The Toll of Tariffs: Protectionism and the Education–Fertility Trade-off in Late 19th Century France*

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Abstract

The idea that education and fertility are endogenous decisions that react to economic circumstances is a cornerstone of Unified Growth Theory and explains the transition to modern growth, yet evidence that such a mechanism was in operation before the 20th century is limited. This paper provides evidence of how protectionism reversed the education and fertility trends that were well under way in late 19th-century France. The Méline tariff, a tariff on cereals introduced in 1892, led to a substantial increase in agricultural wages, thus reducing the relative return to education. 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 education and increased fertility. The magnitude of these effects was substantial, and in regions with large shares of employment in cereal production the tariff offset the time trend in birthrates for up to 17 years. We conclude that even in the 19th century, policies that changed the returns to the education of their offspring affected parents' decisions about the quantity and quality of children.

JEL Classification*:* J13, N33, O15

Key words*:* Education, fertility, unified growth theory, 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 variety of outcomes has been studied, the literature on its implications for other variables, such as fertility, 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 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 during the 1880s and in France 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 enrollment rates.

We analyze how protectionism impacts education and fertility using a small open economy model inspired by unified growth theory that captures how a change in relative prices affects the *quantity-quality trade-off*; see Galor and Weil (2000) and Galor and Moav (2002). In the model, parents derive utility from both the number of children that they have and from the level of education of their offspring, which generates 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. In line with historical evidence, we 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. Because parents spend fewer resources in children's quality, they respond by increasing their quantity,

[1] See 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, Winters (2004) for review of the literature on trade and growth, and Wacziarg and Welch (2008) for evidence on the positive impact of openness on growth.

[2] The few exceptions being Schultz (1985), Galor and Mountford (2008), Chakraborty (2015) and Anukriti and Kumler (2018), see below for a discussion.

and the tariff results in higher fertility rates.

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 measure employment in cereal production as a share of total employment of each district in 1892, just before the switch to protection. We argue that the impact of the tariff on our variables of interest depends on the relative importance of cereals in the district economy, which we proxy through their employment share. Our estimates hence capture the differential impact of the tariff on districts where cereal production accounted for a larger share of employment.

Three variables measure outcomes at the district level: enrollment in primary education, which at the time catered for children aged between 6 and 13, the crude birth rate and the fertility rate. We use three different strategies to estimate the long term impact of the tariff. We first estimate the linear impact of the tariff by multiplying the employment share by a dummy taking the value one whenever the Méline tariff was in operation, a strategy used in papers such as Edmonds, Pavcnik, and Topolova (2010) and Topalova (2010). We also estimate whether the effect increases with the duration of the treatment. Finally we run a dynamic estimate to document how the impact varied through time during the twenty-two years of protectionism, following Wolfers (2006). These strategies allow us to measure the strength of a district's exposure to the policy on our outcomes of interest, an aspect which is important given the role that custom and social norms play in determining fertility decision.

Using data for the period 1872 to 1913, we find that enrollment rates were negatively affected by the introduction of the tariff, while it had a positive impact on birth rates and fertility, consistent with the theory. By the 1870s France had almost completed its fertility transition and achieved high enrollment rates in primary school, implying that protectionism reversed in both cases a decades-long trend. It is therefore unlikely that our results are due to a change in cultural norms that was correlated with the intensity of the exposure to the agricultural tariff, thus supporting our explanation in terms of a rational reaction to a change in economic incentives. Nevertheless, we perform a number of robustness exercises to check that results are not driven by potential confounding factors such as religious conservativeness or the diffusion of different cultural norms of fertility and education caused by the arrival of migrants.

The rest of the paper is organised as follows. Section 2 discusses the literature. Section 3 provides the historical background to our study in terms of agricultural protectionism, educational attainment and fertility. Section 4 develops a two-sector model of the household's decision concerning the number of children and education. Section 5 describes the econometric specification, and the next two sections present the data and the empirical results. Section 8 concludes.

2 Related literature

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. Closest to our work is Galor and Mountford (2008). They develop a unified growth theory model (UGT) with two economies, 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 the 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. 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 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.

A number of related articles have considered the impact of the recent wave of trade liberalization in India. Edmonds, Pavcnik, and Topolova (2010) examine the effect of openness on district enrollment 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 (2018) 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 the tariff reduction 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 (2018) 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 second contribution of our analysis is to the literature concerned with identifying the determinants of parental choices between fertility and education. The model introduced by Becker (1960) and enriched by Becker and Tomes (1976) has been the subject of numerous empirical tests. In contrast to the numerous studies on recent data,[3] historical evidence on this trade-off is scarce, the exceptions being Becker, Cinnirella, and Woessmann (2010), Bleakley and Lange (2009), Diebolt, Mishra, and Perrin (2018), Diebolt, Menard, and Perrin (2016) and De la Croix and Perrin (2018). Our analysis shares much with these papers. Becker, Cinnirella, and Woessmann (2010) identify the quality-quantity trade-off using data for 19th century Prussia; they find suitable instruments for regional differences in education and fertility (sex ratios and distance to Wittenberg) and can hence identify the impact of one variable on the other. Bleakley and Lange (2009) focus on campaigns to eradicate hookworm

[3]Broadly speaking, the evidence supports the existence of such a trade-off in the second half of the 20th century; see, for example, Rosenzweig and Wolpin (1980) or Rosenzweig and Zhang (2009). However, some studies find no significant effect, notably Black, Devereux, and Salvanes (2005).

in the South of the US around 1910. Reducing the incidence of hookworm, a parasite that particularly affects children's health, lowered the "price of child quality" and thus increased the return to human capital. As a result, educational investments rose and fertility rates fell, indicating the importance of individual-level public policies for the quantity-quality trade-off. Our analysis focuses instead on a major aggregate shock, providing evidence that macroeconomic features impact fertility and education, as advocated by unified growth theory.

A vast 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 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 four recent articles have used French district-level data similar to the one in this paper. Both Murphy (2015) and Daudin, Franck, and Rapoport (2018) explore the determinants of French fertility in the 19th century. The former's findings indicate the importance of education, particularly that of females, but also of cultural factors in bringing about the fertility decline. Daudin, Franck, and Rapoport (2018) 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. Diebolt, Mishra, and Perrin (2018) and Diebolt, Menard, and Perrin (2016) are concerned with identifying the trade-off between fertility and education and identify a causal impact of the former on the latter. Furthermore, their analyses of gender differences in schooling indicates that the rise in female educational endowments played a role in the fertility transition, consistent with the findings in Murphy (2015). De la Croix and Perrin (2018) take a different approach by building a detailed model of the determinants of education and fertility. As is the case in our paper, their approach is well-grounded in the theory but rather than using the latter to inspire a reduced-form estimation, as we do, they perform structural estimations aimed at quantifying to what extent observed patterns can be explained by rational choice rather than social norms. They estimate the deep parameters in the model and conclude that the rational-choice model can account for about a third of the fertility variation across districts and over time, while it explains about two thirds of the dispersion of primary school enrollment. These three articles indicate the importance of the quantity-quality trade off in France during the 19th century. The contribution of our paper is to examine to what extent these decisions reacted to an aggregate economic shock.

The paper is also related to several 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,

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

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.

3 Historical background

3.1 The demand for education, agriculture and technology

Nineteenth century France was largely an agricultural economy, with the sector accounting for 38% of French GDP and for 50% of employment in the 1870s. Over our period of interest, the contribution of agriculture to economic activity declined, with its share in output falling to 29% by the 1900s and employment amounting to 40% on the eve of the First World War. These shares are in line with those of other Western European countries at the time, with the exception of Great Britain. France's neighbour employed only 22% and 10% of the labor force in agriculture in those years, and the sector's output share declined from 19% in 1870 to 10% in 1910.[6]

A second feature of the French economy was the low level of agricultural productivity, notably when compared to that in the UK (Dormois, 1996). Neither the capital-labour ratio nor the capital-land ratio matched the levels attained in Britain,[7] and the agricultural sector was neither a quick adopter of new technologies nor a trigger of new technological progress.[8] This stands in sharp contrast with the US or Danish experience during the same period.[9] Although there are no direct quantitative measures of the French lack of technological adoption, there is a consensus among historians that farmers were slow in adopting new techniques to improve the efficiency of cereal harvesting,[10] the consequence of which was a highly seasonal demand

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

[6] The French output data are from Toutain (1987), from which we calculated the output shares by dividing the nominal value of agricultural production by nominal GDP (column V3 p. 102ff and V41 p. 150ff), and Golob (1944, p. 18). For Great Britain, the figures are reported by Crafts (1984, p. 53-4).

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

[8] 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.

[9] 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.: "The key factor in the Danish case was technology: not the 'high-tech' technologies associated with refrigeration, but new ways of feeding cattle, which were transmitted rapidly throughout Danish agricultural society. It was the systematic creation of knowledge based on experimentation and observation by practitioners and academics, and the diffusion of that knowledge, which were crucial." (Henriksen and O'Rourke, 2005, p. 544)

[10] See Augé-Laribé (1950) and Barral (1968).

for unqualified labor during the harvesting period; Sicsic (1992) and Magnac and Postel-Vinay (1994). Moreover, in contrast to other countries, labor productivity in French agriculture did not improve during the period 1870-1913; Dormois (1996). For example, between 1880 and 1910 the use of fertilizers –an important technological improvement to increase the yield of cereal production– 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 lack of investment in new technology made French agriculture a laggard sector. Historians have blamed this lag on farmers' 'low appetite' for education (Weber, 1976) or for technological progress; Barral (1968). Economic historians, on the other hand, have argued that farmers preferred diversifying their saving portfolio rather than invest in increasing the return to a single crop, and that local capital market segmentation created credit constraints in rural areas that prevented technological investments.[11]

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 education 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 the self-employed entrepreneurs and managers of small firms in industry. [12].

Despite this low demand from the agricultural sector, educational attainment had grown massively throughout the 19th century, as 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 matters for citizenship.[13] Successive legislations 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.[14] As a consequence, the number of schools increased from 10,000 in 1830 to 80,000 in the early 1880s and hovered around this number afterwards.[15] Moreover, although free schooling was not required by law until 1881, throughout the period 1870 to 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 creating a substantial equalization of the supply across locations.[16]

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. The

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

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

[13]See Furet and Ozouf (1977).

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

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

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

decline in fertility triggered by the fertility transition –that started in the mid-18th century– and a decrease in religiosity caused by the French Revolution were potentially factors that increased the demand for education; see Squicciarini (2017).

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 in villages, something that is consistent with a (relatively) easy access to schools by pupils. Using archival evidence, Prost (1968) has shown that by the time schooling was made compulsory in 1882, "[almost] all French pupils were already schooled" (p. 102).[17] In fact, Grew and Harrigan (1991) present quantitative evidence that the Ferry laws in 1881-2 had no impact on overall enrollment rates, since all they did was to induce a substitution between private (catholic) schools and public schools.

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. This reduction is evenly distributed across the territory, with 38 districts experiencing a decrease greater than 5% for boys and 43 districts with at least this level of decrease for girls, mostly in South-West France (Prost, 1993), see figure 1. 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; see Guinnane (2011) for a discussion in an international context. Figure 2 depicts the crude birth rate in France over the period 1740 to 2012, with our period of interest (1892-1913) shaded.[18] The first few years in the sample exhibit the usual pre-transition birth rate of around 40 children per thousand individuals. Birth rates started to decline around 1790, almost one century before the fertility transition took place in England and Germany.[19]

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, as can be seen from figure 2. There is nevertheless a slowdown of the trend after 1892. The birth rate fell by 2.5 children between 1872 and 1882 and by 1.9 children in the next decade (reductions of 1 and 0.75%, respectively), yet in the decade following the introduction of the tariff the birth rate declined by only 0.7 children (i.e. by 0.3%). Birth rates changed momentum after World War I, falling by 2.5 children between 1924 (the year in which the birth rate returned to its pre-war level) and 1934.

[17] 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.

[18] Blayo and Henry (1975) is the source of the series before 1800. The 1946 INSEE statistical yearbook gives 19th century numbers, with the corrections proposed in Dupaquier (1988). The digitized series on the INSEE website are the source of figures for the 20th century.

[19] 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).

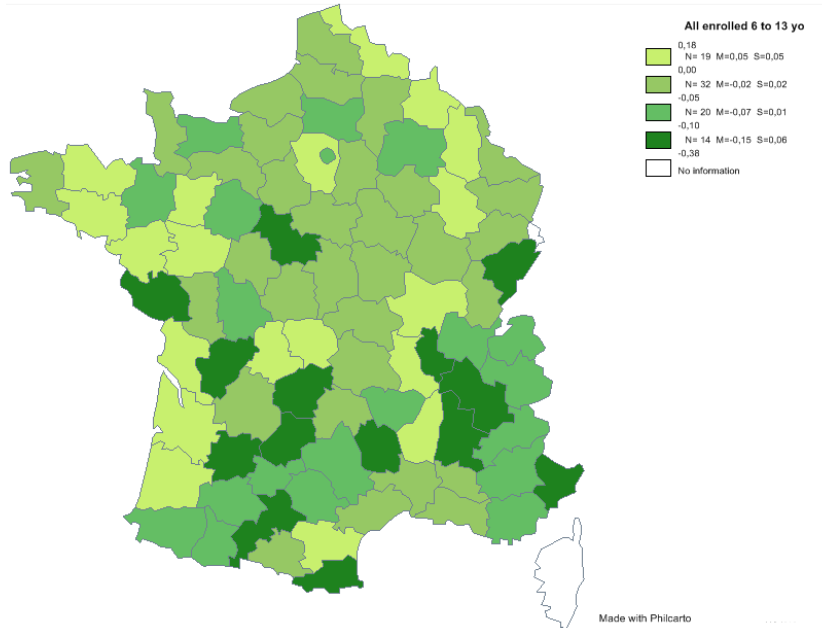

Figure 1 – Change of the enrollment rate in primary school of children aged 6 to 13 between 1886 and 1896.

Reading of the legend: In the 14 districts in forest-green, the enrollment 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 6 for data source.

3.2 The Méline tariff and its economic consequences

The so-called Méline tariff was approved by the French parliament in January 1892.[20] 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 3 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.

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 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).[21] Nye (2007) shows that

[20] 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 saying to 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).

[21] Recent research argues that trade flows largely anticipated trade politics; see Nye (1991), Accominotti and

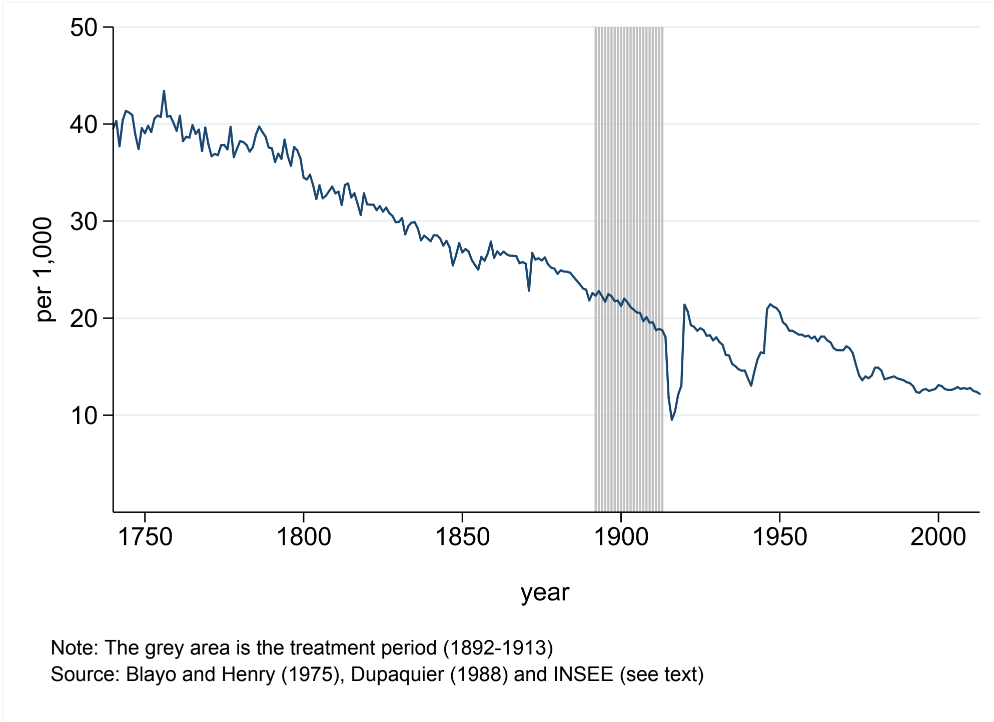

Figure 2 – The birth rate in France 1740-2013

Source: See section 6 and the appendix for details.

effective tariff duties on imports were low in France throughout the 19th century, especially on agricultural products. Against this background, the invention of the steamship and the development of the domestic railway network triggered a decrease of freight rates, which had a massive impact on trade across the Atlantic and increased market integration; Jacks and Pendakur (2010).[22] The resulting boom in trade was mainly driven by large exports of grains and other primary products from America to Europe, which resulted in deflationary pressure on prices in France; see Kindleberger (1950) and O'Rourke and Williamson (1999). Agricultural prices declined faster than other prices, thus reducing farmers' revenues, and generalised discontent led farmers to lobby for protection. Initially, the political climate was such that the alliance between free-traders and industrialists in Parliament prevented the approval of major tariffs.[23] The results of the parliamentary elections in October 1889 tilted the majority of lawmakers towards more protection, and eventually led to an increase in the tariffs on cereals to fight the competition coming from the Americas.

Figure 3 depicts the evolution of the import price of cereals over our period of interest. Between 1871 and 1891 the import price of cereals 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

Flandreau (2008).

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

[23]See Dormois (2012). Farmers' lobbying in the 1880s only led to the introduction of a tariff on wheat, which had a high and a low rate, depending on whether the country of origin of the product 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 taxation; see Bassino and Dormois (2010).

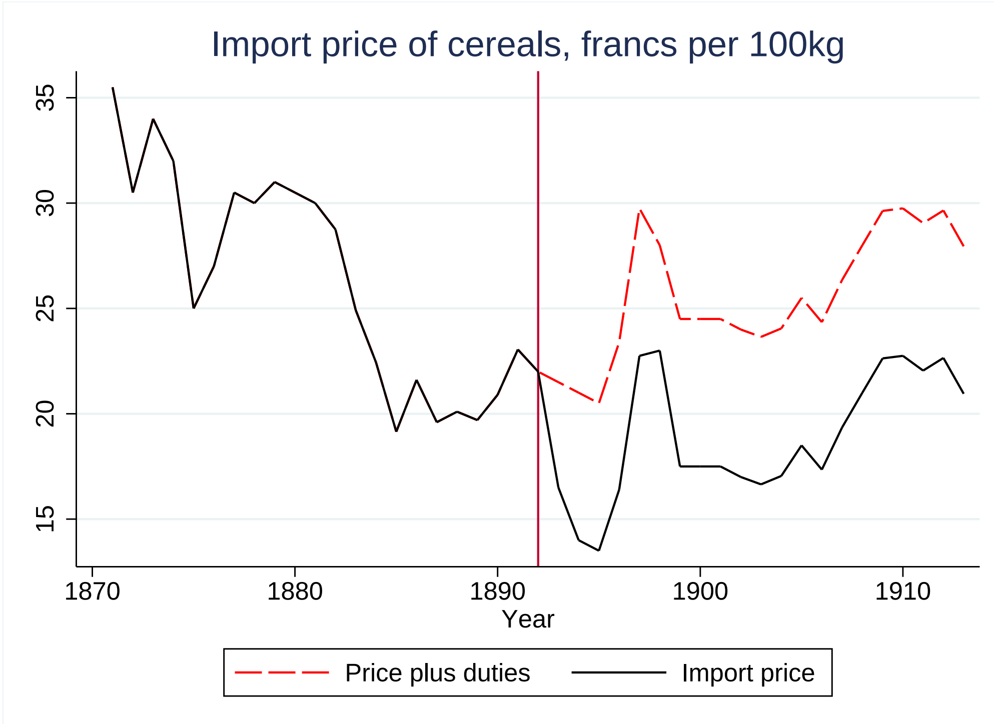

Figure 3 – Cereal price in France, 1872–1913 (source: INSEE (1951) table VIII p. 208*).

following the introduction of the tariff, with 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).

The impact of the tariff was enormous. In a context in which the world price of grains decreased by a third, 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. 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.

4 Modelling education and fertility decisions

In order to understand the way in which tariffs affect fertility and education investments, we consider a two-sector model of the quantity-quality trade-off, inspired by Galor and Weil

(2000) and Galor and Mountford (2008). The production side of the economy features two goods, an agricultural good and a manufacturing good, both of which are traded. As in the original model, the key decision is the choice by households of the number of children and their education, i.e. their quantity and quality, in response to economic incentives, but we consider a static setup and abstract from the determinants of growth.

4.1 Technologies and preferences

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, L_{at} agricultural employment, 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. Since 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 product, and in the appendix we derive the agricultural wage, w_{at}, and the wage per efficiency unit of labour in manufacturing, w_{mt}. Under our assumption that education has no impact on agricultural productivity, the income of a farmer is simply 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 $h_t w_{mt}$. The fraction of the population employed in agriculture is denoted q_t and that employed in manufacturing $1 - q_t$.

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, works and consumes. Also, she makes the fertility decision and that concerning her offsprings' education. Adults have a labour supply of one unit each period.

We suppose that the utility of an agent born at time $t - 1$ is given by

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

where c_t is the consumption of the individual when she is an adult, n_t the number of children she has (which are born at t) and $Ey(e_t)$ the expected (potential) income that her offspring (with education e_t) will get when she is an adult, i.e. in $t + 1$. The time cost of bearing n_t children is given by $\tau^q n_t$, while $\tau^e e_t n_t$ is the time cost of giving them a level of education e_t. The budget constraint is then given by

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

where y_t is the potential income that an individual born at $t-1$ has when she is an adult. We suppose that a constant fraction of consumption is allocated to the agricultural good and the rest to the manufacturing good.[24]

Adults whose parents invested e_t in their education have a level of human capital $h(e_t)$ with

$$h(e_t) = \beta e_t^{\theta}, \tag{4}$$

where $\beta > 0$ and $\theta \in (0,1)$, implying that $h(e_t)$ is increasing in e_t and exhibits diminishing returns to the education investment. When taking the education decision, parents suppose that with probability q_{t+1} they will work in agriculture and with probability $(1-q_{t+1})$ in manufacturing. The resulting expected potential income of an adult born at t is then

$$Ey(e_t) = q_{t+1} w_{at+1} + (1-q_{t+1}) h(e_t) w_{mt+1}.$$

Clearly, the higher the agricultural wage and agricultural employment are, the lower the relative 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.

4.2 Solving the model

The problem faced by an individual born at time $t-1$ is given by

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

The first two constraints give the consumption of the individual and her potential income, where ϕ is an indicator variable taking the value 1 if the individual works in agriculture and 0 if he works in manufacturing. The next constraint gives the human capital of the offspring followed by the expected potential income of an offspring. The last line ensures that fertility, education investments, and consumption are non-negative.

The consumer's problem is solved in the appendix. There we show that the f.o.c. yield the following expressions for education and fertility

$$n_t^* \left(\tau^q + \tau^e e_t^*\right) = \gamma, \tag{6}$$

$$\frac{1-\theta}{\theta} e_t^* + \frac{q_{t+1} w_{at+1}}{(1-q_{t+1}) w_{mt+1}} \frac{(e_t^*)^{1-\theta}}{\beta\theta} = \frac{\tau^q}{\tau^e}. \tag{7}$$

[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 models with an allocation of consumption over two goods.

The first equation gives the quantity-quality trade-off faced by parents, implying that any shock that reduces optimal education investments, e_t^*, results in an increase in fertility. The second equation implicitly defines the optimal education investment as a function of the two wages and population proportions. 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), will depend on the relative returns in the two sectors.

Before we fully solve the model, it is interesting to do some comparative statics with respect to q and wages. From the two equations above 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. The intuition for this effect is simply that since education has no value in the agricultural sector, a higher probability that one's children work in agriculture reduces the expected marginal gain of educating offspring and hence will reduce parents' incentive to invest in their education. An increase in the relative wage in agriculture, i.e. a higher value of the ratio w_a/w_m, would have the same effect.

The full solution to the model requires solving for wages and employment. Assuming no mobility costs, income is equalized across sectors and labour market equilibrium is given by the expression $w_{at}p_t = w_{mt}h(e_{t-1})$, which yields the equilibrium values of wages and employment.[25] 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

$$q_t = \frac{ap_t^2}{ap_t^2 + h(e_{t-1})}, \tag{8}$$

where $a \equiv AT/K$. A higher price of agricultural goods and a lower level of education increase employment in agriculture. If regions differ in the relative productivity of agriculture, they will also differ in their share of employment in agriculture. The higher the amount of land, T, or its productivity, A, are relative to the capital endowment, K, (i.e. the higher a is), the larger is the resulting q_t. Note that what is important for employment in agriculture is not whether agriculture is very productive, but rather whether it is very productive *relative to manufacturing*. 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.

From equation (7) we can see that the only magnitude that matters for education decisions is the ratio of the expected wage in the two sectors, which we denote ω_t. It is possible to show that in equilibrium

$$\omega_t \equiv \frac{q_t w_{at}}{(1-q_t)w_{mt}} = ap_t^2. \tag{9}$$

[25] There is a long-standing debate about the degree of mobility of farmers in France and whether or not their reluctance to move choked industrial expansion; see Sicsic (1992) for a review of the literature and evidence of the comovement of agricultural and manufacturing wages. Our results would hold if we introduced costs of moving into manufacturing, with agricultural employment (wages) changing less (more) the higher these costs are.

The expected relative return to agriculture is hence increasing in the price of agricultural goods p_t. This equation, together with (6) and (7) and the fact that $p_t = p_t^w(1+\eta_t)$, imply that the number of children and level of education are given by two functions

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

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. $\eta_t = 0$) and falling world prices of agricultural goods, these two equations imply that education will be increasing and the number of children falling over time. The intuition is straightforward. A lower price of farm products will reduce the agricultural wage for a given level of agricultural employment, hence labour will flow to manufacturing thus equating wages across sectors and reducing employment in agriculture. If parents at t expect a lower price next period, they will also expect a higher probability of employment in manufacturing for their offspring, which raises the return to education at $t+1$ leading to a higher investment in schooling at t. Since they now spend more time educating their children, parents choose to have fewer of them. As a result, falling world prices for agricultural goods will be accompanied by higher investment in education and smaller families.

Suppose now that a tariff is introduced at time t, i.e. $\eta_t > 0$, 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 (see appendix) that n_{t+1} will be higher and e_{t+1} lower than they would have been had tariffs remained at zero.[26] Moreover, the difference in the two variables relative to their values had the tariff not been introduced will be larger the higher a is, i.e. the more important agricultural production is in the local economy. Since a higher a also implies that a greater share of population is employed in agriculture before the tariff is introduced, districts which have a high initial employment share in agriculture will be those experiencing the sharpest changes in our two variables of interest.

The model hence 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, the effect being stronger the larger is the share of the population employed in agriculture before the policy shock.

4.3 The timing of children's education

The simple model we have considered cannot capture the full complexity of the dynamics of child-bearing and education decisions. In particular, a feature of our model is that if a tariff is introduced in year t, we would observe immediate changes in fertility and the children born after the tariff's introduction would receive less schooling than those of previous cohorts. The effect of the tariff on births would hence be observed immediately but that on education only once those children reached school-age. This raises the question of whether there are immediate effects on education or if these occur with a lag.

In order to examine more precisely the timing of education decisions, we consider an extension of the model and suppose that an individual lives for four periods. She is born at

[26] 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 (e_t) that is higher (lower) than that implied by the trend of world agricultural prices in the absence of the tariff.

$t-2$ and in the next period is educated by her parents. For the following two periods she is an adult: she has children at t and educates them and consumes at $t+1$, and has 0.5 units of time per period. The problem faced by an individual born at time $t-2$ is then

$$\begin{aligned}
\max_{c_{t+1},n_t,e_t} U_{t-2} &= c_{t+1}^{1-\gamma}\left(n_t Ey(e_t)\right)^{\gamma} \\
s.t. \quad c_{t+1} &= y_t\left(\frac{1}{2}-\tau^q n_t\right)+y_{t+1}\left(\frac{1}{2}-\tau^e e_t n_t\right) \\
h(e_t) &= \beta e_t^{\theta} \\
Ey(e_t) &= q_{t+2}w_{at+2}+(1-q_{t+2})h(e_t)w_{mt+2} \\
e_t, n_t &\geq 0, 1/2-\tau^q n_t \geq 0,\ 1/2-\tau^e e_t n_t \geq 0.
\end{aligned} \tag{10}$$

This problem differs from the core model in the consumption constraint. There are now two terms, one for each period of adult life: at t some time is spent having children, at $t+1$ the parent educates them, and income can potentially vary between the two.

Assuming for simplicity that parental wages are constant and denoting the expected relative wage at $t+2$ by $\underline{\omega}_{t+2}$, we obtain the following expressions for education and fertility

$$\frac{1-\theta}{\theta}\underline{e}_t+\underline{\omega}_{t+2}\frac{(\underline{e}_t)^{1-\theta}}{\beta\theta}=\frac{\tau^q}{\tau^e}, \tag{11}$$

$$\underline{n}_t\left(\tau^q+\tau_t^e\underline{e}_t\right)=\gamma, \tag{12}$$

where $\underline{e}_t$ and $\underline{n}_t$ denote the solutions to the model when expected relative wage is $\underline{\omega}_{t+2}$. If the economy introduces a tariff, the relative return to agriculture would be $\overline{\omega}_{t+2}$, higher than $\underline{\omega}_{t+2}$. Individuals optimising under the new prices will chose to have $\overline{n}_t>\underline{n}_t$ children and a lower level of education, $\overline{e}_t<\underline{e}_t$.

Consider now the transition generation. After those individuals have made their fertility decision $\underline{n}_t$, the government announces that a tariff will be in place from period $t+2$ onwards implying that the relative return to education is $\overline{\omega}_{t+2}$, and hence higher than that under which fertility was decided. Parents will reoptimise their education decision in response to the change in the relative return to education and maximize $U_{t-2}=c_{t+1}^{1-\gamma}\left(\underline{n}_t Ey(e_t)\right)^{\gamma}$. That is, they choose education taking the number of children as given. It is possible to show that the solution to the new problem is given by

$$\frac{e_t}{\theta}+\underline{\omega}_{t+2}\frac{(e_t)^{1-\theta}}{\beta\theta}=\frac{1}{1-\gamma}\frac{\tau^q+\tau_t^e\underline{e}_t}{\tau^e}-\frac{\gamma}{1-\gamma}\frac{\tau^q+\tau^e e_t}{\tau^e}, \tag{13}$$

which implies a level of education e_t different from $\underline{e}_t$. Two effects are in operation: the lower return to education will tend to reduce education, while the fact that under the new returns parents optimal fertility is $\overline{n}_t$ but they have only $\underline{n}_t$ children implies that they will tend to compensate their suboptimal fertility by educating their children more. It is possible to show that either effect could dominate. As a result, the change in the return to education following the tariff implies that parents will increase or reduce education even for children that were born before the tariff was implemented, i.e. the effect on education can be immediate and does not occur only once those born after the tariff is introduced reach school-age.

5 Econometric specification

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

$$
\begin{aligned}
B_{it} &= \alpha_0 + \alpha_1 S_i * M_t + \eta_i + \delta_t + \delta_{1i} t + \delta_{2i} t^2 + \epsilon_{it}, & (14)\\
E_{it} &= \beta_0 + \beta_1 S_i * M_t + \mu_i + \gamma_t + \delta_{3i} t + \upsilon_{it}, & (15)
\end{aligned}
$$

where B_{it} and E_{it} are respectively birth rates (or fertility) and education in department 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} to δ_{3i} capture the impact of district-specific time trends affecting fertility and education. We allow for quadratic time trends when we have annual data (birth rates) but only linear ones whenever we have only quinquennial census data. M_t is a dummy for whether the Méline tariff is in operation at time t and S_i is the local share of employment in cereal production in the year in which the tariff is introduced. This variable hence acts as a proxy for the capacity for cereal production, and thus the larger S_i is, the stronger we expect the effect of the tariff to be. Note that we cannot identify the non-interacted effect of the variables M_t and S_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.

Our coefficients of interest are thus α_1 and β_1, which capture the differential impact of the tariff across districts with different degrees of cereal production. The theory predicts a trade-off between fertility and education so that the coefficients α_1 and β_1 are of opposite sign. The model above implies that the tariff acts as a negative shock to the returns to education, leading to higher fertility and lower education, so that we expect $\alpha_1 > 0$ and $\beta_1 < 0$.

The time structure of the impact of a policy is crucial, 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 wages may adjust slowly and bearing children and educating them take time, but also because both variables are affected by social norms resulting from past behaviour that may slowdown the reaction to policy. We will thus consider two further specifications for each of our dependent variables. For birth rates, the first one takes the form

$$
B_{it} = \alpha_0 + \alpha_1 M_t * Exp_t + \alpha_2 S_i * M_t * Exp_t + \eta_i + \delta_t + \delta_{1i} t + \delta_{2i} t^2 + \epsilon_{it}, \quad (16)
$$

where Exp_t denotes the number of years of exposure to the policy, and we expect the coefficient α_2 to be positive, indicating that households take time to adjust their fertility to the policy.[27] An alternative specification, based on Wolfers' analysis of divorce laws, allows for a different impact of the tariff in different years, that is,

$$
B_{it} = \alpha_0 + \sum_k \alpha_k S_i * M_k + \eta_i + \delta_t + \delta_{1i} t + \delta_{2i} t^2 + \epsilon_{it}, \quad (17)
$$

where M_k is a dummy equal to 1 if the policy has been in operation for k years, and α_k indicates the impact of the policy k years after its introduction. This specification gives greater flexibility when estimating the impact of the policy, allowing, for example, for the possibility

[27] We introduce $M_t * Exp_t$ not interacted with S_i in this specification since it is not collinear neither with the year fixed effects nor with the time trends which are district specific.

that there is no impact immediately after the introduction of the tariff while fertility norms adapt to the new regime. We will allow for changes in the impact of the policy every three or five years.

Similarly, we consider two other specifications for education which take the form

$$E_{it} = \beta_0 + \beta_1 M_t * Exp_t + \beta_2 S_i * M_t * Exp_t + \mu_i + \gamma_t + \delta_{3i} t + \upsilon_{it}, \quad (18)$$

$$E_{it} = \beta_0 + \sum_k \beta_k S_i * M_k + \mu_i + \gamma_t + \delta_{3i} t + \upsilon_{it}. \quad (19)$$

The last specification allows, as above, for a differential impact overtime, and given the nature of our data on education we will consider changes every 5 years.

6 The data

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 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, enrollment 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 various groups of population by age and gender. Information on the production of various crops comes from the *Statistique Agricole Annuelle*, as compiled by Toutain (1993).

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 49 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 fertility 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.[28] The data are available separately for boys and for girls, so we compute both overall and gender-specific enrollment rates. It is conceivable that the tariff had different effects across the genders. For example, if the tariff made agriculture a more desirable occupation and if this was largely a male-dominate activity, girls' education could have been affected less than boys'. Alternatively, if the tariff had a positive impact on

[28] 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.

fertility, this may have kept more girls at home to help with household chores and caring for younger siblings.

To obtain enrollment rates for those in the relevant age group we use the population aged 6 to 13, which is available on census years, hence the last observation (1911 census) includes individuals born in 1905, i.e. 13 years after the tariff was introduced. As discussed above the population data by age group is not always reliable, and in a number of cases the enrollment rate we obtain is well over 100%. Since no correction is available for this age group, we simply remove from our sample the observations that are 101% or higher. As an alternative measure we also compute enrollment of those aged between 6 and 13 years as a share of the total department's population. Given the expansion of education that took place over the period, it is important to control for the supply of schooling. We hence compute the number of primary schools per 1000 children aged 6 to 13 and use it as a control in our enrollment regressions.[29]

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 54 and 57 that were no longer part of France following the 1870 war. Our sample hence contains at most 3566 observations, all of which are available for birth rates. For fertility and enrollment rates the quinquennial availability of censuses reduces our sample to around 500 observations.

Our policy variable is the interaction between a dummy for the Méline tariff and a measure of the importance of cereal production in the department's economy in 1892. 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 1892 and the share of the value of cereal production in total agricultural production in 1892, i.e. the last year before the tariff could have an impact. The data concerning these two variables come, respectively, from Toutain (1993) and Combes et al. (2011).[30]

The dummy variable *Méline* takes the value 0 up to 1892 and the value 1 from 1893 onwards, 1893 being the first year in which we could observe a change in birth rates or education. As discussed the time structure of the effect of the policy is of crucial importance, as this variable can have different effects depending on how long the policy has been in operation. We will thus use the variable *Exposure* to measure the number of years that the policy has been in place, and will also allow for differential impacts every three or five years.

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 94 children per thousand women. The average enrollment rate is 91%, and it varies between 52 and 100%, with the variation being both over time and across departments. Over half of the population was employed in agriculture, the employment share going up to 75% in certain departments.

[29] This variable proved not to be significant in the birth-rate and fertility regressions and is hence not included.

[30] 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*.

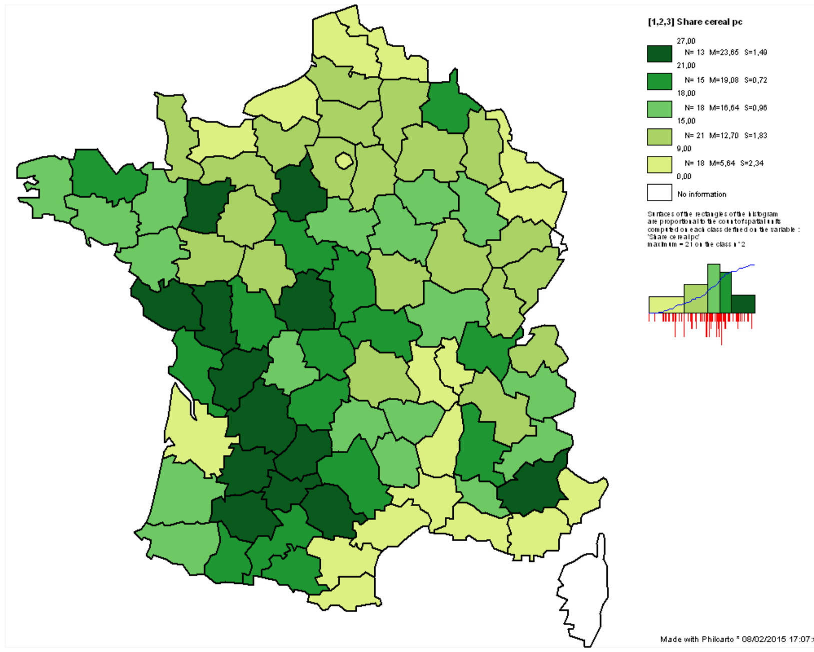

Figure 4 – Employment share in the production of cereals in France in 1892

Reading of the legend: In the 13 departments in forest-green the share of employment in cereals is in the 21%-27% bracket, with an average of 23.6% The sources are Combes et al. (2011) and Toutain (1993)

As we can see in the table, cereal production was an important activity in France, accounting for over a quarter of overall agricultural output.

Our variables of interest interact the proxy for the share of employment in cereal production with variables capturing the time structure of the policy: *Méline*Cereal* is the interaction term between this and the dummy taking a value of one from 1893 onwards and zero for earlier years, while *Exposure*Cereal* interacts it with a variable that measures the number of years since the introduction of the tariff. Our proxy for the share of employment in cereal production averages almost 15%, and varied 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 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 the share of employment in cereal production, and recalls the pattern observed for education in figure 1. It is important to note that we are not measuring the volume of cereal production, which was highest in the Artois, Beauce and Brie areas, but rather the importance in the local economy of this type of production. As a result, some (although not all) of the Northern departments that produced high volumes of cereal but where agriculture was only a small share of total employment exhibit low values of our variable of interest.

7 Empirical results

7.1 Birth rates and fertility

Table 2 reports the regression results for birth rates. The first column simply includes the 0-1 dummy interacted with the share of employment in cereal production, 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 those departments with a higher share of cereal employment and that the effect grew over time. Column 3 presents the most flexible specification, based on equation (17), which allows for differential effects every three years. The initial effect, as captured by the coefficient on *Méline*Cereal* is not significantly different from zero, but after three years becomes significant and increases over time, rapidly in the first decade and more slowly afterwards. This seems to imply that households adapted the number of births gradually in response to the change in the relative price of cereals.

The next three columns estimate the same specifications including both a linear and a quadratic department-specific time trend. Coefficients have the same sign and significance, and are somewhat larger. The specification using *Exposure* indicates that, for the departments with average cereal employment shares, the tariff increased the birth rate by 0.2 births in the first year and by 2 births after 10 years, amounting to half of the standard deviation observed in the data. Similar magnitudes are obtained with the dynamic specification, with no change over the first three years, an increase of about 1.7 births after 10-12 years, and of 3 births after two decades.

Table 3 reports the same specifications using as the dependent variable fertility rates, where, because census data reporting the number of females of child-bearing age is only available every five years, we have only quinquennial observations. As is standard in the literature, we control for the sex ratio; see Angrist et al. (2002), Angrist et al. (2010) and Becker et al. (2010). The sex ratio, defined as the number of males aged 15 to 45 years-old divided by the number of females of the same age, is a measure of the tightness of the marriage market, and a higher ratio reduces the constraints on female marriage and/or the age at which women marry thus increasing the number of children. We also included the marriage rate, but it did not prove significant and had no effect on our coefficients of interest. The results are consistent with those obtained with birth rates: the interaction between the tariff and cereal production has a positive and significant coefficient, whether it is simply a dummy or when we allow for the number of years since the policy was introduced. Column 3 reports the regression based on equation (17), with the effect increasing over time.

The magnitude of these effects is large. In a department with 26% of the labour force employed in cereal production, i.e. the highest share that we observe, 10 years after its introduction the tariff had increased the fertility rate by 6.8 children per 1,000 women (Table 3, column 2). The average increase across all departments is 3.9 children per 1,000 women after 10 years, 7.7 by 1913, figures which are equivalent to 22% and 44% of the standard

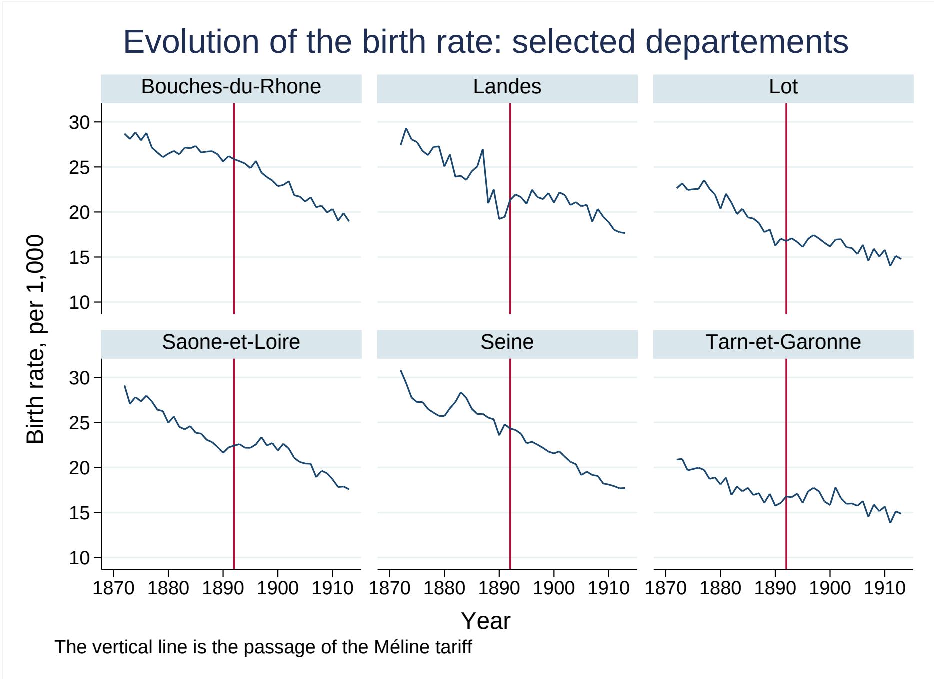

Figure 5 – The evolution of the birth rate in 6 selected départements, 1872-1913

deviation of fertility.

As we have discussed, this was a period of declining birth rates and it is interesting to compare the impact of the policy with that of the time trend, since the former offset the decline in births that had been taking place since the late 18th century. Using the formulation in Table 2, column 5, we find that the combination of the (pre-1892) time trend and the tariff implies that for the average department, i.e. one with a cereal share of 15%, the birth rate returned to its 1892 level only 13 years after the introduction of the tariff.[31] In other words, the tariff implied a 13-year delay in the reduction of fertility for the average department, while during the same period, departments with no cereal production witnessed a reduction of the birth rate of 3.1 children. For those departments with the highest employment share in cereals, the transition was delayed by 22 years.

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 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 percent,

[31] These calculations use a common time trend estimated on pre-treatment data.

and in both the rapid decline witnessed over the previous two decades comes to a halt.

7.2 Education

Consider now the effect on education. Table 4 presents the regression results for enrollment 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 since, as we have argued above, the effect could be different across the sexes. The number of observations is constrained by the census years for which we have data on population by age. The last observation is hence for 1911 and includes individuals born between 1898 and 1905, i.e. up to 13 years after the tariff was introduced.

As we argued above, there was a major expansion of the supply of education during the period which we capture by controlling for the number of schools per 1000 children aged 6-13. As expected this variable has a positive impact on enrollment. The first three columns report our three specifications for all children: one simply including a dummy for the Méline tariff interacted with the share of cereal employment, one multiplying this share by the number of years of exposure to the tariff, and another that allows for a different effect in years nine and 14 after the tariff's introduction (the first census after the introduction of the tariff is that of 1896). The coefficient on our variable of interest is negative and significant in all specifications, as expected. The next columns present two specifications for boys and girls, respectively. The coefficients are significant, have the expected sign, and imply that there is no statistically significant difference between the two genders.

Note that the coefficient on Méline in regression (1), where we impose a common coefficient, is not the average of the three coefficients obtained when we allow for differential effects in column (3). The reason for this is that we include in our specifications a department-specific time trend, and in the absence of differential effects of the tariff over time this trend has to capture the dynamics that are actually due to the policy. The differences between the two specifications indicate the importance of allowing for differential impact of a policy over time, as argued by Wolfers (2006).

The magnitude of the effect is substantial. Table 4, column (1) implies that for a 15% employment rate in cereal production, the tariff reduces enrollment rates by 5.7 percentage points, which amounts to over 75 percent of the standard deviation of this variable. These effects are large when we compare them to the evolution of enrollment rates over time: over the decade prior to the introduction of the tariff, the enrollment rate increased by only 1.4 percentage points in France. When we allow for different effects across time, we find that the strongest impact occurs nine years after the introduction of the tariff, with the effect falling again by year 14. Interestingly, the impact of the tariff on education is immediate, indicating that both children born after but also before its introduction received less school. Such finding is in line with our model that shows that parents may reduce the education also of those children born before the policy was in place.

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*, two with average shares, *Landes* and *Saône-et-Loire*, and those with the highest shares, *Lot* and *Tarn-et-Garonne*. Although enrolment rates appear to have fallen in all departments around 1892, the decline is less marked in the departments including Paris and Marseille, and is particularly strong in *Lot* and *Tarn-et-Garonne*.

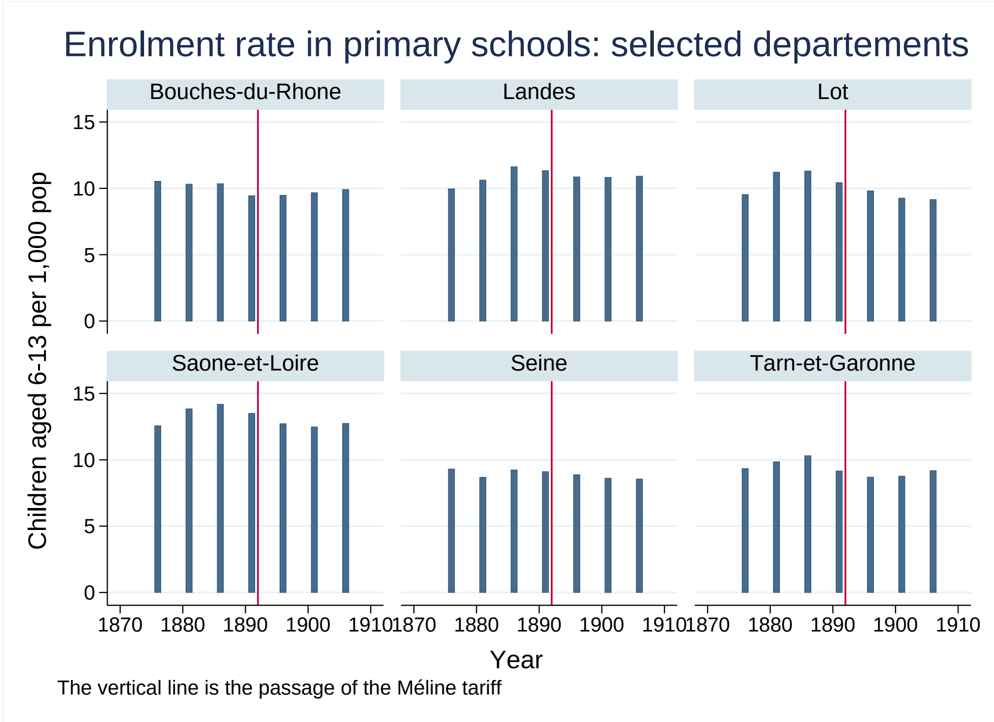

Figure 6 – Evolution of the Enrolment Rate in 6 selected départements, France 1876-1906

7.3 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, but this section examines those for which we did in order to test the robustness of our results.

We perform several exercises. The first consists of using 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 *Experience* 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 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.

The results are reported in table 5. For our three dependent variables -birth rates, fertility rates and enrollment- we obtain equivalent results. The coefficient on the shock interacted with the share of cereal employment remains highly significant and of similar magnitude to those previously obtained. While employment in fruit and vegetable production never exhibits a significant coefficient, that on employment in wine production is significant in two specifications, birth rates and fertility rates. A possible explanation is that the end of the free trade period was perceived as being favorable to all agricultural exports, and thus regions where wine production was important also experienced a stronger increase in birth rates than elsewhere.

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 help transmit social norms about the number of children; see Daudin, Franck, and Rapoport (2018). We hence collected data on both the share of the population born in France but outside the department and on those born abroad (see appendix for the details). 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 norm of migrants by the birth 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 norms were the reason behind the observed increase in birth rates.

Table 6 reports two sets of regressions: those including weighted fertility, the share of foreign migrants in the population and their interaction, and those including the share of those born outside the department. Our variables of interest retain their significance in all specifications. We find no impact of the additional variables on birth rates, while a higher share of domestic migrants increases fertility, a result consistent with rural workers with high fertility migrating to more industrial regions were fertility had fallen faster. Enrollment rates are negatively affected by the share of foreign migrants, in line with the fact that France had an early education expansion compared to its 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 could 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. This can also explain why the share of domestic migrants has no effect on birth rates as positive selection offsets the higher fertility norms in the department of origin.

Lastly, 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 political climate affected attitudes to family size and towards the use of contraception. Moreover, Squicciarini (2017) 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 in more religious districts was perceived as being 'less useful', this could also have affected the demand for schooling and hence enrollment rates. Consequently, our dummy could be capturing a strengthening of conservative attitudes which we would expect to be stronger in those department that were originally more conservative. Second, the size of agricultural properties may also have been important. If agricultural production were concentrated in a few large states and hired farm labour were paid close to subsistence wages by landowners, it is conceivable that farm labour did not obtain higher wages and employment following the introduction of the tariff, thus weakening the effect. We hence construct dummies for these two variables at a particular point in time and interact them with the Méline shock.

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 (2017) 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; see appendix for the details).

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. The impact of the tariff does not depend on the structure of agricultural properties in any of the specifications, while the degree of religious conservatism has a significant coefficient only in the regression for birth rates. The positive coefficient implies that in more conservative departments there was an increase in birth rates after 1892, possibly the result of a more conservative political mood, although we do not observe this when we consider fertility rates.

7.4 The timing of the shock

Our next specification considers alternative time shocks in order to examine whether another shock that took place sooner or latter is being captured by our explanatory variable. We thus construct the *Méline* dummy and the *Exposure* variable 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 share of cereals in 1892. Table 8 presents the results for the birth rate, the fertility rate and enrollment rates. 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 the birth rate, indicate that although the alternative shocks reduce the significance of our explanatory variable, its coefficient remains significant at the 5% level. For fertility and education we have a much smaller sample size. All the shocks have an insignificant coefficient in the fertility regressions, which as we had seen earlier give the least satisfactory results; in contrast, the two regressions for enrollment rates yield highly significant coefficients for our explanatory variable.

7.5 Child labour

Child labour was prevalent in 19th century France, both in agriculture and in the manufacturing sector; see Heywood (2002). Consequently, the tariff could have reduced education because parents faced a trade-off between higher consumption if their offspring worked when they were children and the future skill level of these offspring. An increase in the return to agricultural labour could then induce farmers to make their children work more and hence reduce enrolment rates. The informal nature of child labour implies that we have no measures for its extent, but it is possible that this was an additional aspect reinforcing the effect on education that we have identified.[32] 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 enroll children at school and have them not attending during the months of intensive farm work, notably the summer.[33] 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 9. We report both 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 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.

[32] We built an additional version of the model allowing for child labour. The results are intuitive and decided not to include them: allowing for child labour reinforces the education effect, with the tariff having an even stronger effect on education.

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

8 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 measure the strength of the tariff shock, we compute a measure of the share of employment in cereal production just before the introduction of the tariff. 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 employment in the local economy. Three outcome measures are used: birth rates, fertility rates, and enrollment 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.

These results contribute to a vast literature on protectionism, showing that the protection of low-skill sectors can have important implications for both fertility and education, both 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 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 and the absence of effective birth-control technologies, while education was largely constrained by its supply. A number of previous analyses using historical data have shown that education affected fertility decisions and vice versa, yet no work has so far examined quantity-quality responses to macroeconomic incentives. A key contribution of our paper hence lies in identifying how a major aggregate economic shock can impact households' education and fertility decisions.

It is important to emphasize that we are identifying a relative effect across departments, and that the tariff potentially had a number of other effects that were common across France. Nevertheless, our results raise questions about the role of protectionism in exacerbating inequality across departments, and further work is 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.

9 Appendix

9.1 Appendix 1

This appendix derives some of the results reported in section 3.

The maximization problem in (5) yields the following first-order conditions with respect to n and e

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

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

Dividing one by the other and using the expression for $h(e)$ we get (7) in the text. Rearranging (A.1) we have

$$(\tau^q + \tau^e e_t)n_t = \gamma. \tag{A.3}$$

Consider now the allocation of labour across sectors. Labour market equilibrium implies $w_{at}p_t = w_{mt}h(e_t)$. Since wages are equal to the marginal product of labour and assuming that $\alpha = 0.5$, we have $ap_t^2 L_{mt} = L_{at}h(e_t)$. Substituting for $L_t = L_{mt} + L_{at}$ and defining $q_t \equiv L_{at}/L_t$, we get equation (8).

Now consider (6) and (7). The equilibrium level of education is defined by the equality $f(e_t, p_t^w, \eta_t; a) = 0$, where the function $f(.)$ is defined as

$$f(e_t, p_t^w, \eta_t; a) \equiv \frac{1-\theta}{\theta}e_t + \frac{a}{\beta\theta}\left(p_t^w(1+\eta_t)\right)^2 e_t{}^{1-\theta} - \frac{\tau^q}{\tau^e}.$$

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 for which $f(.) = 0$. Note also that $f_{p^w} > 0$, $f_\eta > 0$, and $f_a > 0$. Then, $de_t/dp_t^w = -f_{p^w}/f_e < 0$, implying that a lower price increases education, while $d(-f_{p^w}/f_e)/da < 0$, indicating that this effect is stronger when a is larger.

Consider now the effect of an increase in the tariff, η. We have that $de_t/d\eta_t = -f_\eta/f_e < 0$, implying that for any given price p_t^w, education will be lower that it would have been without the increase in the tariff. Moreover, since $d(-f_\eta/f_e)/da < 0$, a higher ratio a implies a larger difference between the level of education with the low and with the high tariff.

9.2 Appendix 2

This appendix gives further details on the data.

Territory and population. The French territory was subdivided into 86 *départements*, that were roughly the size of a US county. We dropped the department 'Corsica' because of data availability.

Demographic variables. We use the data available online on the website of the French national statistical institute INSEE (www.insee.fr) and 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/). The number of births, of females and males aged 15 to 45, of children aged 6 to 13, of married women aged 15 to 45, and the total population are available every 5 years. More precisely, these data exist for 1872, 1876, 1881, 1886, 1891, 1896, 1901, 1906, 1911. 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 did not interpolate any other series. The sex ratio is defined as the ratio of males aged 15 to 45 to females aged 15 to 45, and the marriage rate as the ratio of married females aged 15 to 45 to females aged 15 to 45.

Primary school enrollment 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 enrollment rate in high school as a measure of secondary education. We take three variables in the periodical published by the Ministry of Education 'Statistiques de l'Enseignement Primaire' (statistic on primary education): the number of children (boys and girls) aged 6 to 13 enrolled in primary school (public or private), the total number of students in any of the primary schools, and the total 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 part digitized by the National statistical office INSEE and http://acrh.revues.org/3038 for the part digitized by the CRH of the EHESS. Table 10 gives the name of the file and the name of the three variables used to compute enrollment rate. The following corrections were made to correct for typos and errors. 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 Statistical yearbook of the French government that published in its 1884 edition 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. We were able to retrieve the total number of enrolled and the number of children aged 6 to 13 in other sources. We retrieve the number of enrolled students from the section publishing the number on "primary education" in the yearly *Annuaire statistique de la France* (1912, p. 89, reduced to ASF in table 10). We retrieve the number of children aged 6 to 13 by adding the number of children born each year between 1899 to 1905 and alive in 1911. To add 1911 to the database, we add the relevant numbers as they were stored in the census file of 1911 published in dataset number DS244_1 available on the CRH website.

Share of cereals: We compute the product of the share of agricultural employment in total employment in 1892 and the share of the value of cereal production in total agricultural production in 1892, which comes respectively from Combes et al. (2011) and Toutain (1993).

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.

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, as a result we can construct a weighted proxy for their fertility norms. 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.

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 Laurent (1976). He divides departments into three categories according to whether the prevalent form of agricultural property are small, medium sized or large properties, the latter being defined as being those above 40 hectares. We create a dummy that takes the value 1 if large properties dominate.

10 Tables

Table 1 – Descriptive statistics

	(1) Obs.	mean	sd	min	max
Cereal share in agricultural production	85	.268	.0775	.0355	.444
Share of employment in agriculture	85	.538	.147	.015	.753
Share of employment in cereals	85	.148	.0612	.0007	.261
Meline*Cereal	85	.0637	.084	0	.261
Exposure*Cereal	3,566	.574	.867	0	3.659
Birth rate	3,566	22.463	3.94	13.803	35.428
Fertility rate	763	93.973	17.19	54.886	175.015
Enrolment rate, 6–13	469	91.570	7.336	51.998	100.562
Enrolment rate, boys	469	92.615	6.633	57.130	100.867
Enrolment rate, girls	469	90.608	8.554	46.867	100.929
No. of schools	469	19.385	6.917	5.222	43.306

Table 2 – Birth rate

	(1) Meline	(2) Exposure	(3) Dynamic	(4) Meline	(5) Exposure	(6) Dynamic
Meline*Cereal	-0.0487		1.394	-0.101		1.751
	(1.855)		(1.716)	(1.875)		(1.232)
Exposure		-0.0508			-2.238	
		(0.0359)			(6.812)	
Exposure*Cereal		0.971***			1.334**	
		(0.213)			(0.545)	
Years 4-6*Cereal			3.373***			3.700***
			(1.087)			(1.403)
Years 7-9*Cereal			4.475**			5.214**
			(1.813)			(2.492)
Years 10-12*Cereal			8.354***			9.590**
			(2.334)			(3.885)
Years 13-15*Cereal			11.56***			13.38**
			(2.960)			(5.590)
Years 16-18*Cereal			17.21***			19.69**
			(3.446)			(7.720)
Years 19-21*Cereal			15.85***			19.08**
			(3.881)			(8.969)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *dpt	No	No	No	Yes	Yes	Yes
Adjusted R^2	0.904	0.909	0.910	0.922	0.922	0.923
Observations	3566	3566	3566	3566	3566	3566

Standard errors in parentheses

Standard errors are clustered at the department level. The period of estimation is 1872-1913.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 3 – Fertility rate - census years only

	(1) Meline	(2) Exposure	(3) Dynamic
Meline*Cereal	17.29		21.07*
	(13.78)		(11.40)
Exposure		-0.110	
		(0.172)	
Exposure*Cereal		2.196**	
		(1.062)	
Year 9*Cereal			2.133
			(15.76)
Year 14*Cereal			17.31
			(27.85)
Year 19*Cereal			27.77**
			(12.41)
Linear trend *dpt	Yes	Yes	Yes
Adjusted R^2	0.718	0.719	0.718
Observations	763	763	763

Standard errors in parentheses

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 4 – Enrolment rate enrolled over relevant age group

	(1) All children	(2) All children	(3) All children	(4) Boys	(5) Boys	(6) Girls	(7) Girls
No. of schools	1.412**	1.425**	1.332**	1.816***	1.753***	1.802***	1.721***
	(0.644)	(0.653)	(0.657)	(0.428)	(0.440)	(0.389)	(0.398)
Meline*Cereal	-38.20***		-32.52***	-38.42***	-34.08***	-42.75***	-37.02***
	(10.79)		(11.63)	(10.72)	(11.32)	(10.75)	(11.21)
Exposure		0.142					
		(0.266)					
Exposure*Cereal		-3.114**					
		(1.483)					
Year 9*Cereal			-28.60***		-26.71**		-30.66***
			(10.84)		(11.61)		(10.71)
Year 14*Cereal			-11.14		-18.17		-14.90
			(17.61)		(17.03)		(17.52)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.594	0.586	0.602	0.502	0.509	0.678	0.686
Observations	469	469	469	469	469	469	469

Standard errors in parentheses

(1) Enrolment and the schooling population are available for years 1881, 1886, 1891, 1896, 1901, 1906;

(4) Standard errors are clustered at the departement level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5 – Robustness: Different crops

	(1) Birth rate	(2) Birth rate	(3) Fertility	(4) Fertility	(5) Enrolment	(6) Enrolment
Exposure	-2.177	-2.474	-0.355*	-0.0687		
	(6.903)	(6.987)	(0.190)	(0.184)		
Exposure*Cereal	1.589***	1.234**	3.022***	2.357**		
	(0.523)	(0.568)	(1.019)	(1.116)		
Exposure*Wine	0.741*		2.371**			
	(0.440)		(0.978)			
Exposure*FruitVeg		0.937		-1.527		
		(1.476)		(2.743)		
No. of schools					1.419**	1.395**
					(0.654)	(0.639)
Meline*Cereal					-40.12***	-34.90***
					(12.60)	(12.88)
Meline*Wine					-5.508	
					(9.126)	
Meline*FruitVeg						-34.36
						(39.38)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *dpt	Yes	Yes	No	No	No	No
Adjusted R^2	0.922	0.922	0.722	0.719	0.593	0.594
Observations	3566	3566	763	763	469	469

Standard errors in parentheses

(1) Enrolment is the enrolment rate of children aged 6-13 over population aged 6-13;

(2) Shock is lagged/brought forward by 10 years;

(3) Residuals are clustered at the departement level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6 – Robustness: National and foreign migrants

	(1) Birth rate	(2) Birth rate	(3) Fertility	(4) Fertility	(5) Enrolment	(6) Enrolment
Exposure	-0.0404	-0.0619	-0.149	-0.122		
	(0.139)	(0.132)	(0.183)	(0.168)		
Exposure*Cereal	1.563*	1.713**	2.442**	2.200**		
	(0.795)	(0.762)	(1.113)	(1.043)		
Weighted fertility	-0.226		1.245		-3.635	
	(1.721)		(12.89)		(11.54)	
Share of migrants	-43.89		-195.5		-423.7**	
	(40.71)		(187.6)		(207.3)	
WeiFert*ShareMig	38.26		129.4		192.7	
	(26.01)		(146.0)		(154.4)	
Born outside dept		1.645		35.79*		33.15*
		(3.391)		(18.93)		(16.93)
No. of schools					1.390**	1.416**
					(0.640)	(0.631)
Meline*Cereal					-34.17***	-38.40***
					(11.03)	(10.92)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *dpt	Yes	Yes	No	No	No	No
Adjusted R^2	0.944	0.944	0.719	0.721	0.607	0.598
Observations	763	763	763	763	469	469

Standard errors in parentheses

(1) Enrolment is the enrolment rate of children aged 6-13 over population aged 6-13;

(2) Residuals are clustered at the departement level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7 – Robustness: Religious conservatism and size of properties

	(1) Birth rate	(2) Birth rate	(3) Fertility	(4) Fertility	(5) Enrolment	(6) Enrolment
Exposure	-0.0657	-0.103	-0.151	-0.188		
	(0.125)	(0.128)	(0.234)	(0.251)		
Exposure*Cereal	1.745***	1.727***	2.280*	2.266*		
	(0.542)	(0.553)	(1.152)	(1.157)		
Exp*Conserv	0.319**	0.338**	-0.0316	-0.0141		
	(0.135)	(0.136)	(0.354)	(0.364)		
Exp*LargeProp		0.0673		0.0662		
		(0.0626)		(0.150)		
No. of schools					1.394**	1.409**
					(0.650)	(0.644)
Meline*Cereal					-40.24***	-39.74***
					(11.75)	(11.58)
Mel*Conserv					-1.996	-2.476
					(2.740)	(2.868)
Mel*LargeProp						-1.370
						(1.539)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *dpt	Yes	Yes	No	No	No	No
Adjusted R^2	0.936	0.936	0.713	0.712	0.598	0.598
Observations	3314	3314	709	709	442	442

Standard errors in parentheses

(1) Enrolment is the enrolment rate of children aged 6-13 over population aged 6-13;

(2) Residuals are clustered at the departement level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8 – Robustness: Different timing

	(1) Birth rate	(2) Birth rate	(3) Fertility	(4) Fertility	(5) Enrolment	(6) Enrolment
Exposure	0.104	-1.076	0.220	1.517***		
	(0.0847)	(3.784)	(0.264)	(0.417)		
Exposure*Cereal	1.294**	1.535**	2.127	2.445		
	(0.527)	(0.674)	(1.651)	(2.561)		
Exposure lagged	0.0983		-0.595			
	(0.0905)		(0.440)			
Exp*Cereal lagged	-0.138		0.118			
	(0.552)		(2.795)			
Exposure forward		-0.997		-3.444***		
		(2.646)		(0.640)		
Exp*Cereal forward		0.399		-0.466		
		(0.560)		(3.914)		
No. of schools					1.408**	1.401**
					(0.646)	(0.648)
Meline*Cereal					-34.25***	-37.35***
					(12.80)	(11.11)
Mel*Cereal lagged					9.198	
					(14.29)	
Mel*Cereal forward						6.757
						(13.75)
Linear trend *dpt	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *dpt	Yes	Yes	No	No	No	No
Adjusted R^2	0.922	0.922	0.719	0.719	0.594	0.593
Observations	3566	3566	763	763	469	469

Standard errors in parentheses

(1) Enrolment is the enrolment rate of children aged 6-13 over population aged 6-13;

(2) The shock is lagged/brought forward by 10 years;

(3) Residuals are clustered at the departement level.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 9 – Absenteeism: Presence at school in summer

	(1) OLS	(2) OLS	(3) Random effects	(4) Random effects
Presence in December	0.852***	0.841***	0.732***	0.723***
	(0.102)	(0.102)	(0.165)	(0.167)
Cereal	-0.0703*		-0.0664**	
	(0.0408)		(0.0332)	
Agricultural share		-0.0246		-0.0242*
		(0.0169)		(0.0142)
Adjusted R^2	0.289	0.285		
Observations	170	170	170	170

Standard errors in parentheses

(1) Observations are for 1896 and 1906;

(2) Year fixed effects included, clustered s.e. in the random effects model.

* $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 10 – Sources used to construct enrollment rates

Year	File	Boys & girls Aged 6-13 census	Enrolled Aged 6-13	Enrolled all ages	Girls Aged 6-13 census	Enrolled Aged 6-13	Enrolled all ages	Boys 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
1911	DS244_1	census	NA	ASF	census	NA	ASF	census	NA	ASF

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

References

Accominotti, O. and M. Flandreau (2008). Bilateral treaties and the Most-Favored-Nation clause. The myth of trade liberalization in the 19th century. *World Politics 60*, 147–188.

Angrist, J., E. Bettinge, E. Bloom, E. King, and M. Kremer (2002). Vouchers for private schooling in Colombia: Evidence from a randomized natural experiment. *American Economic Review 92*(5), 1535–1558.

Angrist, J. D., V. Lavy, and A. Schlosser (2010). Multiple experiments for the causal link between the quantity and quality of children.

Anukriti, S. and T. J. Kumler (2018). Women's worth: Trade, female income, and fertility in india. *Economic Development and Cultural Change forthcoming*.

Atkin, D. (2016). Endogenous skill acquisition and export manufacturing in Mexico. *American Economic Review 106*(8), 2046–2085.

Augé-Laribé, M. (1950). *La Politique Agricole de la France de 1880 à 1940*. Paris: Presses Universitaires de France.

Autor, D., D. Dorn, and G. Hanson (2013). The China syndrome: Local labor market effects of import competition in the United States. *American Economic Review 103*(6), 2121–2068.

Bairoch, P. (1972). Free trade and European economic development in the 19th century. *European Economic Review 3*, 211–245.

Bairoch, P. (1989). Les trois révolutions agricoles du monde développé : Rendements et productivité de 1800 à 1985. *Annales: Économies, Sociétes, Civilisations 44*(2), 317–353.

Bardet, J.-P. and H. Le Bras (1988). *"Histoire de la Population Française"*, Volume 3, Chapter La Chute de la Fécondité, pp. 351–402. Paris: Presses Universitaires de France.

Barral, P. (1968). *Les Agrariens Français de Méline à Pisani*. Paris: Armand Colin.

Bassino, J. P. and J. P. Dormois (2010). Rainfall, the Méline tariff, and wheat production in mediterranean France. *Australian Economic History Review 50*(1), 23–38.

Becker, G. S. (1960). *Demographic and Economic Change in Developed Countries*, Chapter "An Economic Analysis of Fertility", pp. 209–249. Princeton (NJ): Princeton University Press.

Becker, G. S. and N. Tomes (1976). Child endowments and the quantity and quality of children. *Journal of Political Economy 84*(4), 143–162.

Becker, S. O., F. Cinnirella, and L. Woessmann (2010). The trade-off between fertility and education: Evidence from before the demographic transition. *Journal of Economic Growth 15*, 177–204.

Black, S. E., P. J. Devereux, and K. G. Salvanes (2005). The more the merrier? The effect of family size and birth order on children's education. *Quarterly Journal of Economics 120*(2), 669–700.

Blayo, Y. and L. Henry (1975). La population de la France de 1840 à 1860. *Population 30*(H–S), 71–122.

Bleakley, H. and F. Lange (2009). Chronic disease burden and the interaction of education, fertility, and growth. *Review of Economics and Statistics 91*(1), 52–65.

Bloom, N., M. Draca, and J. Van Reenen (2016). Trade induced technical change? The impact of Chinese imports on innovation, IT and productivity. *Review of Economic Studies 83*(1), 87–117.

Bonneuil, N. (1997). *Transformation of the French Demographic Landscape, 1806–1906*. Oxford: Clarendon Press.

Broda, C. and D. E. Weinstein (2006). Globalization and the gains from variety. *Quarterly Journal of Economics 121*(2), 541–585.

Chakraborty, T. (2015). Trade liberalization in a traditional society: Implications for relative female survival. *World Development 74*(3–4), 381–409.

Chaunu, P. (1972). Malthusianisme démographique et Malthusianisme économique. *Annales: Économies, Sociétes, Civilisations 26*, 1–19.

Combes, P.-P., M. Lafourcade, J.-F. Thisse, and J.-C. Toutain (2011). The rise and fall of spatial inequalities in france: A long-run perspective. *Explorations in Economic History 48*(2), 243–271.

Crafts, N. (1984). Economic growth in France and Britain, 1830–1910: A review of the evidence. *Journal of Economic History 44*(1), 49–67.

Cummins, N. (2013). Marital fertility and wealth during the fertility transition : Rural France, 1750–1850. *Economic History Review 66*(2), 449–476.

Daudin, G., R. Franck, and H. Rapoport (2018). Can internal migration foster the convergence in regional fertility rates? Evidence from nineteenth century France. *Economic Journal forthcoming*.

De la Croix, D. and F. Perrin (2018). How far can economic incentives explain the French fertility and education transition? *European Economic Review forthcoming*.

Diebolt, C., R. Menard, and F. Perrin (2016). Behind the fertility–education nexus: What triggered the French development process? Beta working paper.

Diebolt, C., T. Mishra, and F. Perrin (2018). Did gender-bias matter in the quantity-quality trade-off in 19th century France. Lund Papers in Economic History.

Dormois, J. P. (1996). La vocation agricole de la France. *Histoire et Mesure 11*(3–4), 329–366.

Dormois, J.-P. (2009). *La défense du travail national: L'incidence du protectionnisme sur l'industrie en Europe, 1870–1914*. Paris: Presse Universitaire Paris–Sorbonne.

Dormois, J. P. (2012). With the best intentions? Voting patterns in the adoption of the Méline tariff, 1891–1892. Mimeo.

Dupaquier, J. (1988). *Histoire de la population française*. Paris: Presses universitaires de France.

Easterlin, R. A. (1976). The conflict between aspirations and resources. *Population and Development Review 2*(3), 417–425.

Edmonds, E., N. Pavcnik, and P. Topolova (2010). Trade adjustment and human capital investments: Evidence from indian tariff reform. *AEJ: Applied economics 2*(4), 42–75.

Federico, G. and K. Persson (2007). *The New Comparative Economic History: Essays in Honor of Jeffrey G. Williamson*, Chapter "Market integration and convergence in the world wheat market, 1800–2000", pp. 87–114. Cambridge (MA): MIT Press.

Furet, F. and M. Ozouf (1977). *Lire et écrire*. Paris: Éditions de Minuit.

Galor, O. and O. Moav (2002). Natural selection and the origin of economic growth. *Quarterly Journal of Economics 117*(4), 1133–1191.

Galor, O. and A. Mountford (2008). Trading population for productivity theory and evidence. *Review of Economic Studies 75*(4), 1143–1179.

Galor, O. and D. N. Weil (2000). Population, technology, and growth: From malthusian stagnation to the demographic transition and beyond. *American Economic Review 90*(4), 806–828.

Goldberg, P., A. K. Khandelwal, N. Pavcnik, and P. Topalova (2010). Imported intermediate inputs and domestic product growth: Evidence from india. *Quarterly Journal of Economics 125*(4), 1727–1767.

Golob, E. O. (1944). *The Méline Tariff: French Agriculture and Nationalist Economic Policy.* New York: Studies in History, Economics and Public Law–AMS press.

Goodwin, B., T. Grennes, and L. A. Craig (2002). Mechanical refrigeration and the integration of perishable commodity markets. *Explorations in Economic History 39*(2), 154–182.

Grew, R. and P. J. Harrigan (1991). *School, State and Society, The Growth of Elementary Schooling Nineteenth-Century France–A Quantitative Analysis.* Ann Arbor: Clarendon Press.

Guinnane, T. W. (2011). The historical fertility transition: A guide for economists. *Journal of Economic Literature 49*(3), 589–614.

Harley, K. (1988). Ocean freight rates and productivity, 1740–1913: The primacy of mechanical invention reaffirmed. *Journal of Economic History 48*(4), 851–876.

Henriksen, I., M. Lampe, and P. Sharp (2011). The role of technology and institutions for growth: Danish creameries in the late nineteenth century. *European Review of Economic History 15*(3), 475–493.

Henriksen, I. and K. O'Rourke (2005). Incentives, technology and the shift to year-round dairying in late nineteenth-century Denmark. *Economic History Review 58*(3), 520–554.

Heywood, C. (2002). *Childhood in Nineteenth-Century France: Work, Health and Education Among the 'Classes Populaires'.* Cambridge UK: Cambridge University Press.

INSEE (1951). *Annuaire statistique – partie rétrospective.* Paris: Imprimerie Nationale.

Jacks, D. P. (2006). New results on the tariff–growth paradox. *European Review of Economic History 10*, 205–230.

Jacks, D. P. and K. Pendakur (2010). Global trade and the maritime transport revolution. *Review of Economics and Statistics 92*(4), 745–755.

Kindleberger, C. P. (1950). Group behavior and international trade. *Journal of Political Economy 59*(1), 30–46.

Lampe, M. and P. Sharp (2013). Tariffs and income: A time series analysis for 24 countries. *Cliometrica 7*(3), 207–235.

Laurent, R. (1976). *Histoire Économique et Sociale de la France*, Volume 3, Chapter "Le Secteur Agricole", pp. 619–767. Paris: Presses Universitaires de France.

Levasseur, E. (1911). *Histoire du Commerce de la France.* Paris: Librairie Nouvelle de Droit et de Jurisprudence.

Lhomme, J. (1970). La crise agricole à la fin du 19ème siècle en France. Essai d'interprétation économique et sociale. *Revue Économique 21*(4), 521–553.

Luc, J.-N. (1985). *La Statistique de l'Enseignement Primaire 19e-20e Siècle, Politique et Mode d'Emploi.* Paris: INRP Economica.

Maddala, G. (1977). *Econometrics.* New York: McGraw Hill.

Magnac, T. and G. Postel-Vinay (1994). Wage competition between agriculture and industry in mid-19th century france. *Explorations in Economic History 34*(1), 1–26.

Ministere de l'instruction publique, R. (1876). *Statistique de l'enseignement primaire.* Paris: Imprimerie nationale.

Mitchell, B. (2003). *International Historical Statistics: Europe 1700–2000.* New York: Palgrave Macmillian.

Murphy, T. (2015). Old habit die hard (sometimes): What can Département heterogeneity tell us about the French fertility decline? *Journal of Economic Growth 20*(2), 177–222.

North, D. C. (1958). Ocean freight rates and economic development, 1750–1913. *Journal of Economic History 18*(4), 537–555.

Nye, J. V. (1991). The myth of free trade Britain and fortress France: Tariffs and trade in the nineteenth century. *Journal of Economic History 51*(1), 23–46.

Nye, J. V. (2007). *War, Wine, and Taxes: The Political Economy of Anglo–French Trade, 1689–1900*. Princeton: Princeton University Press.

O'Brien, P. and C. Keyder (1978[2011]). *Economic Growth in Britain and France 1780–1914: Two Paths to the Twentieth Century*. London: Routledge.

O'Rourke, K. H. (1997). The European grain invasion, 1870–1913. *Journal of Economic History 57*(4), 775–801.

O'Rourke, K. H. (2000). Tariffs and growth in the late 19th century. *Economic Journal 110*, 456–483.

O'Rourke, K. H. and J. G. Williamson (1999). *Globalization and History: The Evolution of a Nineteenth-Century Atlantic Economy*. Cambridge (MA): MIT Press.

Postel-Vinay, G. (1991). *Entre l'État et le Marché. L'économie Française des Années 1880 à nos Jours*, Chapter "L'agriculture dans l'économie Française", pp. 59–92. Paris: N.R.F. Gallimard.

Prost, A. (1968). *L'Enseignement en France, 1800–1967*. Paris: Armand Colin.

Prost, A. (1993). Pour une histoire "par en bas" de la scolarisation républicaine. *Histoire de l'éducation 57*(1), 59–74.

Rosenzweig, M. R. and K. I. Wolpin (1980). Testing the quantity-quality fertility model: The use of twins as a natural experiment. *Econometrica 48*(1), 227–240.

Rosenzweig, M. R. and J. Zhang (2009). Do population control policies induce more human capital investment? twins, birthweight, and china's 'one child' policy. *Review of Economic Studies 76*(3), 1149–1174.

Schultz, P. T. (1985). Changing world prices, women's wages, and the fertility transition: Sweden, 1860–1910. *Journal of Political Economy 93*(6), 1126–1154.

Sicsic, P. (1992). City-farm wage gaps in late nineteenth-century France. *Journal of Economic history 52*(3), 675–695.

Squicciarini, M. (2017). Devotion and development: Religiosity, education and economic progress in 19th century france. mimeo.

Statistique générale de la France, M. d. t. (1911). *Annuaire statistique de 1910*. Paris: Imprimerie Nationale.

Statistique générale de la France, M. d. t. (1915). *Annuaire statistique de 1913*. Paris: Imprimerie Nationale.

Tackett, T. (1977). *Priest and Parish in Eighteenth-Century France*. Princeton: Princeton University Press.

Tackett, T. (1986). *Religion, Revolution and Regional Culture in Eighteenth Century France*. Princeton: Princeton University Press.

Topalova, P. (2010). Factor immobility and regional impacts of trade liberalization: Evidence on poverty from india. *AEJ: Applied economics 2*(4), 1–41.

Toutain, J.-C. (1987). Le produit intérieur brut de la France de 1789 à 1982. *Economies et Sociétés : Histoire Quantitative de l'Économie Française*.

Toutain, J.-C. (1993). La production agricole de la france de 1810 à 1990 : départements et régions (tome 2). *Economies et Sociétés : Histoire Quantitative de l'Économie Française AF17-122*.

Van de Walle, E. (1974). *The female population of France in the nineteenth century: A reconstruction of 82 departements*. Princeton: Princeton University Press.

Van de Walle, E. (1980). *Family and Sexuality in French History*, Chapter "Motivations and Technology in the Decline of French Fertility". Philadelphia: University of Pennsylvania Press.

Wacziarg, R. and K. H. Welch (2008). Trade liberalization and growth: New evidence. *The World Bank Economic Review 22*(2), 187–231.

Weir, D. R. (1984). Life under pressure: France and England, 1670–1870. *Journal of Economic History 44*(1), 27–47.

Winters, L. A. (2004). Trade liberalisation and economic performance: An overview. *Economic Journal 114*(493), F4–F21.

Wolfers, J. (2006). Did unilateral divorce laws raise divorce rates? A reconciliation and new results. *American Economic Review 96*(5), 1802–1820.

Wrigley, A. E. (1985a). The fall of marital fertility in nineteenth century France: Exemplar or exception? (part I). *European Journal of Population 1*(1), 31–60.

Wrigley, A. E. (1985b). The fall of marital fertility in nineteenth century France: Exemplar or exception? (part II). *European Journal of Population 1*(2–3), 141–177.

Zolla, D. (1903). *La Crise Agricole dans ses Rapports avec la Baissse des Prix et la Question Monétaire*. Paris: Naud.