Protectionism and the Education–Fertility Trade-off in Late 19th Century France*

Vincent Bignon† Cecilia García-Peñalosa‡

January 2016

Abstract

The assumption that education and fertility are endogenous decisions that react to economic circumstances is a cornerstone of the unified growth theory that explains the transition to modern economic 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. Since the importance of cereal production varied across regions, we use these differences 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 education for up to 15 years. Our results thus indicate that even in the 19th century, policies that changed the economic prospects 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.

*For discussions and suggestions, we thank Eve Caroli, Neil Cummins, Claude Diebolt, Habiba Djebbari, Marc Flandreau, Paul Sharp, Alain Trannoy and participants to seminar in Aix Marseille School of Economics, and to the meetings of the World Congress of the Econometric Society, of the Economic History Association meeting, of the French Economic Association and of the joint Bank of France and Sciences Po conference on "Economic History and Economic Policy". The opinions expressed in this paper are not necessarily those of the Banque de France or the Eurosystem.

†Banque de France. DGEI-DEMFI-Pomone 41-1422, 31 rue Croix des Petits Champs, 75001 Paris cedex, France - Email : vincent.bignon@banque-france.fr

‡Aix-Marseille University (Aix Marseille School of Economics), CNRS & EHESS and CESifo. AMSE, Centre de la Vieille Charité, 2 rue de la Charité, 13002 Marseille - Email : cecilia.garcia-penalosa@univ-amu.fr

1 Introduction

The causes of the emergence of modern growth remain hotly debated amongst economists. One of the most influential theories is unified growth theory (from now onwards, UGT), developed by Galor and Weil (1999), Galor and Weil (2000) and Galor and Moav (2002), which proposes a mechanism through which economies move endogenously from a subsistence Malthusian economy into a regime with growing per capita incomes. UGT builds on two key elements. On the one hand, technological change depends on population size and the level of education of the labour force. On the other, population growth and education are determined by household choices which respond to economic incentives. This second element implies a trade-off between the quantity and the quality of children that an individual has, with parents choosing between numerous but little-educated children or a few well-schooled offspring. Critics of UGT argue that it is unlikely that in the 19th century fertility and education were the outcome of rational choices, and that they were more likely to be shaped by social norms than by economic constraints.[1] The aim of this paper is to provide evidence for the fact that such a trade-off was affected by economic shocks well before the postwar period on which most of the literature has focussed.

Our identification strategy relies on a major policy shock that occurred in France at the end of the 19th century. Following a massive increase in cereal exports that were arriving to Western Europe from the Americas and Russia, cereal prices in France plunged, resulting in a major income loss for cereal producers. As was the case in other European countries, political pressure to impose tariffs on cereal imports grew in the 1880s and led to the adoption in 1892 of the so called Méline tariff, a tariff that halted the fall in cereal prices and led to substantial wage increases (O'Rourke 1997). We argue that, under the assumption that human capital is less productive in agriculture than in manufacturing, the tariff reduced the relative return to education and, as predicted by UGT, led to a reduction in human capital investments and an increase in fertility. It is important to point out that we do not claim that the Méline tariff triggered the demographic transition in France, which had already taken place. Rather, we examine whether an economic shock affects quantity-quality choices at a point in history for which it is well established that households had taken control over their fertility decisions.

We construct a simple model that captures the quantity-quality trade-off. Our economy has two sectors, agriculture and manufacturing, and we suppose that human capital is productive only in the latter. Parents derive utility from both the number of children that they have and from the expected income of their offspring, which generates the usual trade-off between

[1] See Guinnane (2011), Diebolt (2015) and Clark and Cummins (2015) for a discussion.

fertility and investment in children's education. The latter is in turn determined by the relative return to education, that is, by the wage in manufacturing relative to that in agriculture and by the probabilities of being employed in one or the other sector. A tariff on agricultural goods increases wages in farming and the employment share of the sector, thus reducing the 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, and the tariff results in higher fertility rates. The larger the initial share of employment in agriculture, the stronger these effects are since the price increase implied by the tariff represents a large shock to the local economy.

To take the model to the data we use France's division into administrative 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 hence construct a measure of employment in cereal production as a share of total employment for 1892 and interact it with a dummy taking the value one whenever the Méline tariff was in operation. We then examine the effect of the tariff on birth rates and fertility rates, and find a negative impact of the dummy interacted with cereal employment shares which is consistent with the theory. Education is measured in a variety of ways. We consider enrolment rates in primary education, which at the time was supposed to cater for children aged between 6 and 13. An important feature of the period is that the fraction of students older than 13 enrolled in primary education was substantial. We hence compute enrolment rates for all students as well as for two groups, those aged 6-13 and those aged 14 and over. For the former group enrolment rates were negatively affected by the tariff, while for those who are 14 and over we find a positive effect on enrolment during the decade following the introduction of the tariff. Our model shows that for individuals whose parents had already completed their fertility and education decisions, the positive income effect generated by the tariff resulted in an increase in their education investment as young adults. In our data this effect is, however, moderate and overall enrolment rates fell in response to the Méline tariff.

We also consider completed education by using data on army conscripts. The period for which we have data is not long, and spans individuals that were aged between 10 and 20 years of age when the tariff was introduced. Our results indicate that for older cohorts the tariff had a positive impact on education, becoming insignificant and then negative as we consider younger and younger generations. These results provide evidence supporting theories that maintain that both education and fertility react rapidly to economic incentives, and that such reactions took place even in the 19th century.

The paper contributes 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. Most of this literature has used contemporary data and a variety of identification strategies, such as considering the impact of the arrival of twins in a household on subsequent education investments; see Rosenzweig and Wolpin (1980) or Rosenzweig and Zhang (2009) for more recent data. Broadly speaking, the evidence supports the existence of such a trade-off in the second half of the 20th century, although some results are less supportive (notably Black, Devereux, and Salvanes (2005) who argue that the impact of family size on education is in fact a relationship between birth order and education).

In contrast to the numerous studies on recent data, historical evidence on this trade-off is scarce, the exceptions being Becker, Cinnirella, and Woessmann (2010), Bleakley and Lange (2009) and Diebolt, Mishra, and Perrin (2015). 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. Diebolt, Mishra, and Perrin (2015) also examine this trade-off, using French regional data close to that we employ, and focusing on how the rise in female educational endowments played a role in the fertility transition. Both articles indicate that education affects fertility and vice-versa; however, in contrast to our paper, the nature of their data does not allow them to examine how economic variables affect this trade-off. Our work is particularly close to Bleakley and Lange (2009) who use disease eradication in the south of the US around 1910 to analyse fertility and education responses. The exogenous campaigns to eradicate hookworm, a parasite that particularly affects children's health, reduced the "price of child quality" and thus increased the return to human capital. As a result, educational investments rose and fertility rates fell. We follow a similar empirical strategy by focusing on the relative return to education. In contrast to Bleakley and Lange (2009), the external shock we consider has a less direct impact on children's welfare and rather acts by changing equilibrium prices and quantities in the economy. What makes the strength Bleakley and Lange's paper is also its drawback. Because it relies on a shock that has a direct impact on children's quality, the mechanism in operation is well identified, yet it does not provide evidence that aggregate macroeconomic features impact fertility and education as advocated by UGT. Our analysis focuses precisely on a major aggregate shock and identifies its consequences for fertility and education.

The paper is also related to a vast body of evidence trying to identify the determinants of the demographic transition; see Easterlin (1976) for a discussion. Although our analysis is not concerned with this episode, since France had the world's earliest demographic transition which took place almost a century before the Méline tariff was introduced,[2] 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. Murphy (2015) explores French fertility using regional data for the 19th century, and his findings indicate the importance of education, particularly that of females, but also of cultural factors.

Lastly, the paper is related to the economic history 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 and, when systematized to a panel of countries, this positive association between growth and tariffs has generated the so-called tariff-growth paradox; see O'Rourke (1997), O'Rourke (2000) and Jacks (2006). 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 negative effect on children's education.[3]

The paper is organised as follows. Section 2 gives the historical background of our study in terms of agricultural protectionism, education decisions and fertility. Section 3 solves a two-sector model of the joint family decision between the number of children and education. Section 4 presents the econometric specification we use to bring the model to the data. The next two sections present the data and the empirical results. Section 7 concludes.

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

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

2 Historical background

2.1 The Méline tariff and its economic consequences

The signing of the 1860 free-trade treaty with England has been viewed as a milestone in the historiography of French attitudes towards international trade (Bairoch 1972). Recent research argues that economic forces largely anticipated trade politics; see Nye (1991), Accominotti and Flandreau (2008), and Tena-Junguito, Lampe, and Tâmega Fernandes (2012). Nye (2007) shows that effective tariff duties on imports were low in France throughout the century, especially on agricultural products. The invention of the steamship and the development of the domestic railway network triggered a decrease of freight rates, especially across the Atlantic (North 1958 and Harley 1988) that increased grain market integration; see Federico and Persson (2007) and Uebele (2011). The resulting boom in trade was mainly driven by large exports of grains and other primary products from Latin America to Europe which resulted in deflationary pressure on prices in France; see Kindleberger (1950). Agricultural prices declined more than other prices, thus reducing farmers' revenues, and generalised discontent led farmers to lobby for protection although, because of the alliance between free-traders and industrialists, no majority was obtained in Parliament to impose protective tariffs, see Dormois (2012).[4]

The 1889 parliamentary elections tilted the population of lawmakers towards a majority in favor of more protection. Negotiations with the governments and discussions in Parliament lead to the proposal of an increase in the tariffs on cereals to fight the competition coming from the Americas.[5] Tariffs were introduced ad valorem: for each 100 kilos of cereals, the tariff increased the import price by 5 francs in 1892, or by about 25% (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 every year to take into account variations in the world price of cereals. According to Augé-Laribé (1950, p. 246-7) and Golob (1944, p. 234) there were thirty major legislative modifications of the tariff structure of 20 years. For example, in 1894 the wheat duty was increased from 5 to 7 francs per hundred kilograms. These changes induced an upward trend in agricultural duties during the twenty years that followed the adoption of the Méline tariff.

[4] Farmers' lobbying in the 1880s only led to th introduction of two different tariffs on wheat, 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, see Bassino and Dormois (2010).

[5] The promoter of the agricultural tariff, prime minister Méline, justified the increase of 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 [i.e. America, India and Australia] at our door"; quoted in Golob (1944, p.182)

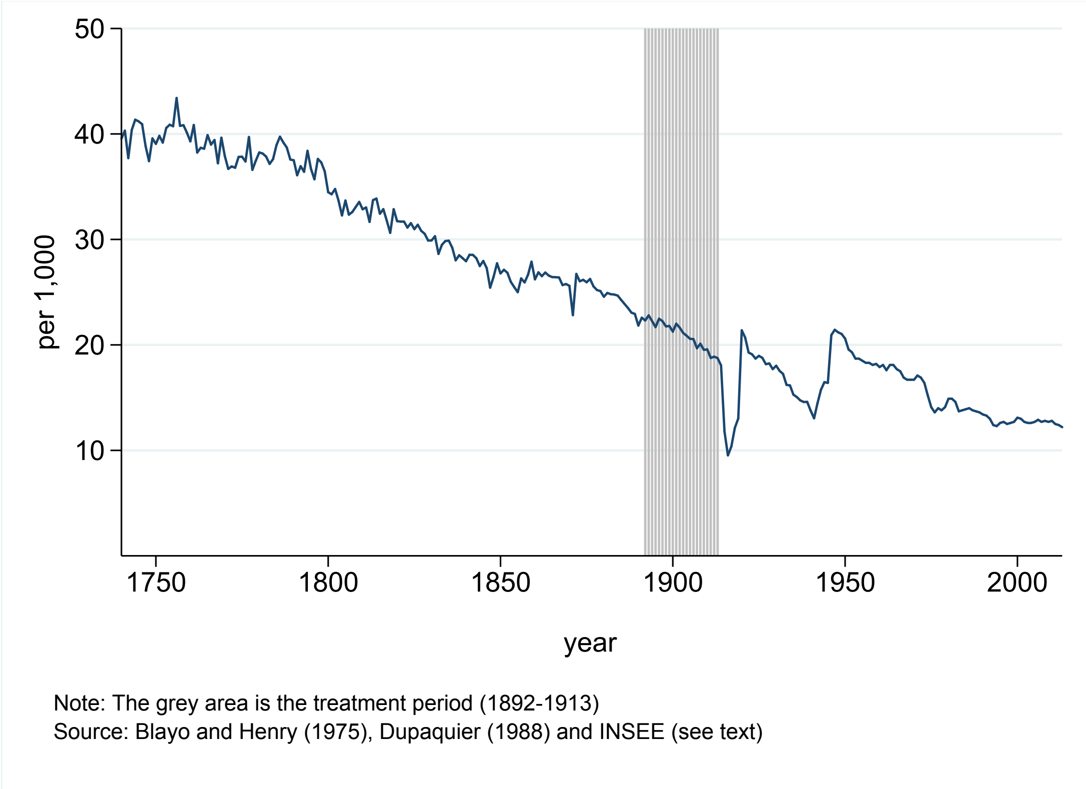

Figure 1: The birth rate in France 1740-2013

The magnitude of the effects 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". For example, Zolla computes a price difference equal to half of the price in London for wheat (after 1892, the price levelled at 10 francs in England against 15 francs in France, cf. p. 28). 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 population represented 50% of the working population (Golob, 1944, p. 18), the tariff implied that actual French grain output was twice as large as it would have been in the absence of protection (O'Rourke, 1997, p. 793). The overall effect of the reduction in world prices plus the tariffs was an increase in the average real wages, largely driven by the wages of farmers who were made better off compared to the rest of the population (see Zolla, 1903).[6]

[6]The impact of tariffs during the 19th century on wages and income is a complex question. See, for example O'Rourke (2000) and the survey in Lampe and Sharp (2013).

2.2 Education, fertility and the demographic transition in France

As it is widely acknowledged, France was the first country to experience a fertility transition; see Guinnane (2011) for a discussion an international context. Figure 1 depicts the crude birth rate in France over the period 1740 to 2012, with our period of interest (1872-1913) shaded.[7] 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. The reasons for this early transition are still poorly 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 be a trigger, while other authors have emphasised the role of wealth and the changes in inequality that followed the French Revolution; see Guinnane (2011), Cummins (2013), Wrigley (1985a, 1985b) amongst others. In contrast to other countries, where the late 19th century witnessed major changes in fertility behaviour, the period just before the introduction of the Méline tariff consists of two decades of substantial stability, as birth rates in France continued the long–run trend, as can be seen from figure 1. 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%). Fertility changed momentum after the World War I, falling by 2.5 children between 1924 (the year in which fertility returned to its pre-war level) and 1934.

Figure 2 uses our district-level data to compute national aggregates for fertility rates and enrolment rates (see section 4 for the details). The change in the fertility trend is apparent here. Fertility is stagnant in the early 1890s and actually increases between 1895 and 1901 before declining again. These increases implied a "delay" in the reduction of fertility of 11 years (the historical minimum of 1895 being attained again in 1906).

The expansion of education in France took place in the middle of the 19th century, the result of major legal changes and a substantial investment in education infrastructure; see Prost (1993). Historians of education describe the period 1837-1867 as a period of "universalization" of primary education (Furet and Ozouf 1977; Grew and Harrigan 1991). The Guizot law of 1833, and the Duruy law of 1867, officially organised primary education by requiring any agglomeration of more than 500 inhabitants to open, respectively, a boys' and a girls' primary school, introducing

[7] 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.

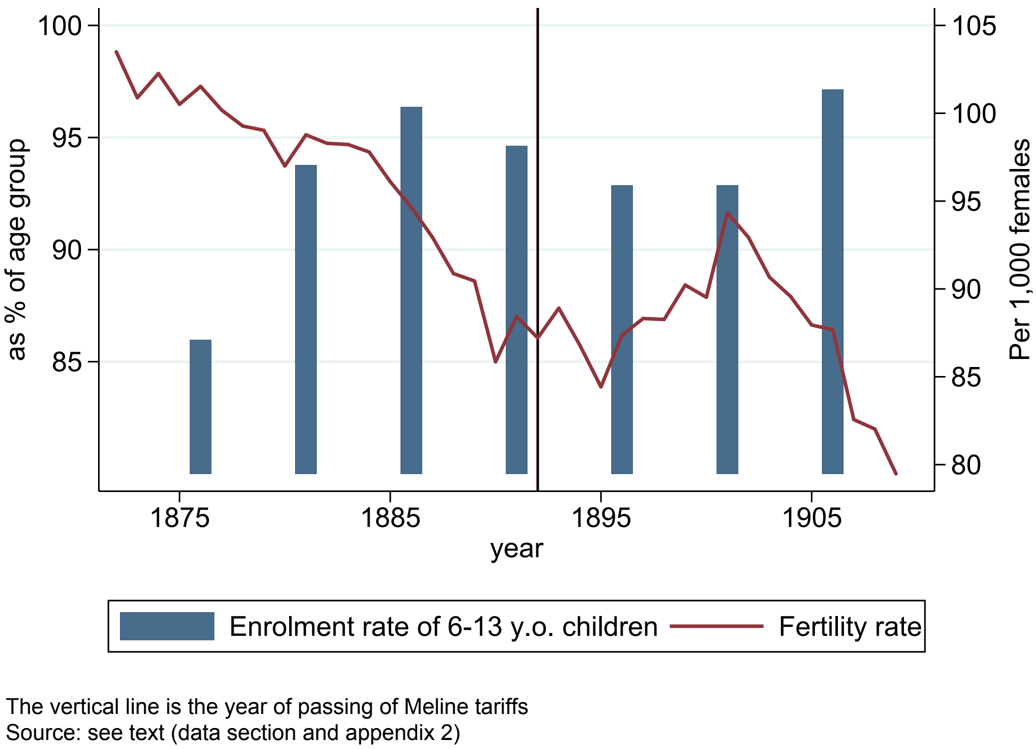

Figure 2: The literacy and the fertility rate, France 1872-1913

a minimum wage for teachers, and facilitating access to schooling by the children of households that were unable to afford school fees. As a result, by the time the Ferry laws were introduced (1881-1882) to implement compulsory and free private education, a majority of districts had attained enrolment rates of one hundred percent. A puzzle in the literature is that of the "lost decade". Between 1886 and 1896 not only there is no progress in primary schooling, but many districts experienced a decline in enrolment rates, with the average falling by 3.9% and 4.4% for boys and girls respectively; see Prost (1993, p 71). The timing of these changes raises the question of whether the Méline tariff was one of the factors behind them.

Figure 2 presents one of our measures of education, enrolment rates in public and private primary schools, defined as number of pupils aged 6 to 13 enrolled over the total population of children aged 6 to 13 (see below for the details). Enrolment rates increased before the passing of the tariff, but the puzzle noticed by Prost (1993) is apparent, as the enrolment rate of children aged 6 to 13 decreased from 1891 to 1901, only to recover in 1906. As we will see below, literacy, as measured by the ability to read and write of male conscripts, increases over the period, and there also seems to be a substantial slowdown of the trend in the early 1900s. Because the data considers completed education, the effect of the tariff will not be immediate and it is not obvious which generation of conscripts will experience a reduction in their educational attainment. Our econometric analysis below will address this issue.

2.3 The returns to education

A key assumption underlying the mechanism that we will explore is that the return to human capital was higher in manufacturing than in agriculture in late 19th century France. Unfortunately, we have no direct measures of these returns as individual data on wages and education over the period is not available, but a number of elements point towards this being a reasonable hypothesis.

Table 1 presents evidence on the urban-rural wage gap during our period of interest, defined as the ratio of the nominal wages in the two types of location for salaried males. We consider wages paid for (unskilled) farm-related work as the nominal wages in rural areas. Wages paid to unskilled workers in urban areas are those paid in the capital city of the region. Table 1 presents two levels of aggregation of the wage gap. The finest level is at the département level. As a robustness check, we also present the wage gap between the capital city of the region (which grouped 4 to 5 départements) and the average paid in the countryside of the region. Lastly, we present the wage gap computed using wages averaged at the national level.

The wage gap at those three levels of aggregation exhibited a similar evolution. The regional figures indicate that there was a moderate gap of 10% around 1850, which grew sharply in the following decades and stabilized around 50% in the late 19th and early 20th century. The département data exhibits a lower wage gap, which is explained by the fact that wages in the département capital cities were on average lower than wages in the regional capital cities. The national data also shows a slow decreasing wage gap, after the introduction of the tariff. This large difference is difficult to justify simply by the cost of mobility, and is likely to have been due to differences in human capital across the two sectors. Data on education by sector of employment are scarce, and the earliest figures we have been able to find correspond to 1906.[8] They indicate that even at this time, lacking education was substantially more common amongst those working in agriculture than in manufacturing, with illiteracy rates for males being over a third higher and for females almost double amongst those employed in agriculture than for manufacturing workers.

The likely explanation for the low educational achievement of the French agricultural labour force was the relative technological backwardness of the sector during the 1870–1913 period.

[8] The data are from the *Annuaire Statistique de la France*, 1910, and are reported by Chanut, Heffer, Mairesse, and Postel-Vinay (1995). See also Furet and Ozouf (1977).

	1852	1882	1892	1896	1900	1906	1911
Département	0.99	1.18	1.29				1.27
Regional	1.1	1.29	1.48				1.51
National			1.53	1.43	1.48	1.45	1.41

Source: Département and regional: Sicsic (1992, p. 685); National: Simiand (1931, table 1).

Table 1: The urban/rural wage gap ratios

Although the reverse hypothesis has been proposed, explaining the low productivity of the agricultural sector by the lack of education of French peasants (Barral 1968; Weber 1976) or their low appetite for technological progress (Barral 1968), recent work maintains that it was due to the lack of agricultural investment (Postel-Vinay 1991; Grantham 1993; Postel-Vinay 1998). Male labour productivity in French agriculture was only 60% of that in England in 1880, and that it had grown to 72% by 1910, a modest catch-up; see Bairoch (1965) as well as more recent studies (O'Brien and Keyder 2011). Dormois (1996) shows that during the 1890-1910 period, France had the fourth lowest average increase of agricultural productivity of the developed world, far behind Germany or the Scandinavian countries. The yield per hectare in wheat production was twice as low in France than in all other European countries except Russia and Italy (Bairoch 1989). Yet it is important to emphasize that this pattern was not prevalent in all of Europe, since in some countries technology had made rapid inroads into the agricultural sector, thus increasing the demand for educated farm workers.[9]

3 Modelling education and fertility decisions

In order to understand the way in which tariffs affect fertility and education investments, we consider a two-sector version of the quantity-quality trade-off model developed by Galor and Weil (1999) and Galor and Weil (2000) that abstracts from technological change. The production side of the economy features two goods, an agricultural good and a manufacturing good. The later is the numeraire, while the agricultural good is traded and has an exogenously given price p_t that will be the source of the shock we consider. 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.

[9] See Golob (1944) on the technological backwardness of French agriculture, O'Brien and Keyder (2011) on a comparison between France and England, and Henriksen, Lampe, and Sharp (2011) for a study of the Danish experience.

3.1 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, and $0 < \alpha < 1$. The manufacturing good is also produced through a Cobb-Douglas technology of the form

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

where Y_{mt} is manufacturing output, B is a fixed factor in the sector (potentially capital, but we abstract from its accumulation), h_t the average human capital of workers and L_{mt} employment in the sector. The price of the manufacturing good is 1, while that of the agricultural good is p_t and will be the source of the shock we consider. A crucial 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 was 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 $h_t w_{mt}$. Labour market equilibrium requires the equalization of incomes across sectors, i.e. $w_{at} = h_t w_{mt}$, and yields the fraction of the population employed in agriculture q_t and that employed in manufacturing $1 - q_t$.

We turn next to households' preferences and constraints. An important aspect in the data is that the education decisions concerning an individual occur through several years. We hence assume that agents live for 3 periods. In the first they are born and receive education from their parents, in the second they are young adults and are endowed with 0.5 units of time. They may work for the entire period or acquire an amount of education x_t at a cost τ^x. In the third period, as mature adults, they are also endowed with 0.5 units of time which they may spend working or raising children. Borrowing across periods is assumed not to be possible.

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

$$U_t = c_t^{1-\gamma} (n_{t+2} E y_{y,t+2})^{\gamma}, \tag{3}$$

where c_t is the lifetime consumption of the individual, n_{t+2} the number of children she has (which are born at $t+2$) and Ey_{t+2} the expected (potential) income that her offspring (born at $t+2$) will get when she is a young adult. 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

$$c_t = y_{y,t}(0.5 - \tau^x x_t) + y_{m,t}(0.5 - (\tau^q + \tau^e e_{t+2})n_{t+2}),$$

where $y_{y,t}$ is the potential income when the individual is a young adult and $y_{m,t}$ that when she is mature. We suppose that a constant fraction of consumption is allocated to the agricultural good and the rest to the manufacturing good.[10]

Young 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. If the individual then invests in education when she is a young adult, her human capital becomes $h(e_t, x_t) = \beta e_t^{\theta}(1 + bx_t)$, where $b > 0$. When taking the education decision of their children, parents suppose that with probability q they will work in agriculture and with probability $(1-q)$ in manufacturing. The resulting expected potential income of a young adult born at t is

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

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.

3.2 Solving the model

Education and fertility

[10] 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.

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

$$\begin{aligned}
\max_{n,e,x} U_t &= c_t^{1-\gamma}\left(n_{t+2}Ey_{y,t+2}\right)^{\gamma} && (5)\\
s.t.\quad Ey_{y,t+2} &= q_{t+3}w_{at+3} + (1-q_{t+3})h(e_{t+2})w_{mt+3}\\
c_t &= y_{y,t}(0.5-\tau^x x_t) + y_{m,t}(0.5-(\tau^q+\tau^e e_{t+2})n_{t+2})\\
h(e_{t+2}) &= \beta e_{t+2}^{\theta}\\
y_{y,t} &= \phi w_{at+1} + (1-\phi)w_{mt+1}\beta e_t^{\theta}\\
y_{m,t} &= \phi w_{at+2} + (1-\phi)w_{mt+2}\beta e_t^{\theta}(1+bx_t)\\
x_t &\geq 0,\ \text{and } (0.5-\tau^x x_t)\geq 0,\\
e_t &\geq 0, n_t \geq 0,\ \text{and } 0.5-(\tau^q+\tau^e e_{t+2})n_{t+2}\geq 0.
\end{aligned}$$

The first three constraints give the expected income of an offspring when young, the consumption of the individual, and the human capital of the offspring. The next two constraints give the income of the individual in the two periods, where ϕ is an indicator variable taking the value 1 if the individual works in agriculture and 0 if he works in manufacturing. The last two lines give the constraints that fertility, education investments, and consumption in each period be non-negative.

The consumer's problem is solved in the appendix, where we suppose that $\alpha = 0.5$ in order to get explicit analytical solutions. There we show that, under the assumption that the time cost of young adults' education is sufficiently high, i.e.

$$\tau^x > b(0.5-\gamma),$$

then, whenever wages are constant over time, there is no adult education and $x_t = 0$. In this case, the f.o.c. yield the following expressions for education and fertility

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

$$\frac{1-\theta}{\theta}e_t^* + \frac{q_t w_a}{(1-q_t)w_m}\frac{(e_t^*)^{1-\theta}}{\beta\theta} = \frac{\tau^q}{\tau^e}. \qquad (7)$$

The first equation is standard and gives the quantity-quality trade-off faced by parents, and implies that any shock that reduces optimal education investments, e^*, results in an increase in fertility and vice versa. 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 education investment in children depends on the way it impacts the expected wage of the offspring. The main difference with existing work is that investments in education 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, noting that all variables are constant over time. From the two equations above it is straight-forward to show that $\partial e^*/\partial q < 0$ and $\partial n^*/\partial q > 0$, 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 an 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 as an increase in agricultural employment.

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 $w_a = w_m h(e)$, which yields the equilibrium values of wages and employment.[11] 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 increases the wage rate in agriculture, leading to a flow of labour into that sector, so that agricultural employment is

$$q = \frac{ap^2}{ap^2 + h(e)},$$

where $a \equiv AT/B$. A higher price of agricultural goods and a lower level of education increase employment in agriculture. Note also that if districts differ in the quantity or productivity of their land, they will also differ in their share of employment in agriculture, with a higher A and/or T (i.e. a higher a) resulting in a higher q.

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

$$\omega \equiv \frac{qw_a}{(1-q)w_m} = ap^2.$$

The expected relative wage in agriculture is hence increasing in the price of agricultural goods p.

Suppose the economy faces a price of agricultural goods $\underline{p}$ and that the resulting fertility and education decisions are given by $\underline{n}$ and $\underline{e}$. Consider now the introduction of a permanent tariff on agricultural products at time $\bar{t}$ that increases the price of agricultural goods to $\overline{p} > \underline{p}$.

[11] 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. In any case, all our results would hold is we introduced finite costs of moving into manufacturing.

Differentiating the two equilibrium equations, it is straightforward to show that the higher price will result in an education investment $\overline{e}$ lower than $\underline{e}$ and a fertility rate $\overline{n}$ higher than $\underline{n}$. The former is the result of the decrease in the relative return to education, while the usual quality-quantity trade-off implies that as parents spend less time in children's education, they have more of them. Note also that

$$\frac{d^2e}{dadp} < 0 \quad \text{and} \quad \frac{d^2n}{dadp} > 0,$$

that is, the reduction in education and the increase in fertility are stronger the greater agricultural productivity is. Since a higher a implies that a greater share of population is employed in agriculture before the price shock, districts which have a high initial employment share in agriculture will be those experiencing the sharpest changes in our two variables of interest.

3.3 Young-adult education

The results just described concern the comparison between individuals facing an agricultural price $\underline{p}$ throughout their lifetime and those facing a price $\overline{p}$ in all periods. However, for the generation born at $\overline{t} - 1$, parental education investment is given by $\underline{e}$, yet their incomes are determined by the new (higher) price of agricultural goods $\overline{p}$.

We thus need to consider the choices of young adults born at time $\overline{t}-1$, who face a change in wages during their life time. These individuals received from their parents a level of education $\underline{e}$. At the start of period $\overline{t}$ this cohort makes their occupational choice (between agriculture and manufacturing) and we suppose that the tariff is introduced after this choice is made. Individuals who are in the manufacturing sector may revise their education decisions in the light of new wages. Rather than having a constant wage throughout their lifetime, they face a wage $\underline{w}_m$ during period $\overline{t}$ and are aware that the tariff will lead to an increase in wages next period to $\overline{w}_m$. This increase in wages implies that for young adults the cost of education is unchanged but the return has risen. In the appendix we show that whenever

$$\frac{\tau^x}{0.5b(1-\gamma)} < \frac{\overline{w}}{\underline{w}}$$

young adults will spend a fraction of time $x = 0.5/\tau^e$ in education. That is, when the increase in wages due to the tariff is sufficiently high, the cohort of individuals who are young adults when the tariff is adopted will experience an increase in the future wage rate and hence invest in education beyond what their parents gave them. As a result the tariff can lead to a temporary increase in education, with the human capital of this group of individuals being $h(e_{t+2}) = \beta e_{t+2}^{\theta}(1 + bx_t)$ and thus higher than that of both previous and latter generations.

The model hence implies that an increase in the tariff on agricultural goods that raises the agricultural wage has the following effects:

- parents reduce the educational investment per child, the effect being stronger the larger is the share of the population employed in agriculture;
- fertility increases, the effect being stronger the larger is the share of the population employed in agriculture;
- in the transition period, young adults invest in education themselves, implying that for some generations educational attainment may increase.

4 Econometric specification

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

$$F_{it} = \alpha_0 + \alpha_1 S_i * M_t + \delta_{1i} t + \delta_{2i} t^2 + \epsilon_{it}, \quad (8)$$

$$E_{it} = \beta_0 + \beta_1 S_i * M_t + \delta_{3i} t + \delta_{4i} t^2 + \upsilon_{it}, \quad (9)$$

where F_{it} and E_{it} are respectively fertility and education in department i at time t, 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. The coefficients δ_{1i} to δ_{4i} capture the impact of district-specific time trends affecting fertility and education.[12] Unified growth 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 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 fertility, the first one takes the form

[12] We do not introduce a district fixed-effect because it is captured by the district-specific time trend.

$$F_{it} = \alpha_0 + \alpha_1 S_i * M_t + \alpha_2 S_i * M_t * Exp_t + \delta_{1i} t + \delta_{2i} t^2 + \epsilon_{it}, \tag{10}$$

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. An alternative specification, based on Wolfers' analysis of divorce laws, allows for a different impact of the tariff in different years, that is,

$$F_{it} = \alpha_0 + \sum_{k \geq 1} \alpha_k S_i * M_t + \delta_{1i} t + \delta_{2i} t^2 + \epsilon_{it}. \tag{11}$$

This specification allows for greater flexibility when estimating the impact of the policy. It allows, for example, for the possibility that there is little impact immediately after the introduction of the tariff while fertility norms adapt to the new regime.

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

$$E_{it} = \beta_0 + \beta_1 S_i * M_t + \beta_2 S_i * M_t * Exp_t + \delta_{3i} t + \delta_{4i} t^2 + \upsilon_{it}, \tag{12}$$

$$E_{it} = \beta_0 + \sum_{k \geq 1} \beta_k S_i * M_t + \delta_{3i} t + \delta_{4i} t^2 + \upsilon_{it}. \tag{13}$$

Recall that the model predicts that for individuals who were mature at the time of the shock, the tariff increases their educational attainment. We will hence estimate these equations for different age groups allowing β_1 and β_k to differ depending on whether we consider the enrolment rates of children or of young adults.

5 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' through 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 three sources to compile our data on education and fertility. The first is the *Annuaire Statistique de la France*, from which we have regional data on live births, total population, and the number of students enrolled in primary education. 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. Lastly we use data concerning army conscripts. At the time, all 20-year-old men had to report for military service, and a number of individual characteristics, including educational attainment, were recorded.[13] The source are the *Compte rendu sur le recrutement de l'armée*, where data on those reporting for military service was collected in a consistent way at the department level from 1850 up to 1912.

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, as proposed by Van de Walle (1974) and Bonneuil (1997).

Our main measure of educational attainment comes from the army data. We focus on the proportion of potential recruits that can at least read and write. An alternative would have been to consider the share of those with a primary education degree, but these were still a very small proportion of the population even in our last sample year (less than 5% of 20-year-old men have such a degree in 1912). These data have advantages and disadvantages over more standard measures. Its main advantage is that because education is measured at age 20, it captures completed education[14] and deals with the possibility, not uncommon in that period, of an individual receiving basic education well into his teens. We use the data for the years 1872 to 1912, which corresponds to individuals born between 1852 and 1892. The last cohort that we consider was hence born on the year in which the tariff was introduced, and could have received primary education over the period 1898 and 1905 (i.e. aged 6 to 13) or latter. That is, our sample consists of individuals presumably unaffected by the tariff, say those who were 14 or older (i.e. born in 1878 or earlier), and individuals for whom the tariff is likely to have had an impact in their level of education, those under 13 years of age (i.e. born between 1879 and 1892).

These data have two major drawbacks. The first is that women are not in the sample, and 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 fertility, this may have kept more girls at home to help with household chores and

[13]These data have been previously used, amongst others, by Banerjee, Duflo, Postel-Vinay, and Watts (2010) who look at the effect of income shocks on health.

[14]Some individuals may study after the age of 20 years is they obtain a higher education degree. However, the fact that we focus on lower levels of educational attainment makes this possibility irrelevant for our purposes.

caring for younger siblings. A second concern is that the army educational data does not cover the entire period over which we would expect the tariff to have an impact. For these reasons we also consider enrolment rates in primary education, using a measure that includes both public and private education. 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.[15] The data are available separately for all students, boys and girls, so we compute both overall and gender-specific enrolment rates. To obtain enrolment rates for those in the relevant age group we use the population aged 6 to 13, which is available on census years (1881, 1886, 1891, 1896, 1901, 1906), hence the last observation includes individuals born in 1900, i.e. 8 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 enrolment 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 enrolment of those aged between 6 and 13 years as a share of the total department's population.

The number of students enrolled in primary education outside the standard age group (6 to 13 years) can be substantial, amounting to between 35 and 45% of those enrolled in some departments. We therefore construct two additional measures of enrolment: the first is the overall number of students enrolled the total population, the second is those enrolled who are outside the 6-13 age group over the total population.

We start our sample in 1872 and if possible we compile data up to 1913, yielding a 42-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 districts. Four observations are missing for *Meurthe et Moselle* between 1872 and 1875, as the district was a merge of the two remaining parts of former districts 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 completed education, we have observations on only 40 years, yielding a total of 3400 observations[16], while for fertility and enrolment rates the quinquennial availability of censuses reduces our sample to around 500 observations.

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

[16] The two missing years are 1913, for which we have no data, and 1878, which we have removed from the sample because of inconsistencies for various departments in the data for that year and previous and subsequent observations.

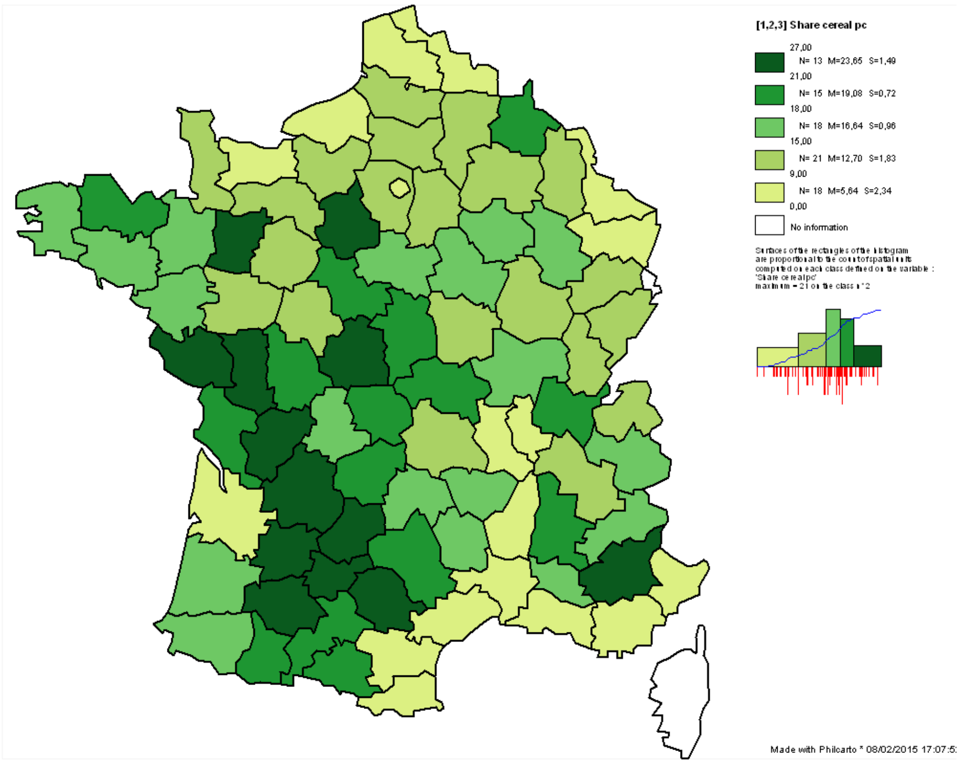

Figure 3: Employment share in local production across French districts in 1892

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 comes from Van de Walle (1974) and Bonneuil (1997).

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 fertility 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 2 presents some descriptive statistics. *Meline* is the interaction term between the share of employment in cereal production and the dummy taking a value of one from 1893 onwards and zero for earlier years. As we can see in the table, cereal production was an important activity in France. Its share of employment averages 14.6%, and varied between 26% and 0.07%, with Lot, Tarn et Garonne and Dordogne being the districts with the highest shares and Seine that with the lowest. Note, however, that not all districts 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 but whose climate is not suitable for cereal production. Figure 3 represents the spatial distribution of the share of employment in cereal production. Both birth rates and fertility rates are high although declining throughout the period, when the average in the sample being 92 children per thousand women. The literacy of men measured at age 20 is high, with an average of 91%, but its variance is large too, with some districts exhibiting rates of 56% and others having a fully literate population.

6 Empirical results

6.1 Fertility

Table 3 reports the results for birth rates. The first column simply includes a 0-1 dummy starting in 1893 which is interacted with the share of employment in cereal production, as well as a department-specific linear time trend. The effect of the dummy is positive and highly significant, indicating that protectionism increased birth rates in those departments with a higher share of cereal employment. The second column considers the impact of the time during which the policy has been in place (exposure) and finds that the effect grows over time. Column 3 presents the most flexible specification, based on equation (11), which allows for differential effects every three years, and indicates that the effect on birth rates increases over time, rapidly in the first decade and more slowly afterwards. This seems to imply that households adapted their fertility gradually in response to the change in the relative return to education. The next three columns estimate those specifications including both a linear and a quadratic district-specific time trend. Coefficients have the same sign and significance, and are somewhat larger.

Table 4 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 interpolated the female population to obtain annual fertility rates. Results using only census years are reported the appendix table 9. The results are consistent with those obtained with birth rates: the interaction between the tariff and cereal production has a positive and significant coefficient and so does the term in which we take into account the number of years of exposure to the policy. Columns 3 and 6 report regressions based on equation (11). Interestingly, we find that the effect increases dramatically after the first three years, as well as between year 6 and year 9, to then stabilize (even decline in the case of a linear trend). The magnitude of these effects is large. In a department with 25% of the population employed in cereal production, i.e. the highest shares that we observe, the introduction of the tariff increased the fertility rate by 8.8 children per 1,000 women, and the average increase across all districts is 5 children per 1,000 women.[17] These figures are equivalent to 50% and 30% of the standard deviation of fertility. As we have discussed, this was a period of declining fertility 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 fertility that had been taking place since the late 18th century. Using the formulation in column 3 (since the linear trend is easier to interpret), we find that the combination of the time trend and the tariff implies that the latter offsets the time trend after 6 years, after which fertility increases. It is only 14 years after its introduction that the fertility rate returns to its 1892 level.[18] In other words, the tariff implied a 14-year delay in the reduction of fertility.

6.2 Education

Consider now the effect on education. Table 5 presents the results for enrolment rates, defined as the number of students registered in primary education over the relevant age group (6 to 13 year-olds). We report results for all children, for boys only and for girls only since, as we have argued above, the effect could be different across the sexes.

For each dependent variable we use two specifications, one simply including the Méline tariff interacted with cereal employment, and another that allows for a different effect in years four, nine, and 14 after the tariff's introduction (these being the census years for which we have data on population by age). The last observation is hence for 1906 and includes individuals born between 1893 and 1900, i.e. up to 8 years after the tariff was introduced. The coefficient on our variable of interest is negative and significant in all specifications, and we find no statistically significant difference between boys and girls. There are two possible interpretations for the latter result. If cereal production were not gender-biased in France, the tariff would have the same impact on the relative returns of male and female education. Alternatively, if it were mainly males that worked in the cereal sector, two offsetting effects could be in operation: boys' education fell due to a change in its relative return, while girls were kept out of school in order to help in a household where there were now more younger siblings to care for.

The magnitude of the effect is substantial: for a 15% employment rate in cereal production, the tariff reduces enrolment rates by 3.4 percentage points, which amounts to almost 60 percent

[17] We obtain these effects by multiplying the coefficient of the tariff times the departments' cereal share.
[18] These calculations use a common time trend estimated on pre-treatment data.

of the standard deviation. These effects are very large when we compare them to the evolution of enrolment rates over time: over the decade prior to the introduction of the tariff, the enrolment 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, while the effect is insignificant for year 14.

Note that the coefficient on Méline in equation (1) is not the average of the three coefficients obtained when we allow for differential effects. 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. Equation (2) implies an average effect of -12.77, which is about half of that obtained when we impose a constant impact of the tariff over time. These differences indicate the importance of allowing for different impacts of a policy over time, as argued by Wolfers (2006). [19]

One problem with the data on enrolment rates is that primary education registries indicate that a substantial fraction of students are older than 13. Our model indicates that the impact of the tariff on education may vary depending on the individual's age. We hence consider separately the number of pupils aged 6 to 13 and those aged over 13. Since we do not have the age range for the latter group, we construct enrolment rates defined as the number of pupils over the total population. The results are reported in table 6. The first two columns consider pupils of all ages and find a negative effect except for the last census year (1911). The 1911 census does not report population by detailed age groups, column three runs the same regression dropping that sample year. Columns 3 and 4 report results for the 6 to 13 age group. The tariff reduces enrolment of this age group in high cereal-producing districts, with the effect increasing over time and being significant in all periods. The last two columns of the table examine the enrolment rate of those older than 13, and find an increase in educational attainment in the first decade after the introduction of the tariff. These results support the idea that income effects led young adults to increase their human capital after the policy was introduced.

To further explore differences in educational attainment across age groups, we consider the data concerning military recruits, which has the advantage of giving us information on completed education. The disadvantage of these data is that it consists mainly of individuals born before the introduction of the tariff. The first specification in table 7 allows for a different effect depending on the time over which the policy has been in operation. The years immediately following the

[19] Table 10 in the appendix reports the same regressions as those in table 5 but without the department specific time trend, indicating that in this case the average effect is the same whether we run a regression with only a policy dummy or with differential effects.

introduction of the tariff (years 1 to 3) exhibit a positive coefficient, indicating that for those young men turning 20 between 1893 and 1895 educational attainment increased. For the next two groups (men turning 20 between 1896 and 1901) we find a negative but insignificant coefficient, probably the result of offsetting positive and negative impacts. For all younger generations, the coefficient on our policy variable is negative and becomes larger over time. For those born in 1893-94, the impact of the policy amounts to a reduction of the fraction of young men who can at least read and write of 5 percentage points in a district with the average employment share in cereal production. In contrast, the positive effect for older generations is weak, increasing educational attainment by the 0.6 percentage points for a district with average employment.

Column 2 examines the effect of exposure and finds a negative coefficient, as expected. The next six columns consider groups of different ages. We start by examining the effect of the tariff on individuals that were 9 or 10 when it was introduced, and then consider those that were 11 or 12, and so on up to 20. For the first two groups we find a negative effect of the tariff, the coefficient is insignificant for those aged 13-14 and 15-16, and becomes positively and significant for those that were 17 or 18 in 1892.

7 Conclusions

This paper examines how an economic shock affects education and fertility decisions in order to test the validity of the quantity-quality trade-off that is a cornerstone of Unified Growth Theory. Our identification strategy relies on a major 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.

In order to test these predictions, we use data on French districts for the period 1872 to 1913 and compute each district's employment in cereal production just before the introduction of the tariff. Our identification strategy is based on the fact that the Méline tariff had a differential effect across districts depending on the share of cereal production in employment. Four outcome measures are used: fertility rates, birth rates, enrolment in primary education, and the educational attainment of army conscripts (20-year-old males). We find that, in line with the model, fertility and birth rates increased in districts where cereal production was important, while both measures of educational attainment fell.

These results contribute to the debate on the quantity-quality trade-off. Although there is substantial evidence of such a trade-off in the second half of the 20th century, critics of Unified Growth Theory claim that at the time of the fertility transition the number of children was not responsive to economic conditions, but rather 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 economic incentives. The main contribution of our paper hence lies in identifying how a major aggregate economic shock can impact households' education and fertility decisions.

Our paper also contributes to a vast literature in economic history on the effects of protectionism, which has largely focused on the wave of anti-free-trade policies that swept Europe in the wake of rising imports from the Americas. 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. Further work is needed to fully understand the full consequences of the tariff. In particular, given that fertility and education decisions can be to a large extent perpetuated, protectionism may have created productivity differences across districts that resulted in long term regional disparities. We leave this analysis for future work.

8 Tables

	N	Mean	Standard Deviation	Min	Max
Employment share in cereal	85	.1485415	.0611807	.0006763	.2614087
Meline	85	.0637092	.0837492	0	.2614087
Birth rate	3566	22.46258	3.940087	13.80399	35.4283
Fertility rate	3566	93.97346	17.19076	54.88631	175.0147
Literacy rate	3566	.8991501	.0850998	.4431624	.9973357
Enrolment rate, all	680	14.31238	2.250529	6.064898	23.21676
Enrolment rate, 6–13	595	11.34968	1.515979	5.171001	17.05617
Enrolment rate, not 6–13	595	2.962695	1.073554	-1.379808	7.743848

Table 2: Descriptive statistics

	(1) Meline	(2) Exposure	(3) Dynamic	(4) Meline	(5) Exposure	(6) Dynamic
Meline	4.395***			4.404***		
	(0.617)			(0.625)		
Exposure		0.534***			2.041***	
		(0.0670)			(0.185)	
Years 1-3			2.646***			3.669***
			(0.547)			(0.399)
Years 4-6			7.449***			9.283***
			(0.749)			(0.689)
Years 7-9			9.264***			12.09***
			(0.924)			(1.029)
Years 10-12			11.84***			15.84***
			(1.070)			(1.404)
Years 13-15			11.52***			16.89***
			(1.223)			(1.887)
Years 16-18			13.61***			20.53***
			(1.351)			(2.467)
Years 19-21			12.58***			21.24***
			(1.450)			(2.932)
Linear trend *departement	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *departement	No	No	No	Yes	Yes	Yes
Adjusted R^2	0.880	0.886	0.895	0.900	0.905	0.909
Observations	3566	3566	3566	3566	3566	3566

Standard errors in parentheses

Notes:

(1) The period of estimation is 1872-1913;

(2) Residuals are clustered at the departement level.

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3: Birth rate

	(1) Meline	(2) Exposure	(3) Dynamic	(4) Meline	(5) Exposure	(6) Dynamic
Meline	33.71***			33.73***		
	(4.429)			(4.484)		
Exposure		1.812***			23.46***	
		(0.335)			(1.832)	
Years 1-3			3.817			14.42***
			(3.348)			(2.122)
Years 4-6			30.65***			49.67***
			(4.446)			(3.558)
Years 7-9			69.81***			99.19***
			(6.952)			(7.641)
Years 10-12			88.18***			129.8***
			(7.098)			(9.582)
Years 13-15			80.17***			136.0***
			(8.308)			(12.71)
Years 16-18			60.95***			132.9***
			(6.781)			(13.57)
Years 19-21			29.47***			119.5***
			(7.595)			(15.39)
Linear trend *departement	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic trend *departement	No	No	No	Yes	Yes	Yes
Observations	3566	3566	3566	3566	3566	3566
Adjusted R^2	0.603	0.592	0.700	0.619	0.684	0.722

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses

Notes:

(1) The period of estimation is 1872-1913;

(2) Residuals are clustered at the departement level.

Table 4: Fertility rate

	(1) All children	(2) All children	(3) Boys	(4) Boys	(5) Girls	(6) Girls
Meline	-26.85***		-29.40***		-27.69***	
	(5.224)		(5.860)		(4.908)	
Year 4		-14.74**		-15.34*		-12.51*
		(5.435)		(6.151)		(5.369)
Year 9		-27.60***		-27.97***		-17.82*
		(6.147)		(7.072)		(6.878)
Year 14		4.040		8.309		19.67
		(8.322)		(9.567)		(10.17)
District trend	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.199	0.326	0.210	0.326	0.316	0.425
Observations	510	510	510	510	510	510

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses

(1) Enrolment and schooling population during years 1876, 1881, 1886, 1891, 1896, 1901, 1906;

(2) Results of regressions with girls and boys - noth shown here- are preserved when the time trend is removed;

(3) The number of pupils aged 6-13 is not available in 1911;

(4) Residuals are clustered at the *departement* level.

Table 5: Enrolment rate of pupils aged 6-13 over children in cohort 6-13

	(1) All ages	(2) All ages	(3) All ages w/o 1911	(4) 6–13	(5) 6–13	(6) Not 6–13	(7) Not 6–13
Meline	-2.113***			-3.321***		1.788***	
	(0.341)			(0.510)		(0.459)	
Year 4		-1.660***	-1.660***		-3.177***		1.517**
		(0.331)	(0.335)		(0.524)		(0.450)
Year 9		-2.300***	-2.300***		-3.786***		1.487***
		(0.592)	(0.600)		(0.607)		(0.393)
Year 14		-2.478*	-2.478*		-3.319***		0.841
		(0.940)	(0.953)		(0.810)		(0.516)
Year 19		-1.394					
		(1.167)					
District trend	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Adjusted R^2	0.706	0.714	0.705	0.575	0.577	0.276	0.281
Observations	595	595	510	510	510	510	510

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses

(1) Enrolment and schooling population are available for years 1876, 1881, 1886, 1891, 1896, 1901, 1906, 1911;

(2) The number of pupils aged 6-13 is not available in 1911;

(3) Column 1 & 2 differs from others by the the inclusion of 1911 data;

(4) Residuals are clustered at the *departement* level.

Table 6: Enrolment rate of pupils over district population

	(1) Dynamic	(2) Exposure	(3) Age 10	(4) Age 12	(5) Age 14	(6) Age 16	(7) Age 18
Years 1-3	0.0403**						
	(0.0141)						
Years 4-6	-0.0110						
	(0.0254)						
Years 7-9	-0.0793						
	(0.0404)						
Years 10-12	-0.129*						
	(0.0548)						
Years 13-15	-0.238**						
	(0.0766)						
Years 16-18	-0.293**						
	(0.0966)						
Years 19-21	-0.370**						
	(0.119)						
Exposure		-0.0225**					
		(0.00662)					
Meline			-0.0586**	-0.0307*	-0.0101	0.0278	0.0704***
			(0.0178)	(0.0129)	(0.015)	(0.0183)	(0.0205)
Linear trend*dpt	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Quadratic t.*dpt	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3400	3400	3400	3400	3400	3400	3400
Adjusted R^2	0.882	0.878	0.877	0.877	0.877	0.877	0.878

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses

Notes:

(1) Information on educational achievement is available yearly between 1872 and 1912;

(2) The number in the heading of columns (3)–(8) refer to the maximum age of the boys when Meline was introduced; For example Age 18 means boys who were aged 18 or less when Meline was adopted, i.e. born after 1874

(3) dpt stands for departement;

(4) Residuals are clustered at the departement level.

Table 7: Educational achievement of 20-year old males

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

$$(1-\gamma)n_{t+2}Ey_{t+2}y_{o,t}(\tau^q+\tau^e e_{t+2})=\gamma c_t\left[q_{t+3}w_{at+3}+(1-q_{t+3})h(e_{t+2})w_{mt+3}\right], \tag{A.1}$$

$$(1-\gamma)n_{t+2}Ey_{t+2}Y_{ot}\tau^e=\gamma c_t(1-q_{t+3})w_{mt+3}h^{'}(e_{t+2}). \tag{A.2}$$

Dividing one by the other and using the expression for $h(e)$ we get (7) in the text. Rearranging (A.1) and using the expressions for c_t and Ey_{t+2}, we have

$$(\tau^q+\tau^e e_{t+2})n_{t+2}=\gamma\left[0.5+\frac{y_{y,t}}{y_{o,t}}(0.5-\tau^x x_t)\right]. \tag{A.3}$$

Note that whenever $x_t=0$, we have $y_{y,t}=y_{o,t}$ and (A.3) simplifies to (6).

Consider now the maximization with respect to x_t. Obviously, $x_t=0$ for those in agriculture. For those in manufacturing, U_t is monotonic in x_t implying that the optimal decision is either $x_t=0$ or $x_t=0.5/\tau^x$. Differentiating we have that $\partial U_t/\partial x_t>0$ if and only if

$$b\left[0.5-(\tau^q+\tau^e e_{t+1})n_{t+2}\right]\frac{w_{mt+2}}{w_{mt+1}}>\tau^x. \tag{C.1}$$

Suppose that wages are constant. Then, if $x_t=0$, we can use (6) to express this condition as

$$\tau^x>b(0.5-\gamma) \tag{A.4}$$

Thus if

$$(\tau^q+\tau^l l_{t+2})n_{t+2}=0.5\gamma \tag{A.5}$$

and wages are constant, then $x_t=0$ is an equilibrium at all points in time.

For $x_t=0.5/\tau^x$, we have $(\tau^q+\tau^e e_{t+2})n_{t+2}=0.5\gamma$, which allows us to write (C.1) as

$$b(0.5-\gamma)\frac{w_{mt+2}}{w_{mt+1}}>\tau^x. \tag{A.6}$$

If wages over the two periods are such that this condition is satisfied, then $x_t=0.5/\tau^x$ is an equilibrium and agents will invest in education as adults.

Consider now the allocation of labour across sectors. Labour market equilibrium implies $w_a p=w_m h(e)$. Since wages are equal to the marginal product of labour and assuming that $\alpha=0.5$, we have

$$ap^2L_m=L_a h(e). \tag{A.7}$$

Substituting for $L=L_m+L_a$ and defining $q\equiv L_a/L$, we get equation (5).

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 district 'Corsica' for data issue.

Demographic variables. The number of births, of female aged 15 to 50 and of the total of the population is available every 5 years, more precisely in 1872, 1876, 1881, 1886, 1891, 1896, 1901, 1906, 1911. The population figures were interpolated yearly using the average of the growth rate of the population between 2 censuses, except in 1912 and 1913 for which we extrapolate the average growth rate of the 1906-1911 period. We use the 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). Those data were digitized as part of the ICPSR project (https://www.icpsr.umich.edu/).

Education. We use two measures of education, the educational attainment of male at age 20 and the enrollment rate in primary schools.

Education level of military conscripts. The source is *Compte rendu sur le recrutement de l'armée* published by the War ministry and *Annuaire statistique de la France* published by the Trade ministry for years 1873–1885. The sources give an account of the level of literacy achieved by potential future conscripts of the army. With the 1872 law, every young men that just turned 20 was called for a literacy and medical testing (Heyberger 2005). The test was administered in each military district facilities. The literacy test was uniform on the territory. The results of the tests were published at the *département* level up to 1912. Starting in 1913 they were aggregated at the level of each army, which corresponded to a region of about a dozen of *département*). We drop year 1878 for consistency reason of literacy tests results. The way categories of educational attainment were constructed varies through time between 1872 and 1912, which lead to aggregate some of the categories. We measure literacy by aggregating all categories in which the young men at least read, write and count, which amount to them having acquired a primary education. Notice that this includes the number of high school graduates. However given that the average numbers of high school graduates averaged 21 per district in 1874 to reach only 72 per district in 1900, we decide to not construct a measure of secondary education.

School enrolment. Throughout the period, schooling was compulsory between age 6 and below age 13 but it was pretty common for older or younger children to attend a primary school. A non negligeable number of students attend private school and confessional school and we add the number of pupils of those schools to those of public schools. The number of high school students was usually very low in most *département*, which forbid to used 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 counted 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 8 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 came 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 district #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 8). 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.

9.3 Appendix 3

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

Table 8: Sources used to construct enrollment rates

	(1) Meline	(2) Exposure	(3) Dynamic
Meline	54.91***		
	(5.541)		
Exposure		1.548***	
		(0.418)	
Year 4			18.77***
			(4.600)
Year 9			94.57***
			(9.012)
Year 14			91.65***
			(10.23)
Year 19			25.49**
			(8.547)
Linear trend *departement	Yes	Yes	Yes
Adjusted R^2	0.557	0.520	0.685
Observations	763	763	763

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses

Table 9: Fertility rate - census years only

	(1) All children	(2) All children	(3) Boys	(4) Boys	(5) Girls	(6) Girls
Meline	-8.638**		-13.39***		-12.68**	
	(3.019)		(3.453)		(3.981)	
Year 4		-11.98**		-16.49***		-18.59***
		(3.955)		(4.311)		(4.474)
Year 9		-23.47***		-29.69***		-26.95***
		(3.508)		(3.887)		(4.524)
Year 14		9.544**		6.010		7.503
		(3.413)		(3.973)		(4.486)
District trend	No	No	No	No	No	No
Adjusted R^2	0.027	0.169	0.047	0.164	0.038	0.141
Observations	510	510	510	510	510	510

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$; Standard errors in parentheses

(1) Enrolment and schooling population are available for years 1876, 1881, 1886, 1891, 1896, 1901, 1906;

(2) The number of pupils aged 6-13 is not available in 1911;

(3) Residuals are clustered at the *département* level.

Table 10: Enrolment rate of pupils aged 6-13 over number of cohorts 6-13

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.

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

Bairoch, P. (1965). Niveaux de développement économique de 1810 1910. *Annales: Économies, Sociétes, Civilisations*, 1091–1117.

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 a 1985. *Annales: Économies, Sociétes, Civilisations 44*(2), 317–353.

Banerjee, A., E. Duflo, G. Postel-Vinay, and T. Watts (2010). Long-run health impacts of income shocks: Wine and phylloxera in nineteenth-century France. *Review of Economics and Statistics 92*(4), 714–728.

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: Librairie 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.

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

Chanut, J.-M., J. Heffer, J. Mairesse, and G. Postel-Vinay (1995). Les disparités de salaires en France au XIXe siecle. *Histoire et Mesure 10*(3–4), 381–409.

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

Clark, G. and N. Cummins (2015). The child Quality–Quantity tradeoff, england 1750–1880: Is a fundamental component of economic theory of growth missing? Mimeo.

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

Diebolt, C. (2015). Reflections on causation with special reference to cliometrics. Mimeo.

Diebolt, C., T. Mishra, and F. Perrin (2015). Clio's role for economic growth: New findings on the quantity-quality tradeoff in 19th century France. Mimeo.

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: Presses Universitaires 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.

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 D. N. Weil (1999). From malthusian stagnation to modern growth. *American Economic Review 89*(2), 150–154.

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.

Golob, E. O. (1944). *The Méline tariff: French agriculture and nationalist economic policy.* New York (NY): Studies in History, economics and public law–AMS press.

Grantham, G. W. (1993). Divisions of labour: Agricultural productivity and occupational specialization in pre-industrial france. *Economic History Review 46*(3), 478–502.

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

Heyberger, L. (2005). *La r'evolution des corps*. Belfort and Strasbourg: Presses Universitaires de Strasbourg and UTBM.

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

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.

Levasseur, E. (1911). *Histoire du commerce de la France*. Paris: Librairie nouvelle de droit et de jurisprudence.

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

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 (NJ): Princeton University Press.

O'Brien, P. and C. Keyder (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.

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.

Postel-Vinay, G. (1998). *La terre et l'argent. L'agriculture et le crédit en France au début du XXe siecle*. Paris: Albin Michel.

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, womens 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.

Simiand, F. (1931). *Le salaire, l'évolution sociale et la monnaie*, Volume 3. Paris: Felix Alcan.

Tena-Junguito, A., M. Lampe, and F. Tâmega Fernandes (2012). How much trade liberalization was there in the world before and after Cobden-Chevalier? *Journal of Economic History 72*(3), 708–740.

Uebele, M. (2011). National and international market integration in the 19th century: Evidence from comovement. *Explorations in Economic History 48*, 226–242.

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

Weber, E. (1976). *Peasants into Frenchmen: The Modernisation of Rural France, 1870–1914*. Stanford (CA): University of California Press.

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

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*. Paris: C. Naud.