order to visualize the differential impact of the tariff, figure 5 depicts the evolution of the birth rate in 6 selected departments. Two of them, *Seine* and *Bouches-du-Rhône* have some of the lowest values of our proxy for employment in cereal production, 0.07% and 3.5%. The former encompasses Paris and its surroundings and the latter Marseille and part of Provence, and although they host the two largest cities in France their production structure was very different, with the former having virtually no agricultural employment and the latter having almost 20% of the labour force employed in agriculture, the main crops being wine, fruit and vegetables. As we can see, the introduction of the tariff, indicated by the vertical line, did

[38] Concerning the fertility rate, a department with the average cereal share witnessed an increase of 6 children per 1,000 women over the 20-year period (using column 6 of Table 2).

not coincide with any disruption in the time trend for birth rates. *Landes* and *Saône-et-Loire* have average cereal shares, around 15 percent, and in both cases the data indicate an increase in birth rates after 1892. Lastly, *Lot* et *Tarn-et-Garonne* have the largest shares, 26.6 and 27.4 percent, and in both the decline witnessed over the previous two decades comes to a halt after 1892.

As indicated by Figure 5, the strongest impact occurred, largely but not only, in the South-West of France (ex. *Lot* and *Tarn et Garonne*), intermediate effects appeared in departments that produced high volumes of cereal (ex. *Saone-et-Loire*) and nochnage is observed in highly-urbanized departments (*Paris, Marseille*). This raises the question of which type of production units were most affected by the policy, notably because in tariff policy the largest behavioral effects occur for the least productive firms who survive instead of exiting. To answer this question we examined how the cereal share in a department is related to various features of the production structure at the department level, notably plot size and the use of mechanical reapers (see Table A.10 in Appendix 4 for the details). High cereal shares are correlated with a prevalence of medium-sized properties, indicating that the effect of the tariff was strongest in departments with this type of farms. To explain this, note that small farms, defined as plots of less than 10 hectares and typically found in mountainous or poor soil regions, were probably characterised by family employment and produced largely for own or local consumption; a change in the price of cereal would hence have a small impact on either employment or profitability. Large farms, located in the 'bread basket', would have been making positive profits, both because agroclimatic conditions were suitable for cereal production but also because the data indicates that there was a greater use of mechanical reapers. The increase in cereal prices would have raised output, but high quality soil and greater use of mechanized reapers would imply a moderate effect on employment. Those most affected were infra-marginal farms, in our case medium-sized farms that were using little capital and made low profits. The declining cereal prices would have threatened the survival of such farms, and the introduction of the tariff would have allowed them to survive, implying an increase in labour demand, thus raising the return to agricultural work. These mid-sized farms seem to be largely located in the South-West, thus explaining our results.[39]

6.2 Education

Table 3 presents the regression results for enrolment rates, defined as the number of students registered in primary education over the relevant age group (6 to 13 year-olds). We report results for all children, for boys only and for girls only. The number of observations is constrained by the census years for which we have data on population for this age group. The last observation is hence for 1906 and includes individuals born between 1893 and 1900, i.e. up to 8 years after the tariff was introduced.

The first two columns report specifications for all children: (1) simply including a dummy for the Méline tariff interacted with the cereal share, and (2) multiplying this share by the number of years of exposure to the tariff. The coefficient on our variable of interest is negative and significant in both cases, as expected. Further specifications were explored and they indicated that the impact of the tariff on education was immediate, hence column (1) is our preferred specification. The remaining columns present regressions for boys and girls

[39]In fact Bassino and Dormois (2010) show that in the 1870s and 1880s acreage under cultivation and output had fallen, particularly in the South of France. See Allen (1988) on property sizes and mechanization.

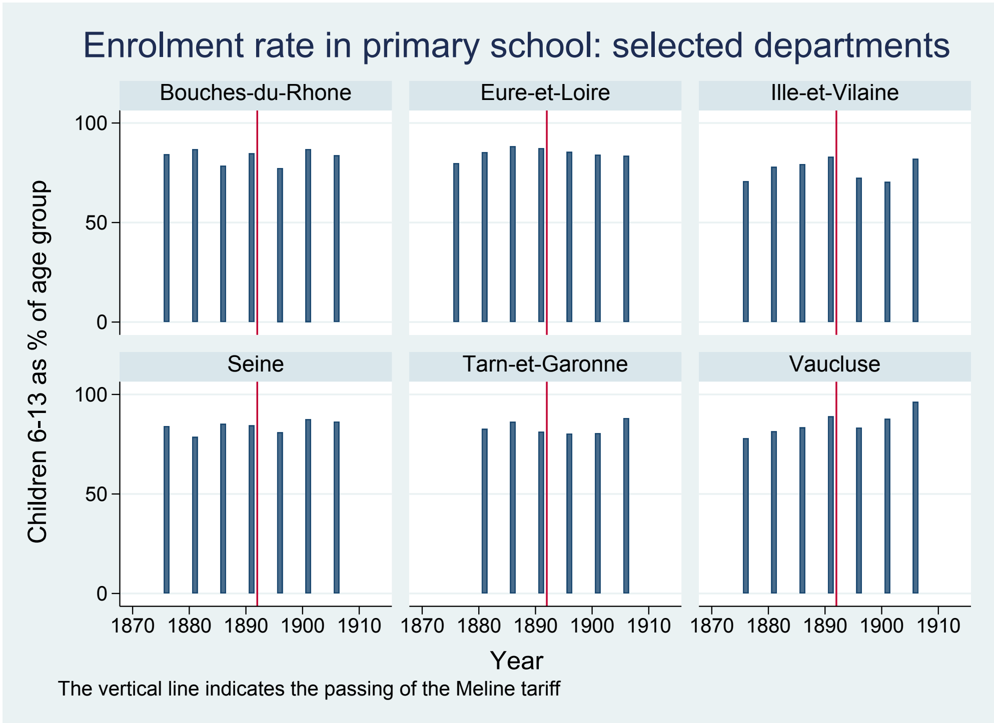

Figure 6 – Evolution of the enrolment rate in selected departments, 1876-1906

separately. The coefficients are significant, have the expected sign, and imply that there is no statistically significant difference between the two genders. Interestingly, the impact of the tariff on education seems to be immediate, indicating that both children born after and also before its introduction received less schooling.[40] Allowing the impact of the tariff to vary every 5 years, yielded equivalent results.

The magnitude of the effect is substantial. Our preferred specification (table 3, column (1)) implies that for a 15% employment rate in cereal production, the tariff reduced enrolment rates by 5.4 percentage points, which amounts to 75 percent of the standard deviation of this variable. This effect is large when we compare it to the evolution of enrolment rates over time: our estimates of time trends imply that prior to the introduction of the tariff, the enrolment rate increased by 5.3 percentage points per decade (see table A.3, column 4). In fact, the estimates for national-level enrolment rates confirm the large impact of the tariff. [41]

Figure 6 depicts six examples of the evolution of enrolment rates. Those with the lowest shares of employment in cereal production, *Seine* and *Bouches-du-Rhône*, exhibit fluctuations both before and after the policy shock. The other four examples are departments where the cereal share is either around the average (*Ille-et-Vilaine* in the North of France and *Vaucluse* in the South) or amongst the highest (*Eure-et-Loire* and *Tarn-et-Garonne*). All of these exhibit marked reductions in enrolment rates that take different forms, such as a sudden reduction

[40] It is possible to show that in a multi-period quantity-quality model parents may re-optimize in the face of a shock and reduce the education investment of already-born children.

[41] The coefficient on the 1892-dummy on column 4 of Table A.3, which is significant at the 12% level despite the small sample size, implies that the reduction in enrolment was equivalent a halt of 14 years of the time trend.

followed by an upward trend, as in *Vaucluse*, or a decline over the 15 years following the introduction of the tariff, as is the case for *Eure-et-Loire*.

6.3 Alternative measure: Relative productivity

We consider next our alternative measure for strength of treatment, relative productivity. Recall that this measure is the ratio of a proxy for productivity in the cereal sector to a proxy for manufacturing productivity, where the former is an agro-climatic measure of potential for cereal production and the later the (inverse of the) distance to Fresnes-sur-Escaut, where the steam engine was first used in France. Table 4 reports our preferred specifications using the alternative measure. The regressions also include the sex ratios and number of schools, both of which will be standard controls in all further specifications. The table reproduces our earlier results, with our alternative policy measure having a negative impact on the enrolment rate and a positive one on birth and fertility rates. Moreover, the R-squareds are virtually identical when we use one or the other policy measure, and the magnitude of the effects similar to those previously obtained. After 20 years, the policy reduces birth rates in the average department by 2.2 children, compared to 2.3 when we use the cereal share, while the effect on fertility is somewhat stronger and that on enrolment somewhat weaker than in our earlier specifications. These results indicate that our hypothesis concerning the impact of the tariff on education and fertility decisions holds whether we measure the intensity of the shock with a contemporaneous measure -share of employment in cereal production- or with a long-run proxy based on geographical, geological and climatic aspects.

An immediate concern with both measures of the intensity of the shock is that the observed patterns may be triggered by the process of industrialization rather than by trade restrictions. Industrialization is expected to increase education investments and lower fertility, and hence it is possible that the changes we attribute to the tariff stem from differential trends in industrialization across departments. Table 5 hence includes as an explanatory variable the share of manufacturing employment in total employment, and measures the intensity of treatment by both relative productivity and the cereal share. Note that although the cereal share includes the employment share in agriculture, and is hence negatively correlated to manufacturing employment, the share of cereal in agricultural output varied considerably across departments, implying that the two variables are not collinear. The coefficient on the manufacturing employment share is insignificant in all specifications in Table 5. The positive effect in the birth and fertility rates regressions is surprising, and is likely due to the fact that manufacturing employment and the department-specific time trends are strongly correlated, and the variable has the expected sign if the trends are omitted (not reported).

Our two policy measures retain their sign and significance. As will be the case in all further analyses, the regression for fertility rate has a more significant coefficient when we use relative productivity as our policy variable, while for enrolment significance is highest when policy intensity is measured by the cereal share. In terms of the fit, there is no clear preference between the two specifications. This is confirmed by a saturated regression in which both measures are simultaneously included (see Table A.4 in the appendix). We hence consider as our core measure the share of employment in cereal production which is easier to interpret, and will perform a number of robustness checks using it. All results are however confirmed when using relative productivity, as reported in the appendix.

6.4 Confounding factors

Our results could be driven by a number of confounding factors, including other aspects of the agricultural sector, migration induced by the policy, cultural norms that have been shown to be important for fertility or changes in attitudes towards child labour. Unfortunately, finding data that controls for many of these aspects proved impossible, notably concerning cultural norms. This section examines those confounding factors for which data exist in order to test the robustness of our results. Details on the data are given in Appendix 3.

We first examine the role of factors that are expected to have a direct impact on fertility decisions. Two aspects are particularly relevant. Child mortality has been shown to be an important determinant of fertility choices. We hence include a measure of child mortality obtained from Bonneuil (1997). Our second specification considers the impact of migration. Migration could be important if the tariff induced migration into the now-richer departments with high employment in cereal production. If national or international migrants to these regions had higher fertility norms, then higher birth rates could be due to migration both because of the actual fertility behaviour of migrants but also because those from high-fertility countries could transmit social norms about the number of children; see Daudin, Franck, and Rapoport (2019). We hence collected data on both the share of the population born in France but outside the department and on those born abroad. Moreover, we have information on the nationality of foreigners as well as on birth rates in the country of origin in each year. We use this information to construct a measure of 'fertility norms'. We proxy the fertility of migrants by the birth rate in their country of origin at year t relative to that in France in the same year, and compute the average norm for all nationalities present in the department, weighted by the share of immigrants of each nationality. This allows us to control for whether foreigners with higher fertility were the reason behind the observed increase in birth rates.

Table 6 reports two sets of regressions: columns (1), (3) and (5) include a measure of child mortality, while columns (2), (4) and (6) include weighted fertility, the share of foreign migrants in the population and their interaction, as well as the share of those born outside the department. Child mortality has the expected sign, although it is not always significant, while the coefficients on the shock interacted with the share of cereal employment remain highly significant and of similar magnitude to those previously obtained. Concerning migration, our variables of interest retain their significance in all specifications. We find that enrolment rates are negatively affected by the share of foreign migrants, in line with the fact that France had an early education expansion, notably compared to its Southern European neighbors, and positively by national migrants. The latter effect is surprising as we would expect domestic migrants from rural areas to be less likely to educate their children, yet it can be explained by positive selection of migrants that are both more motivated to move in response to economic conditions and more motivated to educate their children than the average individual. The share of domestic migrants has a positive coefficient in the birth and fertility rates regressions, consistent with rural workers with high fertility migrating to more industrial regions were fertility had fallen faster, and so does the interaction between foreign migrants and their fertility norm, as expected. Our coefficients of interest remain significant, indicating that the tariff did not mainly operate through inducing migration towards cereal-producing departments.[42] Interestingly, the inclusion of these variables improves considerably the significance of the

[42] We also tested whether the policy induced an increase in internal migration towards departments where cereal production was important, but found no significant effect.

coefficient on the cereal share in the regression for fertility, indicating that for this variable it is particularly important to control for the composition of the population which is probably capturing social norms.

We consider two further variables that may have affected the way in which birth rates reacted to the tariff. The first is religious conservatism. The change of government in 1891 implied a more conservative parliament, and it is conceivable that the change in the political climate affected attitudes to family size and towards the use of contraception. Moreover, Squicciarini (2020) has shown that the degree of religious conservatism had a major impact on the (lack of) introduction of technical education in schools during the late 19th century. If education was perceived as being 'less useful' in more religious districts, this could also have affected the demand for schooling and hence enrolment rates. Consequently, our dummy could be capturing a strengthening of conservative attitudes which we would expect to be stronger in those departments that were originally more conservative. Second, the size of agricultural properties may also have been important, with the effect of the tariff being weaker if agricultural production were concentrated in large states, as discussed above. We hence interact these variables with the Méline dummy.

As a measure of religious conservatism we use the share of priests in a department that did not take the revolutionary oath in 1791. Following the Revolution a "Civil constitution for priests" was promulgated in 1790 that established priests as public employees and made them accountable to the French state rather than to the Vatican. The government requested priests to swear the civil constitution but some of them, the *clergé réfractaire*, refused to do so. These priests became important figures of conservative Catholicism, as argued by Tackett (1977). We follow Squicciarini (2020) and measure the strength of religious conservatism in a department by the fraction of priests in the department that refused the oath. The structure of property is measured by a dummy variable equal to one if the predominant form of agricultural properties in the department were large properties (larger than 40 hectares).

The regressions reported in table 7 indicate that our variable of interest remains significant and maintains the same sign as in our core specifications, with the coefficients becoming somewhat larger in absolute value. Religious conservatism seems to have magnified the effect of the tariff, possibly as a result of a more conservative political mood, reducing enrolment and increasing birth and fertility rates (although the coefficients are not significant for the latter). The impact of the tariff does not significantly depend on the structure of agricultural properties, except for fertility rates. Note that, as was the case in the previous table, including variables that capture social norms improves the significance of the coefficient on our variable of interest in the regressions for fertility.

We also explored other confounding factors reported in the appendix or available upon request. Table A.8 considers two alternative agricultural crops. It is possible that our explanatory variable captures some change, for example, technological, that affected another crop. If there is a correlation between employment in the two crops, our explanatory variable could simply be picking the impact of changes related to the other crop. Including the latter would then render the former insignificant. We hence use our *Exposure* and *Méline* dummies interacted with the share of employment in wine production and that in fruit and vegetables, both of them major crops in France at the time, with these shares proxied by the product of agricultural employment in 1891 and the crop's share (the ratio between the total value of the crop's output to the total value of agricultural output) in 1892. These two crops differ substantially in that wine, as cereals, is easy to export and import, while the perishable nature of fruit and vegetables implies that these good were less subject to international competition. Our results are robust to the use of these variables. Transport costs to Paris or to Fresnes-sur-Escaut, which fell as railways expanded, are also considered (Tables A.9 and OA.3), as well as the number of universities and subscriptions to the encyclopedia, both measures of upper-tail human capital (not reported). These variables have no significant effect on our dependent variables nor on the coefficients of interest. Lastly, we build two alternative measures for the intensity of the policy shock, by multiplying the share of cereals in agricultural output by either the share of female agricultural employment in total employment or the share of male agricultural employment in total employment. Table OA.6 reports the resulting regressions. Both measures have significant coefficients and effects of similar magnitude, indicating that our results are not driven by women's opportunities.[43]

6.5 The timing of the policy shock

Our next specification considers alternative timings in order to examine whether another shock that took place sooner or later is being captured by our explanatory variable. We thus construct the *Méline* dummy and the *Exposure* variables as before, except that we either lag them by 10 years (i.e. the shock occurs in 1882) or forward them by 10 years (shock in 1902). We then interact them with the cereal share in 1892.

Table 8 presents the results. These specifications are extremely demanding on the data as they include department and year fixed-effects, department-specific time trends, and two shocks with a 10-year interval. The first two columns, reporting results for enrolment, indicate that the coefficient on our explanatory variable remains significant and of similar magnitude to those in our baseline specifications, while those on the alternative timing are not significant. Similar results are obtained for birth rates. For fertility rates, the coefficients just miss the 10% significance threshold, with the results for this variable being more satisfactory when we measure the intensity of the shock with relative productivity rather than with the cereal share (see Table A.7 in the appendix).

6.6 Exploring potential mechanisms

Our theoretical discussion has pointed towards a number of mechanisms that can rationalise our results, but given the limited availability of data it is difficult to test for these. However, a number of analyses can help us identify elements that are consistent with the mechanisms that we have highlighted.

Consider first the role of the sectoral structure of the local economy. The mechanism we propose maintains that the policy shock shifted labour from manufacturing to agriculture, and that parental decisions on education and fertility were then determined by the expected demand from the agricultural and manufacturing sector. Table 9 tests for these mechanisms. The first four columns regress the share of agricultural employment in total employment on our policy variables, defined either by the (time invariant) share of employment in cereal production or by relative productivity. In both cases, we find that the policy resulted in an

[43] Although the coefficients on female employment are much larger than those for men, this simply reflects the fact that the mean and standard deviation of the female share is about half that of men. In fact, evaluated at the average of the gendered employment share, male employment yields slightly stronger effects of the tariff.

increase in agricultural employment. The estimated coefficients indicate that for a department with average cereal employment (relative productivity) the policy increased agricultural employment by 5.4 (4.7) percentage points. Looking at the aggregate figures helps put these magnitudes into perspective: between 1872 and 1891 the (nation-wide) share of agricultural employment fell by 8.6 percentage points. The last three columns of table 9 regress our three core variables on the contemporaneous share of employment in manufacturing in the department. The coefficient on agricultural employment is negative in the regression for enrolment and positive in those for birth and fertility rates, in line with our expectations. These results are broadly consistent with our hypothesis that the effect of the Méline tariff operates through its impact on employment shares which in turn affect household decisions.

As we have argued, child labour was prevalent in 19th century French agriculture. The informal nature of child labour implies that we have no measures for its magnitude. The data, however, allows us to capture to some extent the fact that education decisions were affected by the agricultural production structure. Because farm labour is highly seasonal, parents could enrol children at school and have them not attending during the months of intensive farm work, notably the summer.[44] Schooling would then fall, not because fewer children were enrolled but rather because fewer of those enrolled actually attended school.

In order to test this hypothesis, we have collected data on absenteeism reported in the *Statistique Générale de la France*. In the late 19th century, all French schools were visited by an inspector twice during the year. The visits were unannounced and took place in December and in June. Unfortunately, the data are not consistently recorded across years and we have not been able to construct a time series that would allow us to run the specifications previously used. We have nevertheless two consistent observations, for 1896 and 1906, both after the introduction of the Méline tariff. The data give the number of students that were present in the classroom on a particular date in December and in June. We can then compute the rate of presence, defined as the ratio of the number of pupils present to the number of pupils registered. We examine whether in 1896 and 1906 summer absenteeism was greater in departments where the share of cereal employment was larger. There are several aspects that may affect absenteeism: the level of education of parents, the health status of the population, distance to schools, etc. In order to control for these, we regress the presence rate in summer in a department on the rate of presence at schools in December, as well as on our measure of the importance of cereal production. Absenteeism was large. Average presence was 90% in winter and 87% in summer, and the differences across departments were substantial, with certain areas exhibiting summer presence rates of only about two thirds and a seasonal gap of up to 24 percentage points.

The results are reported in table 10. We report OLS regressions that pool the two years together as well as a random effects model (fixed effects cannot be used since our explanatory variable does not vary over time). The results indicate that at the end of the 19th century, departments with a larger employment share in cereals tended to experience greater summer absenteeism, relative to that observed in winter. As an alternative, we use the share of employment in agriculture as an explanatory variable, since lower school presence rates could be due to higher shares of agriculture rather than to cereal production. The share of employment in agriculture also has a negative effect although the coefficients are less significant than for cereals, indicating that cereal employment explains better the gap between winter

[44] At the time, the summer holidays for primary school pupils lasted one month, usually August.

and summer absenteeism than agricultural employment. Although the data is limited, these results are supportive of the hypothesis that in the post-1892 period the importance of cereal in the local economy was a factor affecting school attendance rates and hence was likely to have had an impact on human capital accumulation.

Lastly, we explore differences across the type of school attended by primary-school pupils. As has been argued by Squicciarini (2020), the Catholic Church opposed the technical curriculum that was being introduced in primary schools from the 1870s onward. She shows that in more conservative French departments, religious schooling was more prevalent and that this in turn resulted in slower industrialization. An implication of her results is that, since parents enrolled their children in religious schools for non-production-related reasons, the effect of the tariff should be stronger on secular than on religious schools. We hence compile data for enrolment in religious and secular schools, for all children as well as for boys and girls, and compute enrolment rates in each category of school. Table 11 reports regressions for enrolment rates in different types of schools including, as well as the cereal share, the interaction between religious conservatism and the tariff. The effect of the policy is negative for both types of schools, but much stronger for secular ones, consistent with the idea that parents saw secular schooling as providing skills which became less desirable when the relative return to manufacturing fell.

To sum up, the evidence in this section indicates that the tariff affected agricultural employment, which in turn had an impact on enrolment and fertility. Moreover, the tariff affected mainly enrolment in secular, as opposed to religious, schools. The former provided a more technical curriculum than the latter, a result that is consistent with our argument that enrolment was responding to changes in the demand for skills. We also provide suggestive evidence that child labour played a role, as captured by differences in absenteeism in schools during the harvest period across departments with different shares of cereal employment.

7 Conclusions

This paper examines the effect of a protectionist policy shock that took place in late 19th century France, the 1892 Méline tariff, a large tariff on cereal imports that substantially increased the return to agricultural employment. We develop a two-sector model with endogenous education and birth rates in which, under the assumption that the returns to human capital are higher in manufacturing than in agriculture, a change in the price of agricultural goods implies a reduction in the relative return to education and hence leads to both lower investments in human capital and higher fertility rates.

We use data on French departments for the period 1872 to 1913 to examine the relative effect of the tariff across regions. To capture the strength of the tariff shock, we compute two measures. One is a measure of the actual importance of cereal in the local economy, the share of employment in cereal production just before the introduction of the tariff, while the other is based on agro-climatic factors and captures the (relative) potential for cereal production. Our identification strategy is hence based on the fact that the Méline tariff had a differential effect across departments depending on the importance of cereal production in the local economy. Three outcome measures are used: birth rates, fertility rates, and enrolment in primary education. We find that, in line with the model, fertility and birth rates increased in departments where cereal production was important, while educational attainment fell.

Moreover, the effects are large, reversing pre-existing trends by about a decade in the average department.

These results contribute to a vast literature on protectionism, showing that the protection of low-skill sectors can have important implications for fertility and education, both of them variables that have received little attention so far. Economic historians have extensively examined the consequences of the wave of anti-free-trade policies that swept Europe in the wake of rising imports from the Americas in the mid-19th century. The Méline tariff stands out as one of the rare instances of a protectionist policy that had a positive effect, notably resulting in higher real wages. Our results imply a more nuanced evaluation of the tariff, making it responsible for the brief increase in fertility that occurred at the end of the 19th century, as well as for the so-called 'lost decade' in education.

Our paper also adds to the debate on the origins of modern growth. Unified Growth Theory[45] claims that both education and fertility decisions are choices that responded to economic incentives even during the 19th century, in contrast with the view that childbearing was the result of social norms. A number of previous analyses using historical data have shown that education affected fertility decisions and vice versa. The novelty of our paper is that it identifies how a major aggregate economic shock can impact households' education and fertility decisions, with potential consequences for long-run development.

It is important to emphasize that we are identifying a relative effect across departments, and our results raise questions about the role of protectionism in exacerbating inequality across departments. Further work is hence needed to fully understand the consequences of the tariff. In particular, given that fertility and education decisions can be to a large extent perpetuated through slowly-moving social norms, protectionism may have created productivity differences across departments that resulted in long term regional disparities. We leave this analysis for future work.

[45] See Galor and Weil (2000) and Galor (2005)

Tables

Table 1 – Summary Statistics of Key Variables

	Obs	Mean	S.D.	Min	Max
Birth rate	3566	21.952	4.105	12.622	37.104
Fertility rate	679	89.362	16.881	52.295	150.570
Enrolment rate	570	82.745	7.227	45.585	105.000
Enrolment rate, girls	570	81.772	8.143	41.106	105.000
Enrolment rate, boys	570	83.717	6.765	50.059	105.000
Empl. sh. in agriculture, 1891	85	0.538	0.150	0.019	0.790
Cereal sh. in agric. output, 1892	85	0.268	0.078	0.036	0.444
Cereal (share in employment)	85	0.148	0.062	0.001	0.274
Meline*Cereal Share	3566	0.074	0.086	0.000	0.274
Exposure*Cereal Share	3566	0.815	1.166	0.000	5.756
Cereal Suitability	85	0.824	0.095	0.381	0.942
Distance to Fresnes	85	0.498	0.215	0.059	0.863
Relative Productivity	85	4.005	1.629	0.495	6.734
Meline*Relative Productivity	3566	2.005	2.307	0.000	6.734
Exposure*Relative Productivity	3566	22.050	31.409	0.000	141.415
No. of schools/1000 children	679	18.085	6.562	4.127	42.601
Sex ratio	679	1.001	0.078	0.577	1.544

Table 2 – Birth rate and fertility

	(1)	(2)	(3)	(4)	(5)	(6)
	Birth rate	Birth rate	Birth rate	Birth rate	Fertility	Fertility
Meline*Cereal	-0.124		4.112*		14.82	
	(1.870)		(2.239)		(11.01)	
Exposure*Cereal		0.788***		0.813***		1.992*
		(0.212)		(0.235)		(1.054)
Sex ratio			0.270	0.301	31.59**	31.61**
			(1.164)	(1.147)	(13.73)	(13.81)
No. of schools			0.109**	0.0802*	-0.216	-0.294
			(0.0449)	(0.0408)	(0.238)	(0.232)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.916	0.919	0.925	0.928	0.887	0.888
Observations	3566	3566	679	679	679	679

The dependent variables are birth rates and fertility rates. All regressions include year and department fixed effects, columns (2), (4) and (6) also include Exposure. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3 – Enrolment rate

	(1)	(2)	(3)	(4)	(5)	(6)
	All children	All children	Boys	Boys	Girls	Girls
Meline*Cereal	-36.11***		-33.51***		-36.95***	
	(9.301)		(9.749)		(10.22)	
Exposure*Cereal		-3.712***		-3.997***		-3.263**
		(1.316)		(1.327)		(1.411)
No. of schools	2.374***	2.451***	2.370***	2.450***	2.349***	2.419***
	(0.315)	(0.326)	(0.318)	(0.326)	(0.354)	(0.364)
Sex ratio	2.175	2.141	4.224	4.176	0.0573	0.0386
	(6.700)	(6.916)	(7.007)	(7.172)	(6.796)	(7.026)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.632	0.632	0.552	0.556	0.658	0.655
Observations	570	570	570	570	570	570

The dependent variables are enrolment rates for boys, girls and both groups together. All regressions include year and department fixed effects, columns (2), (4) and (6) also include Exposure. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 – Alternative policy measure: Relative productivity

	(1) Enrolment	(2) Birth rate	(3) Birth rate	(4) Fertility
Meline*RelProd	-0.734*			
	(0.438)			
Exposure*RelProd		0.0279***	0.0315***	0.103***
		(0.00826)	(0.00932)	(0.0365)
Standard controls	Yes	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes
Adjusted R^2	0.623	0.918	0.929	0.889
Observations	570	3566	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (2) to (4) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 – Controlling for manufacturing employment

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-36.61***					
	(9.676)					
Exposure*Cereal			0.799***		1.948*	
			(0.245)		(1.088)	
Meline*RelProd		-0.772*				
		(0.450)				
Exposure*RelProd				0.0308***		0.101***
				(0.00952)		(0.0373)
Manufact. emp.	3.900	4.053	1.122	0.741	3.313	1.721
	(6.328)	(6.502)	(1.692)	(1.636)	(6.704)	(6.527)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.632	0.623	0.928	0.928	0.888	0.889
Observations	570	570	679	679	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 – Robustness: Controlling for child mortality and migrants

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-32.65***	-33.69***				
	(9.146)	(10.33)				
Exposure*Cereal			0.921***	0.756***	2.684*	2.330**
			(0.302)	(0.227)	(1.383)	(1.012)
Child mortality	-18.44		6.616***		7.928	
	(12.48)		(2.445)		(11.87)	
Weighted fertility		8.379		0.320		-13.18*
		(12.11)		(1.489)		(7.371)
Share of migrants		-549.5*		-39.73		-433.7***
		(329.8)		(31.58)		(130.7)
WeiFert*ShareMig		344.6		40.29*		261.3***
		(246.5)		(22.58)		(81.61)
Born outside dept		33.06***		5.092*		30.25*
		(10.82)		(2.947)		(15.65)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.636	0.646	0.902	0.930	0.840	0.891
Observations	570	570	594	679	594	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 – Robustness: Controlling for religious conservatism and size of properties

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-38.66***	-38.64***				
	(9.440)	(9.578)				
Exposure*Cereal			1.513***	0.833***	2.561**	2.547**
			(0.536)	(0.232)	(1.074)	(1.110)
Mel*Conserv	-6.063**	-6.209**				
	(2.745)	(2.784)				
Mel*LargeProp		-0.536				
		(1.234)				
Exp*Conserv			0.314**	0.0189	0.0730	0.139
			(0.133)	(0.0641)	(0.298)	(0.304)
Exp*LargeProp				0.0148		0.228*
				(0.0266)		(0.125)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.646	0.646	0.936	0.921	0.883	0.884
Observations	531	531	3314	3314	631	631

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8 – Robustness: Alternative policy timing

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-31.78***	-36.69***				
	(8.587)	(10.11)				
Exposure*Cereal			0.869***	0.719**	2.260	2.693
			(0.320)	(0.315)	(1.456)	(1.726)
Mel*Cereal lagged	8.925					
	(10.15)					
Mel*Cereal forward		-2.968				
		(9.461)				
Exp*Cereal lagged			-0.162		-0.681	
			(0.504)		(3.420)	
Exp*Cereal forward				0.123		-1.230
				(0.309)		(2.037)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.632	0.631	0.919	0.919	0.887	0.888
Observations	570	570	3566	3566	679	679

The dependent variables are the enrolment rate for all children, birth rate and fertility rate. The shock is lagged/brought forward by 10 years. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9 – Mechanism: Determinants and impact of agricultural employment

	(1) AgEmp	(2) AgEmp.	(3) AgEmp.	(4) AgEmp.	(5) Enrolment	(6) Birth rate	(7) Fertility
Meline*Cereal	36.28***						
	(5.380)						
Exposure*Cereal		2.162***					
		(0.573)					
Meline*RelProd			1.167***				
			(0.203)				
Exposure*RelProd				0.0412*			
				(0.0241)			
Agricultural emp.					-19.60***	2.798**	14.03**
					(4.894)	(1.081)	(5.645)
Adjusted R^2	0.462	0.523	0.447	0.647	0.216	0.752	0.697
Observations	679	679	679	679	570	679	679

The dependent variables are the share of agricultural employment in total employment, the enrolment rate for all children, birth rate and fertility rate. All regressions include department fixed effects and a time trend, regressions (5) to (7) include standard controls. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10 – Mechanism: Presence at school in summer

	(1) OLS	(2) OLS	(3) Random effects	(4) Random effects
Presence in December	0.856***	0.846***	0.735***	0.725***
	(0.102)	(0.102)	(0.165)	(0.167)
Cereal employment share	-0.0694*		-0.0643*	
	(0.0409)		(0.0365)	
Agricultural emp. share		-0.0226		-0.0215
		(0.0168)		(0.0161)
Adjusted R^2	0.288	0.284		
Observations	170	170	170	170

The dependent variable is presence in summer. Observations are for 1896 and 1906. Year fixed effects are included in all regressions, standard errors are clustered in the random effects model. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 11 – Mechanism: Enrolment rates in religious and secular schools

	(1) Rel. All	(2) Sec. All	(3) Rel. Boys	(4) Sec. Boys	(5) Rel. Girls	(6) Sec. Girls
Meline*Cereal	-8.386	-30.28***	-5.032	-32.13***	-12.39	-26.64***
	(6.064)	(8.048)	(7.477)	(9.841)	(7.481)	(9.306)
Mel*Conserv	-1.654	-4.409**	0.0837	-7.733***	-3.242*	-1.068
	(1.461)	(2.097)	(1.454)	(2.677)	(1.805)	(2.314)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.903	0.933	0.839	0.864	0.906	0.940
Observations	531	531	531	531	531	531

The dependent variables are enrolment rates in religious and secular schools for all children, boys and girls. All regressions include year and department fixed effects. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Appendix

This Appendix has four sections. Appendix 1 examines two aspects that help us understand the historical context. First, we look at media coverage of agriculture and protectionism and show that after its introduction the tariff remained a focal point in the public debate as indicated by sustained media presence. Second, we examine the evolution of the price of wheat in France and how it was affected by the tariff, in particular relative to that in the UK. Appendix 2 provides the computations of the model and explore some extensions. The third appendix gives details on the data, while Appendix 4 provides additional tables and figures.

Appendix 1: The historical context

A1.1. Protectionism in the media

In this appendix we document the media coverage of agriculture and protectionism, which culminates at the time of the adoption of the tariff and stays at this level until WWI. This change in media coverage is striking since the share of agriculture in the French economy as declining, suggesting that an increase in coverage of agriculture and in particular cereals was not due to long-term trends in the economic structure but rather can be related to political factors. To document that this pattern is not the result of changes in the media industry, we compare this issue with another major political debate at the time: the Dreyfus affair. Alfred Dreyfus was an army officer who in 1894 was accused of and then indicted for being a spy for Germany. The Dreyfus affair revealed the depth of anti-Semitism in the French army and, more generally, French society. In 1896, evidence came to light -through non-official channels- which identified the real culprit and revealed the whole affair as a plot organized by some army officers. The attempts by the army to cover and dismiss the evidence led to a media campaign by intellectuals, notably Emile Zola, to prove the innocence of Dreyfus, which divided the country. The main events of this affair span from 1894 with the accusation of Dreyfus to his pardon and release in 1899, but the affair continued until Dreyfus was exonerated and reinstate as a major by the highest court of justice in 1906. Data on the Dreyfus affair will be presented below as a comparison that allows us to see the evolution of media coverage of major political debates during our period of interest.

Construction of the database

Seven newspapers were selected because they were -by far- the daily newspapers with the greatest readership at the time or because they were highbrow papers addressing each a different segment of the elite. The four general interest dailies we consider are *Le Petit Journal*, *Le Petit Parisien*, *Le Matin* (from 1884 onwards), and *Le Journal* (from 1892 onwards), which were all nonpartisan. In contrast, the three highbrow newspapers had particular readerships: *La Croix* (from 1883) had a conservative catholic readership, consisting mostly of landlords and clergymen, *Le Temps* targeted the bourgeois republican elite, and *Le Figaro* was mainly read by the aristocratic and bourgeois elite. In 1892, these seven dailies sold 4 million of copies a day, representing 80% of the total circulation of newspapers in France and a readership of 100 copies per 1,000 inhabitants (Albert, 1972).

We used the database *Gallica* from the *Bibliothèque Nationale de France* to extract text files from the journals and performed the word counts for each journal and year. We scraped all issues from 1872 to 1913.

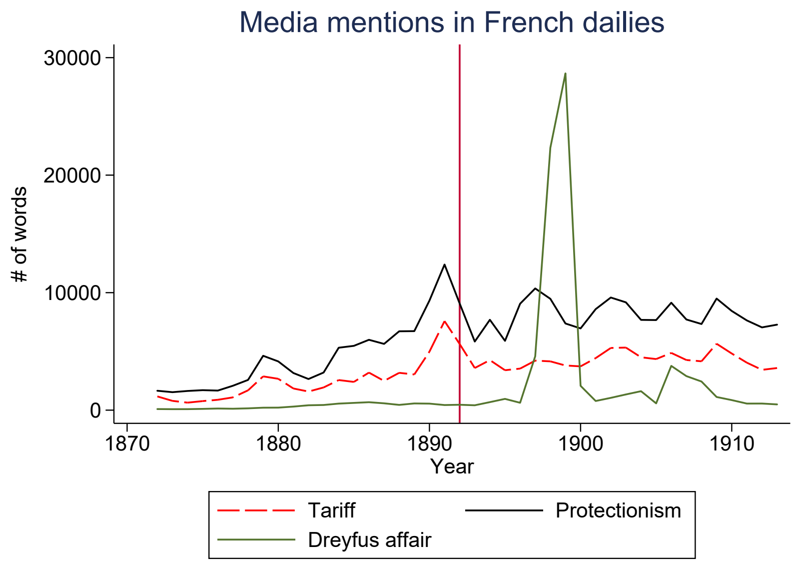

Figure A.1 – Protectionism in the press: 1872 to 1913.
Author's calculations. The figure reports the total counts of words related to each issue, protectionism, tariffs, and the Dreyfus affair in seven daily newspapers. The vertical line indicates the date of introduction of the Meline tariff.

Reading articles in the newspapers allowed us to select words related to protectionist policies (and the Dreyfus affair). The word count was then implemented using supervised techniques, i.e. by assembling a list of words related to protectionist policy. We also used unsupervised techniques to check that we had not omitted an important word related to the issue of interest. To this end, we built a corpus of newspaper articles in the three general interest dailies from 1892 to 1902 that cover protectionism and performed an LDA (Linear Discriminant Analysis) to establish the frequency of words used in those articles. All unique words cited in the text are assembled into a vocabulary vector. To limit word cluttering and transcription errors (from picture format to text), we clean the vector of the words for stopwords (and, for, yes, if, etc.), very short or long words (with length lower than or equal to 4 characters and higher than or equal to 15 characters), or words with a number of consecutive vowels higher than or equal to 3 or with a number of consecutive consonants higher than or equal to 4. We then compute the number of times that each of the following words were printed within each issue of all seven dailies between 1872 and 1913:

- Protectionism : "douani" ("customs"), "tarif", "Meline" and "importation" ("import").
- Dreyfus: "antisem", "dreyf", "picquart" and "esterh" (the last two being contractions of the surnames of the Army officer that exposed the affair and of the actual culprit).

Since each newspaper was printed at the same frequency (daily) and since the evolution of the number of pages in each issues did not vary substantially over the period (according to our calculations), a count of occurrences is unlikely to be biased compared to a ratio of number of occurrences per page. Moreover, since the pattern of media mention is similar across the various newspapers, we perform the quantitative analysis by summing up the number of occurrences in all newspapers.

Figure A.1 shows the evolution of the number of each cluster of words in the seven dailies for each year. The number of media mentions of words related to protectionism increased progressively during the first two decades we consider (with an average of 3,694 between 1872 and 1889), jumped in 1890, peaking at 12,392 in 1891, and then levelled at around 10,000 for the following two decades (i.e. at an average of 1,400 mentions per newspaper per year or 4 mentions per issue). One of the components of our composite measure, tariff, is also reported and shows a similar pattern. It is interesting to compare these pattern with that observed for the Dreyfus affair. The enormous interest on the affair is captured by the massive increase in words related to the affair's protagonists and to anti-Semitism. Yet, the presence in the media of these words wanes rapidly once Dreyfus is acquitted. In contrast both our composite measure of protectionism and the word tariff remain present in newspaper articles for the two decades following the introduction of the tariff.

Regressions

To better gauge the change in media presence we test for breaks in the trends we observe, so as to assess if there was a change in media coverage of protectionism and whether this change was permanent. We start by performing a S-Wald test for structural change in media coverage for the cluster of words in *Protectionism* as well as its two main components, *Tariff* and *Custom*. The bottom panel of Table A.1 reports the break year and the Wald test, which is significant at the 1 or 5%. We then regress the word count on a pre-break and a post-break trend (using the date reported in the bottom panel).

Table A.1 – Time trends in media presence

	(1) Protectionism	(2) Tariff	(3) Custom
Pre-break trend	366.3***	169.7***	217.5***
	(52.61)	(34.19)	(28.79)
Post-break trend	-50.69	-30.24	18.94
	(39.49)	(25.66)	(33.22)
Adjusted R^2	0.805	0.730	0.702
Observations	42	42	42
Break year	1890	1890	1893
Wald test	56.38	37.48	10.93

The dependent variables are the number of appearences of each word in the main 7 daily newspapers during a year, over the period 1872-1913. The two explanatory variables are a pre- and a post-break trend, with the trend date being the break year according to the Wald test reported in the lower panel. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The results show that media mentions associated with protectionism initially increased, as seen by the positive and significant coefficients on the pre-break trend. This pattern of media mentions had a break in 1890 for both *Protectionism* and the word *Tariff*, with a stable use from 1891 onward. A similar pattern is obtained for *Custom*, although the break is in 1893. These results are consistent with the idea that following the introduction of the tariff media pressure stabilized yet the topic was highly present in newspapers, suggesting a new regime for the discussion of protectionist policy in the public debate.

A1.2. The Méline tariff and cereal prices

We have just seen that the Méline tariff was perceived as a major policy change. We next ask whether this perception was justified in terms of its impact on cereal prices. Simply looking at cereals prices before and after 1892 is not a suitable way of examining the impact of the tariff since consumer prices were determined by both the tariff and import prices, and the latter kept declining as a result of improved transport technologies. Instead we look at price differentials across cities, focusing on France and the UK and comparing prices with those observed in the Americas.

We have consistent data for five French and three English cities for the period 1880-1908: Paris, Bordeaux, Lyon, Marseille, and Toulouse in France and London, Liverpool and Manchester in the UK. We consider these as destination cities and construct pairwise price ratios between prices in these cities and prices in three cities in the Americas, New York, San Francisco and Buenos Aires. These were all major ports for cereal exports, and have been chosen because there is information on freight costs for merchandise originating from the three ports and going to Europe, allowing us to control for the impact of these costs on the price differential. Freight costs were a key component of the price at destination, yet, as argued by Jacks and Pendakur (2010), the way in which freight rates are computed makes them endogenous to trade flows. We will hence also control for trade volumes and exchange rates.

We consider prices for wheat, both because it was the most widely-consumed cereal in France and the UK at the time (Postel-Vinay and Robin, 1992) and because of data availability. Wheat prices in the various cities come from Jacks (2005). Total bilateral trade between the reporting (exporter) and the partner (importer) country is computed as the sum of exports and imports. Those between the US and France or UK come from Jacks (2006) (available at www.sfu.ca/ djacks/data), those for Argentina are from the RICardo database (see ricardo.medialab.sciences-po.fr). We have information on inbound freight faced by Europe, and there are two sets of freights, one for Norther European territories and another for Southern Europe. We use the latter for the cities of Marseille and Toulouse, for all other cities we use the Northern route. The data are from Jacks and Pendakur (2010) and Federico and Tena-Junguito (2019) (see www.sfu.ca/ djacks/data and www.uc3m.es/ss/Satellite/UC3MInstitucional/es/TextoMixta/1371246237481). Prices and trade volumes are computed in 2016 US dollars. David Jacks' database reports prices in 1990 US dollars. In order to update its information to 2016 values, we used the calculator "Measuring Worth", (see Officer (2021) and www.measuringworth.com/exchangepound/). Data on historical pounds and dollars were converted using Federico and Tena-Junguito (2019). We then define city-pair relative prices by computing the logarithm of the ratio between the price in each destination city and each origin city.

We estimate an equation for the price differential between city i (in Europe) and city j (in the Americas) of the form

$$ln\frac{p_{it}}{p_{jt}} = \alpha FR_i * M_t + \beta X_{ijt} + \eta_{ij} + \delta_t + \epsilon_{ijt},$$

where FR_i is a dummy taking value one if the destination city was in France, M_t is the Meline dummy, X_{ijt} are other control variables, η_{ij} is a city-pair fixed effect, and δ_t is a year fixed effect. The coefficient on interaction between FR_i and M_t captures the average effect of the tariff on wheat prices in the five French cities. The results are reported in Table A.2

Table A.2 – Wheat price differential between cities in France/UK and in the Americas

	(1) Price differential	(2) Price differential	(3) Price differential	(4) Price differential
Meline	0.191***	0.195***	0.167***	0.179***
	(0.0175)	(0.0176)	(0.0206)	(0.0206)
Bil. trade flow		-0.0510*	-0.0706**	-0.0724***
		(0.0267)	(0.0276)	(0.0273)
Freight rate			-0.272***	-0.130
			(0.105)	(0.110)
Exchange rate				0.394***
				(0.103)
Pairwise fixed effects	Yes	Yes	Yes	Yes
Adjusted R^2	0.123	0.127	0.134	0.152
Observations	672	672	672	672

The dependent variable is the relative price of wheat between a European city (Paris, Bordeaux, Lyon, Marseille, Toulouse, London, Liverpool and Manchester) and an American one (New York, San Francisco, Buenos Aires). All regresions include year and city-pair fixed effects. Standard errors (in parentheses) are clustered at the city-pair. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

The first regression includes only the fixed effects and the effect of the tariff and indicates that over the period 1880-1908 the tariff implied an increase of wheat prices in French cities of 19%. We then include then include trade volume between the countries in which the two cities are located, freight rates on the relevant route, and the exchange rate between the two countries. The results indicates that the effect of the tariff remains robust at around 18%.

Appendix 2: Details of the model

This appendix provides the details of the model. Consider first the maximization problem in (5). Substituting for consumption and differentiating yields the following first-order conditions with respect to n and e

$$(1-\gamma)n_t(\tau^q+\tau^e e_t) = \gamma\left(1-(\tau^q+\tau^e e_t)n_t\right), \tag{A.1}$$

$$(1-\gamma)\tau^e n_t Ey(e_t) = \gamma\left(1-(\tau^q+\tau^e e_t)n_t\right)(1-q_{t+1})w_{mt+1}h^{'}(e_t). \tag{A.2}$$

Dividing one by the other and using the expressions for $Ey(e_t)$ and $h(e)$ we get equation (6) in the text. Rearranging (A.1) we obtain equation (7).

To determine the allocation of labour across sectors, recall that labour is paid its marginal value product, hence the agricultural wage is given by $w_{at} = \alpha p_t(AT)^{1-\alpha}L_{at}^{\alpha-1}$ and that in manufacturing by $w_{mt} = \alpha K^{1-\alpha}\left(h_t L_{mt}\right)^{\alpha-1}$. Labour market equilibrium implies $w_{at} = w_{mt}h(e_{t-1})$, and assuming that $\alpha = 0.5$, we have $ap_t^2 L_{mt} = L_{at}h(e_{t-1})$, where $a \equiv AT/K$. Substituting for $L_t = L_{mt}+L_{at}$, where L_t is the total labour supply, and defining $q_t \equiv L_{at}/L_t$, we get equation (8).

Now consider the equilibrium as defined by equations (7) and (9). The equilibrium level of education is defined by the equality $f(e_t, p^w_{t+1}, \eta_{t+1}; a) = 0$, where the function $f(.)$ is defined as

$$f(e_t, p^w_{t+1}, \eta_{t+1}; a) \equiv \frac{1-\theta}{\theta}e_t + \frac{a}{\beta\theta}\left(p^w_{t+1}(1+\eta_{t+1})\right)^2 {e_t}^{1-\theta} - \frac{\tau^q}{\tau^e}.$$

This function is strictly increasing and concave in e_t, while for $e_t = 0$ we have $f(.) < 0$ and $f(.) = \infty$ for $e_t = \infty$. The function thus takes a negative value at zero and crosses the horizontal axis, implying that there exists a unique positive value of $e_t^\star$ for which $f(.) = 0$. Consider now the effect of an increase in the tariff, η. Note that $f_\eta > 0$, $f_e > 0$, and $f_a > 0$. Then, $de_t/d\eta_{t+1} = -f_\eta/f_e < 0$, implying that a higher tariff reduces education, while $d(-f_\eta/f_e)/da < 0$, indicating that this effect is stronger when a is larger. From equation (7) equivalent results can be obtained for n_t.

The model can also be solved for the case with no sectoral mobility. With q fixed, the effect of the tariff is to increase the agricultural wage. Substituting for wages in equation (6), we get

$$\frac{1-\theta}{\theta}e_t + p^w_{t+1}(1+\eta_{t+1})\left(\frac{q}{1-q}\right)^\alpha \frac{a^{(1-\alpha)}e_t^{1-\alpha\theta}}{\theta\beta^\alpha} = \frac{\tau^q}{\tau^e}, \tag{A.3}$$

from which we can obtain comparative statics equivalent to those above. In particular, the negative effect of η_t on e_t is stronger both for higher a and for higher q.

We next introduce several modifications to our model. First, we suppose that children are productive as soon as they are born and education requires time investment by the child, as described in the text. The child's productivity is given by λ^s, where $\lambda^s < 1$ and $s = a, m$, allowing for a different relative productivity across sectors. Second, the weight of offspring potential income is now given by γ^e, which may or may not be equal to γ. The problem faced by an individual born at time $t-1$ working in sector s is hence

$$\begin{aligned}
\max_{c_t,n_t,e_t} U^s_{t-1} &= (1-\gamma)\ln c_t + \gamma \ln n_t + \gamma^e \ln Ey(e_t) \\
s.t. \qquad c_t &= y^s_t\left(1-\tau^q n_t\right) + \lambda^s y^s_t\left(\rho - \tau^e e_t\right) n_t \\
Ey(e_t) &= q_{t+1} w_{at+1} + (1-q_{t+1}) h(e_t) w_{mt+1} \\
h(e_t) &= \beta e_t^{\theta} \\
e_t &\geq 0, \quad n_t > 0, \ c_t > 0.
\end{aligned}$$

From the first-order conditions it is possible to show that when $\lambda^s > 0$, the interior solution given by

$$n^s_t\left(\tau^q - \lambda^s(\rho - \tau^e e^s_t)\right) = \gamma, \tag{A.4}$$

$$\frac{\tau^q - \lambda^s \rho}{\lambda^s \tau^e} = \frac{1-\widetilde{\theta}}{\widetilde{\theta}} e^s_t + \frac{a p^2_{t+1}\left(e^s_t\right)^{1-\theta}}{\widetilde{\theta}\beta}, \tag{A.5}$$

where $\widetilde{\theta} \equiv \gamma^e \theta/\gamma$. The model hence delivers a quantity-quality trade-off. A change in the tariff can be shown to have equivalent effects to that in the model without child labour.

Other scenarios can be considered. First, the equilibrium outcomes may differ across sectors if $\lambda^a \neq \lambda^m$. Assuming that children's productivity is at least as large in agriculture as in manufacturing, i.e. $\lambda^a \geq \lambda^m$, implies that education investments will be (weakly) lower and fertility (weakly) higher in agriculture than in manufacturing. The average optimal magnitudes will then be given by $\overline{e}_t = q_t e^a_t + (1-q_t)e^m_t$ and $\overline{n}_t = q_t n^a_t + (1-q_t)n^m_t$, which depend on the relative weight of the sectors, and imply that $e^a_t \leq \overline{e}_t \leq e^m_t$ and $n^m_t \leq \overline{n}_t \leq n^a_t$. It is then possible to show that an increase in the tariff will reduce education (increase fertility) both because it reduces education (increases fertility) for households in each sector and because a greater share of population will work in agriculture. If child labour is not used in manufacturing, i.e.$\lambda^s = 0$, utility is strictly increasing in education, implying the corner solutions $e^s_t = \rho/\tau^e$ and $n^s_t = \gamma/\tau^q$. The decisions if households in the manufacturing sector will then be unaffected by the tariff, but the aggregate outcome will.

Lastly, consider the case in which $\gamma^e = 0$, implying that parents do not care about their offspring future income, only about the quantity of children. Suppose also that $\lambda^a > 0$ and $\lambda^m = 0$. In this case, we have a corner solution for both types of households, with $e^m_t = \rho/\tau^e$ and $n^m_t = \gamma/\tau^q$, and $e^a_t = 0$ and $n^a_t = \gamma/(\tau^q - \lambda^a \rho)$. Both e^a_t and e^m_t are unaffected by the tariff, yet average education will change with η_t through its impact on q_t. Note that in this setup, we would need to change the human capital production function to $h(e_t) = \min\left\{\underline{h}, \beta e^{\theta}_t\right\}$ to ensure that individuals with no education have positive productivity in manufacturing, in which case the production side of the economy can be solved as before.

Appendix 3: Dataset construction and sources

This appendix gives further details on the construction of our dataset and the variables used in the analysis. We create a new dataset at the department level to examine the effect of trade protection of cereal on education and fertility depending on the intensity of the exposure of the department to protectionism. In the sections below we detail the construction of the measure of exposure, of the demographics, educational attainment and additional variables.

Territory The French territory was subdivided into 86 *départements*, that were roughly the size of a US county. We dropped one department, Corsica, because of lack of data for certain variables.

Intensity of the policy shock Three sets of variables are used to compute our measures for the intensity of the policy shock.

Cereal share: This is a proxy for the share of employment in cereal production. We compute the product of the share of agricultural employment in total employment in 1891 and the share of the value of cereal production in total agricultural production in 1892, which come respectively from the 1891 census and Toutain (1993).

Cereal suitability: Cereal suitability is measured using the indices of potential yields of land from the project Global Agro-Ecological Zones (GAEZ) provided by the Food and Agriculture Organization (FAO); see FAO (2010). The data measure the suitability of grid cells of 5 arc minutes to cultivating different crops. They are constructed from models that use a location's climate information (rainfall, temperature, etc.) and soil characteristics for the period 1961-1990 to obtain the maximum yield that could be attained in each grid cell. We combine the cells that form each French department and obtain a measure of the mean potential yield of the department in tons per hectare per year for each crop. The measure is per hectare of land, not of arable land. GAEZ provides different yields depending on the inputs used. We chose the variable measuring yields under rain-fed and low-input agriculture. Rain-fed outputs are the most exogenous measure as they are not affected by human activity such as irrigation. Low-input agriculture is consistent with the period we are considering, given that France was a laggard in the use of fertilizers at the end of the 19th century, see Dormois (1996).

From these data we compute the potential yield for rye, for oat, and for wheat, and convert each into calories using the caloric content of each cereal from the "USDA Food Composition Database" as in Galor and Ozak (2016). We then use as potential cereal yield for the department the maximum caloric yield of the three crops. The result is given in billion of kcal/ha.

Potential Industrialization: Potential industrialization is proxied by the aerial distance between the capital city of a department and Fresnes-sur-Escaut, the location where the first steam engine was introduced in France in 1732. Franck and Galor (2021) show that this distance is an exogenous predictor of the ability to industrialize in the second half of the 19th century. It is indeed indicative of a local diffusion process of the steam engine from Fresnes-sur-Escaut, as shown by the negative correlation between the aerial distance and the intensity of the use of steam engines in the department in 1861–1865, even after controlling for confounding geographical factors (such as land suitability, latitude, rainfall and temperature) or institutional factors (such as the concentration of power in Paris and its region) or pre-industrial development (notably the urbanization rate).

Demographic variables All demographic variables were retrieved from the Censuses, which were usually conducted every 5 years, i.e. in 1872, 1876, 1881, 1886, 1891, 1896, 1901, 1906, 1911. The results of the Censuses are available online on the website of the *Centre de Recherche Historique* (CRH thereafter) of the EHESS (http://acrh.revues.org/2890). The data were digitized as part of the ICPSR project (https://www.icpsr.umich.edu/).

Population and gender: The number of adult females and males (including by age subgroup and marriage status), or children and the total population are available every 5 years.

Occupations: Depending on the year, the census gives either the number of individuals holding a job in a particular sector or both the number of "individuals living from a given sector" and the number of "family members in sector i". In the latter case, we compute the number of individuals working in sector i by subtracting the number of family members in sector i from the number of people living from sector i. To make the data consistent across censuses, and following the current international standard, the employees of fishing and mining companies are included in the agricultural sector.

Birth rate: Crude birth rates are defined as the number of live births per 1,000 inhabitants. The number of births at the department level is available every year from *Mouvement general de la population* published on the CRH website. To construct an annual time series for birth rates, the population figures were interpolated yearly using the average of the growth rate of the total population between 2 censuses, except in 1912 and 1913 for which we extrapolate the average growth rate of the 1906-1911 period. We use the corrections of the population data proposed by Van de Walle (1974) and Bonneuil (1997).

Fertility: The fertility rate is computed as the ratio of the number of births to the total population of women aged 15 to 45 years in 1,000s.

Sex ratio: The sex ratio is defined as the ratio of males aged 15 to 45 to females aged 15 to 45, which we constructed from census data.

Child mortality: Child mortality data are from Bonneuil (1997). Using census data, he computes corrected mortality rates, defined as the probability for a cohort of children to die before age 5. Given the quinquennial nature of the data, the figures for, say, 1871, gives the probability for those of age a who are alive in 1871 of dying in the next 5 years. We hence use for 1876 the mortality rate for 1871, and so on. Bonneuil provides data on child mortality up to 1901, implying that we can use this last observation for our estimates for 1906.

Migrants: The census reports data on those living in a department who have not been born in the department. We can hence construct quinquennial series for the fraction of the population who is French but born in another department as well as that of foreigners. Moreover, foreigners are classified according to their nationality.

Weighted fertility: We construct a weighted proxy for the fertility norms of foreigners. To do so we use data from Mitchell (2003) on birth rates by country. At each point in time, we construct a measure of the birth rate in the country of origin relative to that of France and compute an average relative birth rate for foreigners, weighted by the size of each nationality among the department's foreign population.

Marriage: The marriage rate is the ratio of married females aged 15 to 45 to all females aged 15 to 45. The average age at marriage is computed by weighting the age at marriage of each cohort by the size of each cohort. The data are available for every census year. Because they are displayed by brackets of 5-years intervals for every age older than 20 and younger than 50, we assume that the year at marriage of each bracket was the median age of the bucket.

Primary school enrolment Education is measured as the ratio of primary school enrolment to the population of children for which enrolment was compulsory. Throughout the period, primary schooling was compulsory between the ages of 6 and 13 but it was common for older children to attend a primary school. A non negligible number of students attended private and confessional schools and we add the number of pupils in those schools to those in public schools. The number of high school students was usually very low in most *départements*, which prevents us from using the enrolment rate in high school as a measure of secondary education. We use three variables from the periodical published by the Ministry of Education *Statistiques de l'Enseignement Primaire* (statistic on primary education): the number of children, of boys and of girls aged 6 to 13 enrolled in primary school (public or private), and the number of children aged 6 to 13 in each census. Digitized data are available online at these web addresses http://acrh.revues.org/3376 for the years digitized by the French national statistical office INSEE and at http://acrh.revues.org/3038 for the years digitized by the CRH of the EHESS. The online appendix, and in particular Table OA.1, gives the name of the file and the name of the three variables used to compute enrolment rate. Occasionally, enrolment rates are above 100 percent. As is often the case with contemporary data, this can be due to discrepancies in the reported age of children. However, in some cases we obtained very large values, the result of an out-of-trend observation for the population in this age group (no correction is available for population by age group). We hence top code enrolment rates as 105% for observations where the enrolment is above this figure (7 observations).

Industrialization and market integration. Two measures are used, transport costs and sectoral employment.

Transport cost: The transport cost is the product of the distance between the capital city of each district to either Paris or Fresnes-sur-Escaut multiplied by the average cost per kilometer using the cheapest available mode of transport. Distance between two districts is computed as the Great Circle Distance between the capital city of each district, as computed by Daudin et al. (2019). In most departments for almost all of the period, the capital was linked to Paris and Fresnes by train (which was the cheapest transportation technology). When the two capital cities were connected by train, we use the average transport cost of commodities by train as computed by Toutain (1967). In four cases the department was not connected to Paris by train in 1872. We then use the transport cost by road, also in Toutain (1967), until the train line is built.

Manufacturing employment: The share of individuals employed in manufacturing (over total employment is used as a measure of industrialization. The measure is built using census data on occupations.

Additional variables A number of additional variables are used in our analysis.

Number of schools: The number of schools is obtained from the *Annuaire Statistique de la France*, which reports both the number of public and of private schools. Starting with the volume for 1879 which reports schools for the academic year 1876-77 we collect data for all census years. No data is available for 1891-92 and hence we use the figures for 1892-3.

Absenteeism: The data are from various issues of *Statistique Générale de la France*. We use figures for primary school students attending school in December and in June, adding up the figures for private and for public schools. These are divided by the total number of students registered at primary schools (private and public).

Religious conservatism: The data are from Tackett (1986) and we are grateful to Mara Squicciarini for providing them to us. We use data on the total number of priests in the department in 1791 and the number of priests that did not take the revolutionary oath to construct the share of conservative priests.

Large properties: The data are from the 1882 agricultural survey, which provides information on the size of farms. Three categories are given â farms of less than 10 hectares, between 10 and 40, over 40 hectares. We have information on the total arable land in each of these categories and hence compute a measure of the share of arable land in each size-bracket. Following Laurent (1976), who splits departments into three categories according to whether the prevalent size of agricultural property was small, medium-sized or large, where the latter is defined as properties greater than 40 hectares. We create a dummy that takes the value 1 if large properties dominate. The correlation of the cereal share with the over-40 share is zero (0.004), with medium-sized farms it is positive (0.25) and with under-10 farms negative (-0.19).

Mechanical reapers: The data are from the 1882 agricultural survey. We compute the number of reapers per hectares cultivated with cereals, pulses and potatoes.

Appendix 4: Additional figures and tables

Table A.3 – Aggregate birth, fertility and enrolment rates

	(1) Birth rate	(2) Birth rate	(3) Fertility	(4) Enrolment
Time trend	-0.203***	-0.224***	-0.955***	0.530*
	(0.00923)	(0.0180)	(0.104)	(0.195)
Meline	0.691***	1.188**	3.759	-7.665
	(0.224)	(0.463)	(2.669)	(3.934)
Adjusted R^2	0.973	0.982	0.970	0.503
Observations	42	9	9	7

The dependent variables are the birth rate, fertility rate and enrolment rate for all children. Standard errors are clustered at the department level. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.4 – Saturated regressions

	(1) Enrolment	(2) Birth rate	(3) Fertility
Meline*Cereal	-33.31***		
	(10.29)		
Exposure*Cereal		0.643***	1.378
		(0.221)	(1.054)
Meline*RelProd	-0.452		
	(0.438)		
Exposure*RelProd		0.0218***	0.0898**
		(0.00819)	(0.0384)
Standard controls	Yes	No	Yes
Linear trend *dpt	Yes	Yes	Yes
Adjusted R^2	0.633	0.921	0.889
Observations	570	3566	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (2) and (3) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.5 – Robustness: Controlling for child mortality and migrants

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*RelProd	-0.876**	-0.429				
	(0.425)	(0.372)				
Exposure*RelProd			0.0510***	0.0260***	0.163***	0.102***
			(0.0102)	(0.00884)	(0.0459)	(0.0364)
Child mortality	-25.69*		8.510***		13.74	
	(13.22)		(2.459)		(13.00)	
Weighted fertility		10.35		0.180		-13.66*
		(12.24)		(1.506)		(7.407)
Share of migrants		-422.2		-9.336		-328.5**
		(370.6)		(34.20)		(135.5)
WeiFert*ShareMig		236.2		18.19		179.9*
		(280.3)		(25.89)		(91.58)
Born outside dept		36.48***		3.973		25.54*
		(12.40)		(2.887)		(15.30)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.631	0.637	0.908	0.929	0.844	0.891
Observations	570	570	594	679	594	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.6 – Robustness: Controlling for religious conservatism and size of properties

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*RelProd	-0.865**	-0.892**				
	(0.430)	(0.439)				
Exposure*RelProd			0.0740***	0.0308***	0.103**	0.0901**
			(0.0192)	(0.00903)	(0.0393)	(0.0430)
Mel*Conserv	-4.414	-4.302				
	(2.718)	(2.683)				
Exp*LargeProp				-0.0121		0.146
				(0.0268)		(0.135)
Mel*LargeProp		0.303				
		(1.336)				
Exp*Conserv			0.213*	-0.0359	-0.103	-0.0489
			(0.113)	(0.0601)	(0.277)	(0.285)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.637	0.636	0.937	0.920	0.883	0.883
Observations	531	531	3314	3314	631	631

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.7 – Robustness: Alternative policy timing

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*RelProd	-1.047***	-0.626				
	(0.330)	(0.482)				
Exposure*RelProd			0.0295***	0.0318***	0.0858*	0.0950**
			(0.00787)	(0.00869)	(0.0500)	(0.0440)
Mel*RelPr lagged	-0.638					
	(0.411)					
Mel*RelPr forward		0.603*				
		(0.362)				
Exp*RelPr lagged			0.0229		-0.210	
			(0.0539)		(0.583)	
Exp*RelPr forward				-0.0561		0.105
				(0.0439)		(0.327)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.625	0.625	0.918	0.919	0.889	0.889
Observations	570	570	3566	3566	679	679

The dependent variables are the enrolment rates for all children, birth rate and fertility rate. The shock is lagged/brought forward by 10 years. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.8 – Robustness: Policy variable based on other crops

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-37.09***	-30.92***				
	(8.889)	(9.886)				
Exposure*Cereal			0.939***	0.820***	2.757***	1.956*
			(0.193)	(0.208)	(0.986)	(1.138)
Meline*Wine	-2.878					
	(9.071)					
Meline*FruitVeg		-50.33**				
		(21.79)				
Exposure*Wine			0.482***		2.487***	
			(0.164)		(0.509)	
Exposure*FruitVeg				-0.307		0.348
				(0.340)		(2.501)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.631	0.635	0.921	0.919	0.890	0.887
Observations	570	570	3566	3566	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. The alternative policy measures are the share of employment in the production of wine or fruit and vegetables in 1892. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.9 – Robustness: Controlling for transport costs

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-35.62***	-35.46***				
	(9.128)	(9.266)				
Exposure*Cereal			0.770***	0.797***	1.974*	1.972*
			(0.211)	(0.206)	(1.048)	(1.064)
Trans. Fresnes	0.160		-0.117***		-1.048***	
	(0.366)		(0.0427)		(0.302)	
Trans. Paris		0.184		-0.0353**		-0.0567
		(0.120)		(0.0147)		(0.101)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.631	0.634	0.919	0.920	0.889	0.888
Observations	570	570	3566	3566	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table A.10 – Correlations: Cereal share, property sizes and mechanical reapers

	Cereal Share	Cereals Suit.	Distance Fresnes	Small pro.	Medium pro.	Large pro.	Mech. reapers
Cereal Share	1.00						
Cereal Suit.	-0.089	1.00					
Distance Fresnes	-0.202	0.485	1.00				
Small pro.	-0.188	0.048	0.302	1.00			
Medium pro.	0.259	0.212	-0.015	0.090	1.00		
Large pro.	0.004	-0.155	-0.228	-0.834	-0.625	1.00	
Mech. reapers	-0.299	0.371	0.471	0.037	-0.184	0.073	1.00

See the data section for sources.

Correlations between the cereal share, cereal suitability, distance to Fresnes-sur-Escaut, the share of land held in small, medium-sized and large properties, and the number of mechanical reapers per hectare. All variables except the cereal share have been normalized to a mean of 0 and variance of 1.

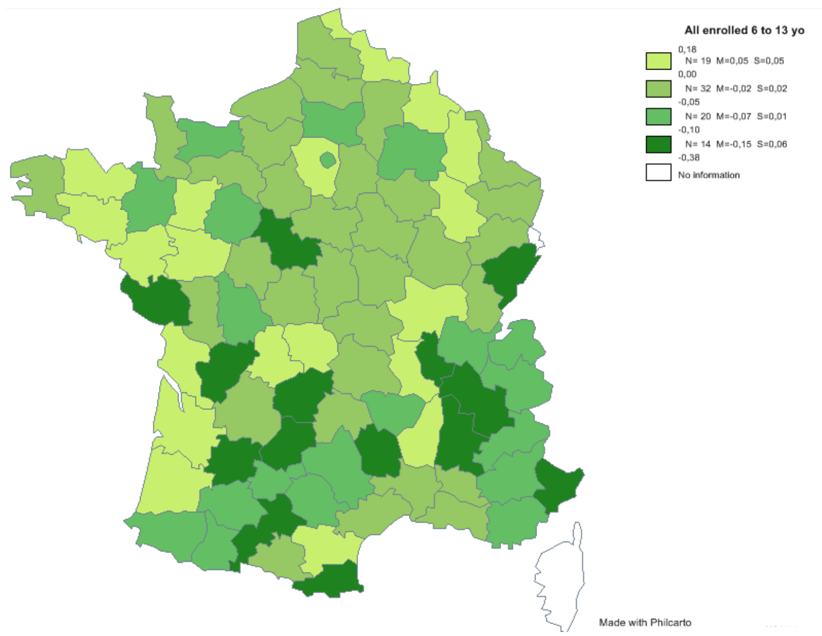

Figure A.2 – Change of the enrolment rate in primary school of children aged 6 to 13 between 1886 and 1896.

Source: See data section. Reading of the legend: In the 14 districts in forest-green, the enrolment rate of children in primary school decreased by between 10% and 38% between 1886 and 1896, with an average of -15% and a standard deviation of 6%. The enrolment rate is calculated as a share of the relevant age group; see section 5 for data source.

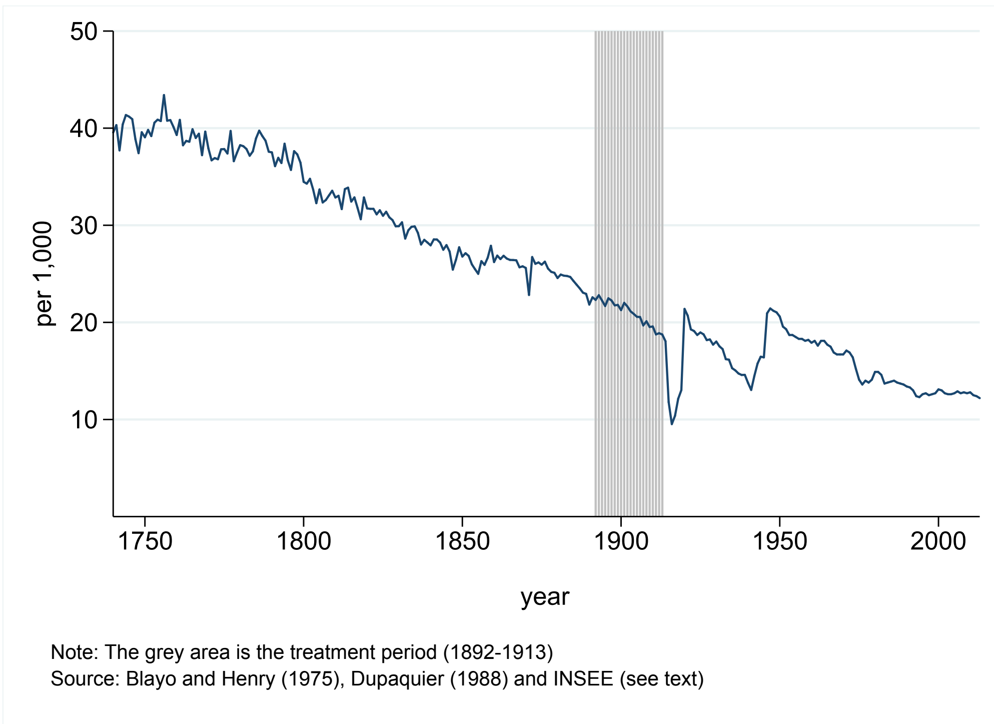

Figure A.3 – The birth rate in France 1740-2013

Source: Blayo and Henry (1975) report data for the period before 1800. The 1946 INSEE statistical yearbook gives 19th century numbers, that have been corrected following the corrections proposed in Dupaquier (1988). The digitized series on the INSEE website are the source for figures for the 20th century.

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Online Appendix

The Toll of Tariffs: Protectionism, Education and Fertility in Late 19th Century France

Vincent Bignon and Cecilia García-Peñalosa

This Online Appendix has two sections. In Section A, we present further details on the data. Section B reports additional tables.

A. Additional data sources and corrections

Table OA.1 gives the name of the file and the name of the three variables used to compute enrolment rate. The following corrections were made to correct for typos and errors. In 1881, 1886, 1891 and 1896, the number of children aged 6 to 13 do not include those aged more than 13 while it does for the other years (1872, 1876, 1901, 1906). Since the measure of enrolment was at age 13 completed, we harmonize between years by including all children aged over 6 to age 13 completed. In 1881, the relevant variables in file T53.xls that write the number of children enrolled are V176, V177 and V178. They are obviously miscalculated, and we therefore went back to the data published in the 1884 Statistical yearbook of the French government that retrieved the number of pupils enrolled in 1881 (*Annuaire statistique de la France*, 1884, p. 261). In 1896, there is a typo in the online resource for the number of children aged 6 to 13 enrolled in schools for department #41 that we correct using the *Annuaire statistique de la France* from 22,409 to 32,409. The publication of the survey by the ministry of education was discontinued after 1906. Despite our corrections some observations for enrolment rates remain problematic. We hence drop 27 observations which are problematic when we consider time trends or where the figures are inconsistent across the genders. For example, for Seine-inferieure the three measures (boys, girls, all) jump by 40 percentage points between 1876 and 1881.

Table OA.1 – Sources used to construct enrolment rates

Year	File	Boys & girls			Girls			Boys		
		Aged 6-13 census	Enrolled Aged 6-13	Enrolled all ages	Aged 6-13 census	Enrolled Aged 6-13	Enrolled all ages	Aged 6-13 census	Enrolled Aged 6-13	Enrolled all ages
1876	print	Table 1	Table 31	Table 28	Table 1	Table 30	Table 28	Table 1	Table 29	Table 28
1881	ENSP T53	V207	V211	ASF	V199	V203	ASF	V191	V195	ASF
1886	ENSP T57	V227	V231	V198	V219	V223	V197	V211	V215	V196
1891	ENSP T79	V142	V146	V111	V133	V137	V110	V124	V128	V109
1896	ENSP T83	V44	V48	V9	V35	V39	V8	V26	V30	V7
1901	DS208_1	V110	V114	V75	V101	V105	V74	V92	V95	V73
1906	DS203	V139	V143	V104	V130	V134	V103	V121	V125	V102

V stands for variable, ASF stands for Annuaire statistique de la France, see text for details

B. Additional tables

The additional tables we present report a number of robustness exercises. As we have argued, the number of schools per child in the department could be determined by demand for schooling and hence be a result of changes in enrolment rates. To check the robustness our results, Table OA.2 reports our core regressions without controlling for schools. No major change appears in our coefficients of interest. Tables OA.3 and OA.4 repeat some of our robustness checks concerning transport costs and religious schools but using relative productivity rather than the cereal share as our measure of the policy intensity. Table OA.5 considers the role of marriage age, while in Tables OA.6 and OA.7 we spilt agricultural employment into male and female employment and create new policy variables in which we consider only one gender.

Table OA.2 – Robustness: Without schools per child and sex ratio

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-38.05***	-38.11***				
	(11.24)	(11.15)				
Exposure*Cereal			0.820***	0.818***	2.099**	1.934**
			(0.217)	(0.215)	(0.933)	(0.886)
Sex ratio	5.641		0.340		32.05**	
	(8.566)		(1.483)		(15.90)	
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.510	0.509	0.929	0.929	0.885	0.876
Observations	570	570	763	763	763	763

The dependent variables are the enrolment rate for all children, birth rate and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA.3 – Robustness: Controlling for transport costs

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*RelProd	-0.809*	-0.738*				
	(0.469)	(0.437)				
Exposure*RelProd			0.0265***	0.0297***	0.0970***	0.112***
			(0.00829)	(0.00805)	(0.0366)	(0.0357)
Trans. Fresnes	-0.150		-0.0572		-0.963***	
	(0.361)		(0.0382)		(0.302)	
Trans. Paris		0.202		-0.0414***		-0.148
		(0.123)		(0.0128)		(0.104)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.622	0.625	0.919	0.920	0.890	0.889
Observations	570	570	3566	3566	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA.4 – Mechanism: Enrolment rates in religious and secular schools

	(1) Rel. All	(2) Sec. All	(3) Rel. Boys	(4) Sec. Boys	(5) Rel. Girls	(6) Sec. Girls
Meline*RelProd	0.276	-1.140***	0.306	-0.980**	0.236	-1.298***
	(0.226)	(0.323)	(0.237)	(0.407)	(0.274)	(0.315)
Mel*Conserv	-1.781	-2.633	-0.140	-6.088**	-3.250	0.802
	(1.571)	(2.072)	(1.503)	(2.784)	(1.965)	(2.093)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.903	0.933	0.839	0.863	0.906	0.940
Observations	531	531	531	531	531	531

The dependent variables are enrolment rates in religious and secular schools for all children, boys and girls. All regressions include year and department fixed effects. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA.5 – Robustness: Controlling for marriage age

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-63.80***					
	(14.83)					
Meline*RelProd		-0.808				
		(0.770)				
Exposure*Cereal			0.796***		2.411**	
			(0.226)		(1.169)	
Exposure*RelProd				0.0280***		0.131***
				(0.00896)		(0.0385)
Av. age at marriage	1.139*	1.414**	0.237**	0.171*	0.288	-0.0127
	(0.603)	(0.641)	(0.106)	(0.101)	(0.524)	(0.537)
Standard controls	Yes	Yes	No	No	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.650	0.625	0.929	0.929	0.897	0.899
Observations	487	487	2376	2376	594	594

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA.6 – Alternative policy variable: Female and male agricultural employment

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*CerealFemale	-97.63***					
	(30.06)					
Meline*CerealMale		-47.06***				
		(13.23)				
Exposure*CerealFemale			1.806**		4.375	
			(0.754)		(3.247)	
Exposure*CerealMale				1.144***		2.812*
				(0.321)		(1.463)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.630	0.630	0.927	0.928	0.887	0.888
Observations	570	570	679	679	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. The policy variables are the share of women (men) working in ceral production in 1892. All regressions include year and department fixed effects and the ratio of women (men) working in agriculture over total employment, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table OA.7 – Alternative policy variable: Female and male agricultural employment

	(1) Enrolment	(2) Enrolment	(3) Birth rate	(4) Birth rate	(5) Fertility	(6) Fertility
Meline*Cereal	-36.04***					
	(9.413)					
Meline*RelProd		-0.700				
		(0.433)				
Exposure*Cereal			0.821***		2.008*	
			(0.234)		(1.058)	
Exposure*RelProd				0.0320***		0.104***
				(0.00935)		(0.0365)
Female Sh. Agriculture	3.470	2.830	0.601	0.710	1.341	1.817
	(4.313)	(4.411)	(0.859)	(0.857)	(4.065)	(3.937)
Standard controls	Yes	Yes	Yes	Yes	Yes	Yes
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.632	0.623	0.928	0.929	0.888	0.889
Observations	570	570	679	679	679	679

The dependent variables are the enrolment rate for all children, birth rate, and fertility rate. All regressions include year and department fixed effects, columns (3) to (6) also include Exposure. Standard controls include schools per child and the sex ratio. Residuals are clustered at the departement level. Standard errors in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$