

Industrialization as a Deskillling Process?

Steam engines and Human Capital in XIXth Century France

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Abstract:

Was technological progress conducive to human capital accumulation or, on the contrary, was industrialization a deskilling process? This issue is currently being revisited. The prevailing view has been that technological progress at the early stage of industrialization was negatively correlated to human capital accumulation. But recent literature on the issue gives rise to contrasting views regarding the validity of the deskilling hypothesis.

This article contributes to the debate by providing new evidence on the effect of the French industrialization process on human capital accumulation throughout the nineteenth century. It differs from the seminal work of Franck and Galor (2016) who consider the very first stage of industrialization as established. The novelty of our research is to explore the deskilling hypothesis for the subsequent stages of the process and to introduce a disaggregated industrial sector-based perspective. Our analysis builds upon a new comprehensive dataset providing an exhaustive assessment of the diffusion of steam technology in France at the regional level over the 1839-1913 period.

Keywords: Industrialization, Human Capital, Education, Steam Engine, France

JEL classification: N33, O33, O14, J24

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Summary:

A consensus surrounds the idea that, in the contemporary period, technological change is skill-biased, that it favours skilled over unskilled labor. In contrast, up until very recently, the view that the process of industrialization was deskilling in the first phase of industrialization has prevailed (see for instance Nicholas and Nicholas 1992, Mokyr 1993, Mitch 1999). Supporting this view, Goldin and Katz (1998) conclude as well that the transition to technology-skill complementarity took place in the early twentieth century, the technological shift from steam power to electricity being notably at the origin of the increase in demand for skilled labor. Very recently, renewed attention has been paid to this issue and gives rise to contrasting results.

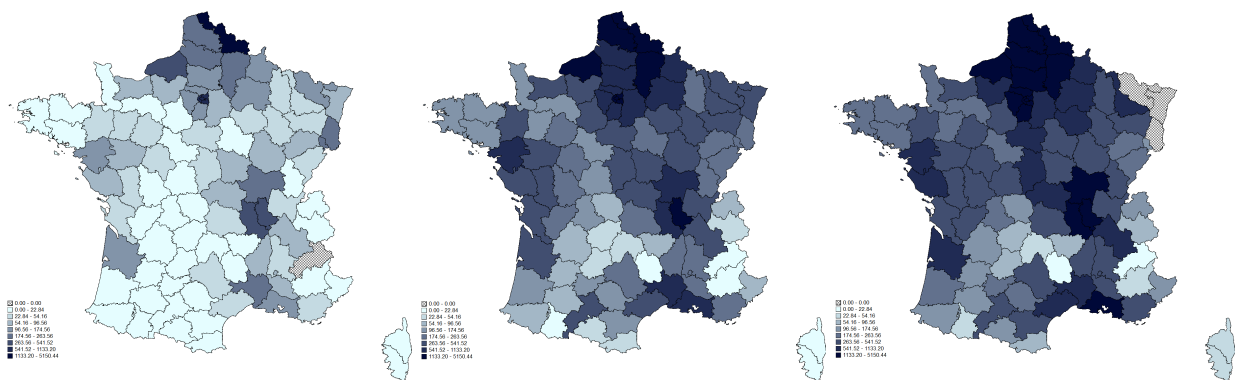
Feldman and Van der Beek (2015) claim that technological progress was conducive to skills acquisition in eighteenth century England by showing that the number of apprentices and their share in the cohort of the fifteen year-olds increased in response to inventions. Franck and Galor's (2016) analysis also supports the 'skill-biased technological change' hypothesis for the French case in the early nineteenth century. For DePleijt, Nuvolari and Weisdorf (2016), the effect of industrialization on human capital is ambiguous. They show that technological adoption was skill demanding since it improved the average skills of workers. But they also highlight that adopting new technologies was not conducive to higher elementary education (approximated by literacy rates and enrolment rates). Contrastingly, DePleijt and Weisdorf (2017) show a large decrease in average skills in agriculture and industry from the end of the sixteenth century to the beginning of the nineteenth century in England. They claim therefore that deskilling globally occurred with technological progress, despite a modest increase in the share of 'high-quality' workmen. This finding gives support to the view, already defended by Mokyr (1990, 2005) and, more recently for the French case by Squicciarini and Voigtländer (2015), that upper-tail knowledge played a prominent role in early industrialization.

The aim of this paper is to contribute to this open debate. We provide analysis of the effects of the French industrialization process on human capital accumulation

throughout the nineteenth century. It differs from the seminal work of Franck and Galor (2016) who consider the very first stage of industrialization as established. The novelty of our research is to explore the deskilling hypothesis for the subsequent stages of the process and to introduce a disaggregated industrial sector-based perspective. Our analysis builds upon a new comprehensive dataset providing an exhaustive assessment of the diffusion of steam technology in France at the county level (the department). This dataset gathers information on the number of steam engines used in industries, the number of steam appliances, but also the number of industries in each French department that uses steam technology and the steam power in use (horsepower).

Figure 1: Number of steam machines used in industries

(a) Machine average 1840-1864 (b) Machine average 1865-1889 (c) Machine average 1890-1909



As a first step, we use this original statistical information to explore the patterns of the steam engines diffusion across French departments over the 1839-1913 period. Galor and Franck (2016) evidence a steam engine diffusion from Fresnes-sur-Escaut in 1839-1847. We exploit the time dimension of the data to test the robustness and persistence of this finding on subsequent stages of industrialization. Estimation results using panel data from 1839 to 1913 support that the number of steam engines used in French industries is significantly negatively correlated to the distance between the administrative centre of each department from Fresnes-sur-Escaut. We also investigate the possible effects of different industrial sectors, namely relative to textile, extractive and metal industries, on the adoption of steam engines. Our results show a strong and positive relationship between the number of steam engines in use and the weight of the metal industry in the department. Since steam engine is considered to fill the

characteristics of 'General-Purpose Technologies' (Rosenberg and Trajtenberg 2004) and thus not specifically suited to the activities of the metal sector, we investigate the mechanisms that possibly lie behind this relationship. We try to assess whether it reveals a higher capacity of the metal sector to adopt technological innovation and how it is linked with human capital endowment at the department level.

As a second step, we examine the effect of steam technology adoption on human capital. Our empirical strategy follows the one used in DePleijt, Nuvolari and Weisdorf (2016) and Galor and Franck (2016). We rely on a 2SLS analysis, using the distance from Fresnes-sur-Escaut to instrument the log of the number of steam engines.

In order to test the deskilling hypothesis, our approach relies on the exam of the French educational landscape in the nineteenth century and on the analysis of the pathways through which human capital was accumulated in nineteenth century France. We notably include in the empirical analysis adults courses and upper primary teaching, which developed, according to the historiography of nineteenth century France, as a response to the perceived economic needs of the period.

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