

**ERC Advanced Grant 2017  
Research proposal [Part B1]**

**Did elite human capital trigger the rise of the West? Insights from a new database of scholars from European universities and academies**

**UTHC**

**David de la Croix**

**Université catholique de Louvain**

**Proposal duration in months: 60**

**Field: SH1\_14 Quantitative economic history; institutional economics; economic systems**

Our aim is to determine whether elite knowledge and upper-tail human capital (UTHC) were critical in triggering the rise of the West. We propose to build a database of a large sample of university professors and members of academies in Europe over the period 1200CE-1800CE. This database will integrate and harmonize existing university-specific databases, include the information available from published books and electronic resources, and be completed by in-depth research in universities for which the data is not available. To measure the quality of scholars, we will match this database with the existing databases of published books and historical biographies.

Second, we will exploit the variation in the density, composition, and quality of the UTHC across time, space, fields, and the variation in longevity and migration of the UTHC to measure the correlation between the UTHC and the adoption of new techniques and better institutions, and the development of literacy, numeracy, and urbanization. Causal identification will rely on both instrumental methods and exogenous variations in the creation of universities and in the density of the UTHC.

Third, we will develop and test a new theory of the complementarity between elites and artisans, to determine the incentives under which an economy will rely on applied codified knowledge in addition to tacit knowledge, thus speeding up the diffusion of ideas. A second, new theoretical model will be devoted to revealing the dynamic interactions between conservative and modern forces within universities and learned societies; the key trade-off here is between keeping the old thinking (satisfying vested interests) and developing new approaches and fields, letting scholarly elites change culture and promote development. Moreover, with our data, we measure the importance of these theoretical mechanisms and how the UTHC and society interact.

Finally, the resulting database will be made openly available to researchers and the civil society.

**Section a: Extended synopsis of the scientific proposal**

The “Rise of the West” (Mc Neil, 1963) unleashed an economic and social transformation which had never been experienced before by any society since the Neolithic Revolution. What happened around 1800 was deeply rooted in history. Many authors have searched for the profound causes of the “Rise of the West”: Landes (1998), Maddison (2001), Clark (2007), Mitterauer (2010), Galor (2011), and Mokyr (2009, 2016), among others. For most of them, self-reinforcing dynamics of technological progress played a key role. The outstanding debate concerns the key forces that made these virtuous circles possible.

The degree to which the long march of history is driven by a “vital few”, such as emperors, religious leaders, and great inventors is disputed. It is particularly controversial as far as technological progress is concerned. Were individuals such as Newton, Galileo, Kepler, and Vesalius really needed for the Industrial Revolution to finally take place? Is it true that, as Mokyr (2016) writes, in a market economy, it is the few who drag along the many? Is it true that, even if the role of overall human capital as an engine of growth (Cervelatti and Sunde (2005), Galor (2011)) remains disputed, its upper tail was key?

In this project, the objective is **to analyze quantitatively whether elite knowledge and upper tail human capital (UTHC) were critical to triggering the rise of the West**. The current literature, mostly based on qualitative approaches, can be grouped into three competing views. As far as industrialization is concerned, one view leans towards considering innovation as driven essentially by the UTHC – those scientists and mathematicians who pushed the envelope of propositional knowledge, which was then applied. For example, Mokyr (2002) suggests that a small group of at most a few thousand people became the main actors who showed the way to the Industrial Revolution. This view is shared by Jacob (2014) and Wootton (2015). The opposite view sees innovations as driven by artisanal knowledge, which improves over time through learning-by-doing and the occurrence of improvements through trial-and-error and serendipity. Formal, codified knowledge plays no role in this model. For example, pre-modern cathedrals were built with heuristic rules of thumb rather than by using pre-established plans and engineering calculations (Epstein, 2013). This view suggests that the seedbed of revolution rests with craftsmen rather than scholars, in university-less London rather than Oxford, or in Lyons rather than Paris (Porter 1996). The rising artisanal skill levels and the high level of innovation among the most sophisticated craftsmen alone are seen as having fostered the Industrial Revolution, without the help of elite, codifiable knowledge and formal science. A third approach promotes the importance of the indirect effect of elite knowledge. The latter triggered a cultural change in the period 1500-1700, which made the population, or at least part of it, ready to invent, accept, and promote the modern world. This thesis is defended in the recent book by Mokyr (2016): the Enlightenment in the eighteenth century was pivotal in driving economic growth in the nineteenth century, but it was not a mass phenomenon. *“It was an Elite phenomenon, confined to intellectuals, scholars, ...”* From a theoretical point of view, this view resembles the threshold externality story of Azariadis and Drazen (1990), in which a take-off occurs once a certain threshold in human capital is reached.

There are currently no global quantitative analyses of the historical effect of the UTHC on the dynamics leading to the Industrial Revolution. Recent country-level studies include Dowey (1916) for England, Squicciarini and Voigtländer (2015) for France, and Dittmar and Meisenzahl (2016) for Germany. Squicciarini and Voigtländer (2015) show that the number of people who subscribed to Diderot’s and d’Alembert’s Grande Encyclopédie in eighteenth century France predicts economic development later on, both at the city and the county level. Dittmar and Meisenzahl (2016) show that German cities, which adopted better institutions following the Reformation, displayed more people recorded as famous in the German biography database and grew faster at the same time. Although very innovative, these studies are confined to either France or Germany and rely on a limited time frame. By aiming at a European view over a 600 year period, our project answers the call to arms of the History Manifesto (Guldi and Armitage 2014), arguing in favor of the revival of a more global and *longue durée* analysis after a period of comparative retreat among professional historians (which is found in economics too).

To take the debate to such a level, we propose, in a first step, to build a database of a large sample of university professors and members of scientific academies in Europe from the creation of the first universities (c. 1200) to the Industrial Revolution (c. 1800). The database will eventually be used to develop new theory and undertake empirical studies that will be used in combination with each other. This database will be unique, as it will link scholars to the places where they actually worked and interacted (universities and academies). The current state of the art either uses databases on a selection of people from the elite (often mixing scholars in with a large group of famous or noble people), or on university institutions, like Cantoni and Yuchtman (2014), or on the

production of books, like Baten and van Zanden (2008), who use data on book production as a proxy for the development of human capital.

Creating such a database will enable us to exploit the variation in the composition, density, and quality of the UTHC across time, space, and key fields **to establish the nature and extent of the correlation between the UTHC and the adoption of new techniques and better institutions, the development of cities, and the rise in literacy and numeracy at the regional level.** It will also make it possible to perform causal identification by exploiting exogenous variations in the creation of universities and in the density of the UTHC. Yet, before going into the exploitation of the database, let us discuss the feasibility of the project.

Over the period 1200-1800, the number of **universities in Europe** rose to nearly two hundred (Frijhoff, 1996). This alone stresses the relative risk of the project, as we do not fully control ex ante how much time will be needed to gather a significant amount of data. However, obtaining coverage rich enough to evaluate and test significant variability across places, times, and fields, and to identify mobility patterns, would already be a substantial achievement. We will limit the database to universities active during the period 1200-1800, and it will include all professors in these universities active before 1800. We will start with Northern Europe, where a wealth of information is already available. We can quickly (in a few months) establish data for 10,000 professors by integrating and harmonizing existing sources within a new structure that will make new lines of analysis possible. Indeed, for some universities, such as Groningen, Leiden, Leipzig, Rostock, and Utrecht, the list of professors has recently been established and has been made available on the web. This shows the interest of these universities themselves in looking at their past cultural and economic impact in a more systematic way. Some universities have not yet established the list of their professors, but some authors, sometimes a century ago, independently published a biography of them. This is true in Cambridge, Jena, Oxford, and Strasbourg, for example. A third category of universities has neither a ready-to-use website nor a published biography of their professors. Here, we will need to undertake in-depth research, combining knowledge from books written on their history with material based on their archives, such as *matricula* (persons registered at a given university) and *chartularia* (containing transcriptions of original documents related to the historical events at a university). Based on archive inventories, we will also occasionally get data from specific archives (for example, on nominations to courses).

Once the intermediary goal of reaching 10k scholars is achieved, we will then proceed in two directions (1) completing the database further by increasing the number of scholars covered from the core group of universities, covering Europe beyond the hexagon bounded by Glasgow, Copenhagen, Krakow, Naples, Marseilles, and Plymouth (suggested in Ferguson (2011) to cover the key figures of the Scientific Revolution), and (2) enriching the database by incorporating data from other existing sources (such as data on books published). Reaching this intermediate stage may require adjustments in our project planning, by either broadening or reducing the space covered by the project.

Over the course of six centuries, medieval universities preserved a recognizable identity, including their independence from Church and State (Ashby, 1963). Each one went through phases of glory and decadence. They were sometimes accused of being an obstacle to modernity or of being completely irrelevant for the Scientific Revolution, as exemplified by Manuel (1968) about Cambridge and Newton: “*an intellectual desert, in which a solitary man constructed a system of the world*”. Examining the evidence for England more closely, Porter (1996) still finds that a high proportion of the great names of early modern science made their career as professors in university employment. An exodus of scientists from the universities is still well documented (Pedersen, 1996). Hence, universities only cover a subsample of the relevant scholars and *litterati*. Hopefully, we will find many of them in the list of members of the **Scientific Academies**. Initiated in Florence, the movement gained momentum in Northern Europe with the creation of the Académie Française (1635) and the Académie des Sciences (1666), the Royal Society of London (1662), and the Academia Leopoldina (1677). These academies formalized in a way the Republic of Letters, which linked together small bands of intellectuals through a very effective network of publications. This transnational organization is viewed by Mokyr (2016) as a key engine of cultural change. Gathering information on all members of these academies since their inception is a feasible task as the information is readily available from the web. Merging all these records and adding the members of the learned societies to the core database, paying special attention to their fields, will enable us to capture the shifts in focus following the humanistic revolution.

An important aspect of the core database will be the inclusion of data on fields of study. When universities emerged, there were four faculties (arts, law, medicine, and theology), each serving a particular sector of society. Later on, when society's needs increased, some universities expanded the realm of their expertise, while others did not, thus becoming increasingly obsolete. Humanism, directly followed by Protestantism, induced an expansion of the faculty of arts. Encoding properly the field of scholars will make it possible to quantify and map these changes in a very precise way, and also to identify the ability of various universities to adjust to and influence the changing world.

To enhance the power of the core database, we will enrich it by integrating several elements. Most importantly, we will add a measure of the quantity and quality of the output of scholars and establish their migration patterns. **We propose to measure the quality and influence of institutions (universities and academies) in different ways: the book production and influence of their members; the diversity of their members in terms of geographic origin; and the mean distance with respect to the birth place of their members.** Data on books have been collected and harmonized by Buringh and van Zanden (2009) and by Chaney (2017) from various sources. As far as migration is concerned, the mobility of students and professors has been a key aspect of European universities since their inception. Until the seventeenth century, all universities taught in Latin, which facilitated *peregrinatio academica*, or academic pilgrimage (Rydder-Symoens, 1992). As our proposed database will integrate records from a cross section of universities and academies, it will enable us to identify the patterns of migration for scholars in a systematic way, well beyond what is presently known for only the most outstanding individuals (for example, Desiderius Erasmus tutored in Paris, then Louvain, then Cambridge, before moving to Italy). The identification of these patterns matters to map the dynamics of the diffusion of scientific and technical knowledge. In addition, we will be able to measure the quality and attractiveness of universities by building an index of birthplace diversity along the lines suggested by Alesina, Harnoss, and Rapoport (2016).

Compared to the existing literature on famous people using big data, the proposed database will have unique advantages. Unlike most historical demography (see Cummins 2014 for the *apogée* of this discipline), it will not focus on noble families, which might not be prime depositors of upper-tail human capital. Compared to generalist studies of famous people (see de la Croix and Licandro 2015) or of authors (Chaney 2017), we will target one precisely defined group, for whom we know the nomination date (hence, the population can be computed) and the migration patterns. Finally, compared to studies based on electronic resources (a fascinating new study is by Gergaud, Laouenan, and Wasmer 2016), we will focus on a specific group, using much more thorough and reliable sources, while the migration patterns will be assessed by comparing samples from different universities.

I will now detail the way in which we intend to use the new database to answer our core research question. Yet, first, notice that once completed, the new database will be made openly available for use in a variety of ways by the scientific communities in economics, demography, and prosopography. It can be compared with other databases to deliver new insights. The database will also be available online for the civil society. Indeed, there is a great interest in many European universities in recording their history more systematically, as attested to by many university websites. More generally, the database can be used to further assess how intellectual elites interacted with society (still a very timely issue, with the rise and success of some anti-elite movements in this year 2017).

**The proposed database will first be used to establish to what extent the UTHC is related to growth and modernization.** The aspects of the UTHC we will focus on are: composition (by field and place of birth), density, quality and quantity of output, mobility, birthplace diversity, and longevity. The units of analysis will be the city and the region. A strength of our methodology will be the ability to observe where the scholars actually worked, which is not the case when one only knows the place of birth and the place of death. To measure outcomes, we will rely on existing sources, for example: Bairoch, Batou, and Chèvre (1988) built a database of city population for almost all cities in Europe that reached 5k inhabitants before 1850. City growth is often used as an indicator of economic vitality. DeLong and Shleifer (1993) built an indicator of whether cities were free or subject to the will of a prince. Beyond cities, Dittmar (2011) compiles information from three different sources on the adoption of the printing press during its infancy period (1450-1500). To measure regional development in terms of broad human capital, we can rely on numeracy indexes based on age heaping measures, as suggested by A'Hearn, Baten, and Crayen (2009). Literacy in the pre-industrial period can be measured by signatures on marriage registers. The integration of these sources will open up possibilities for radically new analyses of such issues, which have been considered separately until now.

The proposed database will be rich enough **to address the question of the existence of agglomeration externalities and peer effects, or, in other words, whether the presence of particularly productive scholars increased the productivity of other scholars around them.** We will thus challenge the external validity of Waldinger's (2012) result, who found no evidence of such effects on twentieth-century data, using the dismissal of scientists by the Nazi government in 1933 as a source of exogenous variation in the peer group of scientists staying in Germany.

On the demographic side, we will apply nonconventional methods (in economics), to identify characteristic statistical patterns in the migration of scholars. Taking inspiration from Schich et al. (2014), we will provide **(1) a macroscopic view of the history of scholars and universities in all parts of Europe, that were, or not, the crucibles of the Scientific and Industrial Revolutions, and (2) document the historical trends in the primacy of knowledge centers beyond the scope of specific events or narrow time intervals that historians usually restrict themselves to.** Moreover, the large number of observations, as well as the knowledge of the age at which each scholar entered the population at risk (their age at nomination), will allow us to properly compute the life expectancy of scholars, and to measure its standard error correctly. Life expectancy can be computed for different regions and time periods, and also correlated to outcome variables.

The composition and density of the UTHC are not, however, the whole story. Another, more subtle channel linking elites to outcomes is the contact time effect. In a world where face-to-face communication was essential for knowledge transmission and enhancement, the productive life of the elite had to be long enough to give them enough time to significantly affect their environment. A formal link between productivity growth and longevity is implicitly provided by Lucas (2009). In his model, people learn ideas from the people they meet. The more people they meet, the better they become. If they live long, they have more chances of becoming excellent, and they also provide many opportunities for other people to learn from them. This effect of longevity on growth might quantitatively be sizeable, and this justifies why several authors have tried to assess changes in the longevity of the elite before the Industrial Revolution (Cummins, 2014, de la Croix and Licandro, 2015). We will, however, be able **to go well beyond these studies, as we will know precisely where the scholars interacted and for how long.**

When exploiting the database empirically, we will have to address the issue of the endogeneity of the localization of human capital that many other researchers have faced before us. The literature has adopted several strategies to deal with this issue. One is to use instrumental variable techniques to isolate causal links. An alternative is to find a source of random variation, which modified the allocation of the UTHC without altering other relevant unobserved variables. The creation of universities itself can be seen in some cases as a natural experiment. Why there was no university in London until 1836, and why universities were sometimes founded later in more important cities are questions which remain a mystery for historians (Rüegg, 1992). Looking in detail into the history of each university will provide valuable information to identify the possible sources of exogenous variations. Persecution by the authorities is a surprising ingredient in the foundation of new universities. This is what happened in Cambridge, with masters and students fleeing Oxford following the execution of a few students upon the order of the mayor and the king (Verger, 1992). The same pattern was repeated in Paris in 1229-31, leading to the creation of universities in Orléans and Angers. The Great Schism between the Pope and the Emperor is considered to have played a major role in the creation of universities, and is treated as a natural experiment by Cantoni and Yuchtman (2014). Later, at the beginning of the modern period, the religious conflicts between Catholics and Protestants led to a major migration of skilled people (Scoville 1953), implying changes in the university landscape. The Huguenot diaspora and the migration to Prussia which followed the revocation of the Nantes edict is an example used in the literature (Hornung, 2014). One can also notice that several members of the French academies left after this revocation (but were still allowed to maintain written exchanges with their former colleagues, see Pederson (1996)). The decline of Louvain and the rise of Leiden in the Netherlands might also be evidence of a brain drain from the Spanish Brabant.

The possible link between UTHC and modernization goes through the adoption of new techniques and new institutions. To further understand the mechanisms linking the UTHC to technical progress, **we will develop a new theory of the complementarity between elite knowledge and artisanal techniques. We will also do this for the complementarity between elites and the adoption of enlightened institutions.** Notice that, to model productivity growth, we cannot rely on existing explicit models of endogenous technological progress built on R&D efforts by firms, following the seminal papers of Romer (1990) and Aghion and Howitt (1992). While

such models are useful to analyze innovation in modern times, their applicability to long-run historical change is doubtful, partly because legal protections for intellectual property became widespread only recently. Instead, we need to build a new model on the assumption that productivity growth is based on the exchange of ideas from person to person, and that new ideas cannot be protected and therefore spread rapidly.

Concerning the first complementarity, the existing literature assumes a sort of substitutability between artisans and elites. For example, in de la Croix, Doepke, and Mokyr (2017), we assume that apprentices acquire ideas from master craftsmen, but also get new ideas exogenously (maybe from contacts with the elite), and that they implement the best of the two. The literature on the history of science (Valleriani 2017), however, shows that the interface between upper-tail human capital and practical knowledge is more complex than just adopting a new idea for free, and that more elaborate modelling is required to understand the incentives underlying fast adoption and diffusion. We will model this interface by considering three layers. The first layer is theoretical knowledge, *scientia*, mostly developed by intellectuals and generally codified in books. The second layer is codified practical knowledge, often in collections of recipes or in almanachs. The third layer is *ars*, the knowledge of master craftsmen, which is mostly uncoded, acquired through apprenticeship. Such a theoretical framework allows the three layers of knowledge to interact by modelling explicitly the process of publishing recipe collections which is at the core of the second layer. One key question the model will address is **determining the incentives under which an economy will rely on applied codified knowledge in addition to tacit knowledge, speeding up the diffusion of ideas**, or rather, stick to the traditional way of learning through interpersonal contacts. Incentives depend on the printing technology, density of the population, literacy of the population, and protection of intellectual property. As patents and copyrights did not apply during the period we consider, intellectual property was not formally protected, I plan to consider mechanisms of innovation without monopoly rents inspired from Boldrin and Levine (2008).

With regard to the complementarity between elites and the adoption of enlightened culture and institutions, I start from the idea that the presence of learned institutions is a two-edged sword. There are cases in history when universities fought against novelty. This might have arisen because universities had a vested interest in the status quo, for example when the Scientific Revolution involved the repudiation of key Aristotelian dogmas (Porter 1996), which had been taught for centuries. A theoretical way to model this insight can be based on Acemoglu (2008). In his model, an oligarchic institution may initially enjoy a high rate of growth, but oligarchies also tend to extract rents and establish barriers to entry. Over time, innovation inevitably moves from one location to the next, so that members of a sitting oligarchy do not remain at the frontier. Such a situation, in which entrepreneurs (in our case, scholars) remain in place irrespectively of their productivity, is labelled a sclerotic equilibrium by Acemoglu. As many new universities emerged in Europe as corporations of masters and students (see Greif and Tabellini (2012) on why the adoption of corporations in Europe was much more attractive), they fit well Acemoglu's oligarchic institutions. However, there are many cases in which universities and academies favored modernity. **To model this race within universities between conservative and modern forces, we will see universities as firms offering several products (fields). Investing in the development of a new product line (faculty) puts universities closer to the frontier, but hurts the vested interests of the scholars working in the existing fields.** We will also model the influence of adopting new fields on the culture of the rest of society. The third ingredient will consist in modelling the effect of a more modern society on the trade-off faced by universities between developing new fields and the interests of its scholars. Such a new model of the dynamic interactions between conservative and modern forces within universities and learned societies will allow us to derive the conditions under which modernity prevailed, and use the richness of our database to examine where and when it did so.

To conclude, constituting the database and developing empirical and theoretical research which relies on its wealth will allow for the first time to have a view at the European level of the role of the UTHC in the rise of the West which is rigorously grounded in evidence, can be reproduced, falsified, and developed further. Once we have reached a critical amount of information, and developed a structure and a methodology to address the measurement of the UTHC, it will be easier to continue extending the database beyond the 60 months of the project, particularly by further broadening its geographical scope. Maintaining and extending this database will be a valuable research asset to me in future research.

## References

- Acemoglu, Daron. 2008. Oligarchic Versus Democratic Societies. *Journal of the European Economic Association*. **6**, 1-44.
- A'Hearn, Brian, Baten, Jörg, and Dorothee Crayen. 2009. Quantifying Quantitative Literacy: Age Heaping and the History of Human Capital, *The Journal of Economic History*, **69**, 783-808.
- Aghion, Philippe and Peter Howitt. 1992. A Model of Growth through Creative Destruction. *Econometrica* **60** (2): 323–351.
- Alesina Alberto, Johann Harnoss and Hillel Rapoport. 2016. Birthplace diversity and economic prosperity. *Journal of Economic Growth*, **21**, 101-138.
- Ashby, Eric. 1963. *Technology and the Academics – an Essay on Universities and the Scientific Revolution*. London: MacMillan.
- Azariadis Costas and Alan Drazen. 1990. Threshold externalities in economic development, *Quarterly Journal of Economics*, **105**, 501–526.
- Bairoch, Paul, Jean Batou and Pierre Chèvre. 1988. *La Population Des Villes Européennes*, Geneva: Librairie Droz.
- Baten, Joerg and Jan Zanden, 2008. Book production and the onset of modern economic growth, *Journal of Economic Growth*, **13**(3), 217-235.
- Boldrin, Michele, and David K. Levine. 2008. Perfectly competitive innovation. *Journal of Monetary Economics* **55** (3): 435–453 (April).
- Cantoni, Davide and Noam Yuchtman. 2014. Medieval Universities, Legal Institutions, and the Commercial Revolution, *Quarterly Journal of Economics*. **129** (2), 823–887.
- Cervellati Matteo and Uwe Sunde. 2005. Human capital formation, life expectancy and the process of development, *American Economic Review* **95**, 1653–72.
- Chaney Eric. 2017. *Scientific Revolution: Institutions and the Intellectual Rise of the Western World*. Harvard University, mimeo.
- Clark, Gregory. 2007. *A Farewell to Alms*. Princeton, NJ: Princeton University Press.
- Cummins, Neil. 2014. “Longevity and the Rise of the West: Lifespans of the European Elite, 800-1800,” LSE Economic History Working Paper Series, #209.
- de la Croix, David, and Omar Licandro. 2015. The Longevity of Famous People from Hammurabi to Einstein. *Journal of Economic Growth*, **20**:263-303.
- de la Croix, David, Matthias Doepke, and Joel Mokyr. 2017. Clans, Guilds, and Markets: Apprenticeship Institutions and Growth in the Pre-Industrial Economy. *Quarterly Journal of Economics*, forthcoming.
- DeLong, Bradford and Andrei Shleifer. 1993. Princes and Merchants: City growth before the Industrial Revolution, *Journal of Law and Economics*, **36**, 671-702.
- Dittmar, Jeremiah. 2011. Information technology and economic change: the impact of the printing press. *Quarterly Journal of Economics*, **126**, 1133-1172.
- Dittmar, Jeremiah and Ralf Meisenzahl (2016), State Capacity and Public Goods: Institutional Change, Human Capital and Growth in Early Modern Germany, CEP Discussion Paper No 1418.
- Dowey, James. 2016. *Mind over Matter. Access to Knowledge and the British Industrial Revolution*. LSE Ph.D thesis.
- Epstein, Stephan R. 2013. Transferring Technical Knowledge and Innovating in Europe, c. 1200-c. 1800. Chapter 1 of *Technology, Skills and the Pre-Modern Economy in the East and the West*, edited by Jan Luiten van Zanden and Marten Prak. Boston: Brill.
- Galor, Oded. 2011. *Unified Growth Theory*. Princeton, NJ: Princeton University Press.
- Greif, Avner and Guido Tabellini. 2012. The Clan and the City: Sustaining Cooperation in China and Europe. IGER Working Paper Series, 445.
- Guldi, Jo and David Armitage. 2014. *The History Manifesto*. Cambridge: Cambridge University Press.

- Hornung Erik, 2014. Immigration and the Diffusion of Technology: The Huguenot Diaspora in Prussia, *American Economic Review*, **104**(1), 84-122.
- Jacob, Margaret C. 2014. *The First Knowledge Economy - Human Capital and the European Economy, 1750–1850*, Cambridge: Cambridge University Press.
- Kelly, Morgan, and Cormac Ó Gráda. 2016. “Adam Smith, Watch Prices, and the Industrial Revolution.” Forthcoming, *Quarterly Journal of Economics*.
- Landes, David. 1998. *The Wealth and Poverty of Nations*. New York: W. W. Norton.
- Maddison, Angus. 2001. *The World Economy—A Millennial Perspective*, Development Centre Studies, OECD, Paris.
- Manuel, Frank E. 1968. *A portrait of Isaac Newton*. Cambridge, MA: Belknap Press of Harvard University Press.
- Mc Neil, William. 1963. *The Rise of the West. A History of the Human Community*. Chicago: University of Chicago Press.
- Mitterauer, Michael. 2010. *Why Europe? The Medieval Origins of Its Special Path*. Chicago: University Of Chicago Press.
- Mokyr, Joel. 2002. *The Gifts of Athena. Historical Origins of the Knowledge Economy*, Princeton: Princeton University Press.
- Mokyr, Joel, 2009. *The Enlightened Economy*, New York and London: Yale University Press.
- Mokyr, Joel, 2016. *A Culture of Growth, The origins of the modern economy*, Princeton: Princeton University Press.
- Pedersen, Olaf. 1996. Tradition and Innovation, in: Ridder-Symoens, Hilde de (ed.): *A History of the University in Europe. Vol. II: Universities in Early Modern Europe (1500–1800)*, Cambridge: Cambridge University Press, pp. 451–487.
- Porter, Roy. 1996. The scientific revolution and universities, in: Ridder-Symoens, Hilde de (ed.): *A History of the University in Europe. Vol. II: Universities in Early Modern Europe (1500–1800)*, Cambridge: Cambridge University Press, pp. 531-562.
- Romer, Paul. 1990. Endogenous Technological Change. *Journal of Political Economy* **98** (5): S71–S102.
- Rüegg, Walter, 1992. Themes. In Rüegg, Waster (ed.): *A History of the University in Europe. Vol. I: Universities in the Middle Ages*, Cambridge: Cambridge University Press, 3–34.
- Schich, Maximilian, Chaoming Song, Yong-Yeol Ahn, Alexander Mirsky, Mauro Martino, Albert-László Barabási, and Dirk Helbing. 2014. A network framework of cultural history, *Science*, **345** (6196), 558-562.
- Scoville, W. C. 1953. Minority migrations and the diffusion of technology. *Journal of Economic History* **11** (3), 347-360.
- Squicciarini, Mara and Nico Voigtländer. 2015. Human Capital and Industrialization: Evidence from the Age of Enlightenment, *The Quarterly Journal of Economics* **130** (4): 1825-1883.
- Valleriani Matteo 2017, *The Structures of Practical Knowledge*, Springer.
- Verger Jacques. 1988. Peut-on faire une prosopographie des professeurs des universités françaises à la fin du Moyen Âge?, *Mélanges de l'Ecole française de Rome. Moyen-Age, Temps modernes* **100**, 55-62.
- Waldinger, Fabian. 2012. Peer Effects in Science: Evidence from the Dismissal of Scientists in Nazi Germany. *Review of Economic Studies* **79** (2): 838–61.
- Wootton, David. 2015. *The Invention of Science: A New History of the Scientific Revolution*, London: Allen Lane.



**Section b: Curriculum vitae****PERSONAL INFORMATION**

David de la Croix

Belgian nationality. Born April 22, 1964.

website: <http://www.de-la-croix.be>

orcid.org/0000-0002-7589-8535

**EDUCATION**

1992: Ph.D. in Economics (Université catholique de Louvain) on “Union-Firm Bargaining and Equilibrium Unemployment in Quantity Rationing Models.” Director: H. Sneessens.

1988: Master of Arts in Economics (Université catholique de Louvain), Magna cum laude.

**CURRENT POSITION(S)**

2005- : Full professor at Université catholique de Louvain

**PREVIOUS POSITIONS**

Invited professor at the University of California, Los Angeles (2000-2001), University of Copenhagen (2008), National Taiwan University (2009), University of Cape Town (2012), University of Poznan (2015).

1995-2005: Research Associate at the National Fund for Scientific Research (Belgium).

1992-1993: Research Fellow at the Rijksuniversiteit Limburg (Maastricht).

1989-1993: Research assistant (1989-1993) and Post-doctoral Researcher (1993-1995) at the National Fund for Scientific Research.

**FELLOWSHIPS AND AWARDS**

2015-2017: International Panel on Social Progress

2014-2017: Francqui Research Professorship

2010-2013: United Nations: Panel on New Challenges in Population and Development (IUSSP)

2003-2004: Francqui Chair, Ghent University.

2000-2001: Fulbright research grant.

2000-2001: NATO research grant.

**SUPERVISION OF GRADUATE STUDENTS**

I firmly believe that Ph.D. students are the blood and flesh of any good department. Among the nineteen Ph.D. students who completed their dissertation under my supervision, fourteen work in research and teaching positions (among whom nine already hold permanent positions at universities or in Central Bank research centers), five are in executive positions (EU and World Bank). I am currently supervising five Ph.D. students (2 almost ready to complete).

19 completed dissertations as supervisor: Alexandra Rillaers (2000), Rafael Munoz (2000), Géraldine Mahieu (2002), Joao Medeiros (2003), Lionel Artige (2004), Fabio Mariani (2005), Tapas Mishra (2006), Carmen Camacho (2007), Alessandro Sommacal (2008), Davide Dottori (2009), Luca Marchiori (2009), Gül Ertan Özgüler (2010), Paolo Melindi Ghidi (2012), Paula Eugenia Gobbi (2013), Emeline Bezin (2015), Pierre Pecher (2016), Hamzeh Arabzadeh (2016), Robert Stelter (2016), and Lucia Granelli (2018).

**INSTITUTIONAL RESPONSIBILITIES**

2015-2016: Member of scientific commissions at the National Fund for Scientific Research.

2010-2015: Member of the promotion committee (UCL).

2010-2014: Member of the Research Council of the University (UCL).

2005-2010: Director of the doctoral program in Economics, UCL.

### ACADEMIC ENTREPRENEURSHIP

When I started working on long-run growth at IRES in the nineties, I was alone on the subject. Over the years, I participated with other colleagues to the transformation of IRES, a business cycle advising unit founded in 1928, into a modern research center publishing in the best journals. I lead the team on long-run growth and demographic economics, which now includes three other permanent professors, 3 post-docs and 15 Ph.D. students.

Trying to get people of different horizons to work together is one of my aims. In 2008, I obtained a large grant for a joint project on “sustainability” between economists and applied philosophers of the Hoover Chair of economic and social ethics, thereby promoting a new interdisciplinary approach to long-term growth. In 2015, I obtained another large grant on “Family transformations”, now involving economists and demographers.

More information: <http://perso.uclouvain.be/david.delacroix/arc-family.html>

Three years ago, I created a new journal. The Journal of Demographic Economics (JODE, published by Cambridge University Press) is intended to be the premier professional outlet for what has become a vibrant and flourishing subfield within economics. The objective is to encourage research in this field, exploiting the complementarities between theory and empirics, and promoting interdisciplinary collaborations between demographers and economists.

More information: <http://perso.uclouvain.be/david.delacroix/jode.html>

### OVERVIEW OF PUBLICATION RECORD

49 coauthors, 81 published articles, 2 monographs, 2 encyclopedia entries, 32 popular articles.

#### Significant publications in top-5 journals:

De la Croix D., M. Doepke, and J. Mokyr, Clans, Guilds, and Markets: Apprenticeship Institutions and Growth in the Pre-Industrial Economy, *Quarterly Journal of Economics*, forthcoming.

Baudin T., De la Croix D., and P. Gobbi, Fertility and childlessness in the United States, *American Economic Review*, **105**, 1852-1882, 2015.

De la Croix D. and F. Mariani, From Polygyny to Serial Monogamy: a Unified Theory of Marriage Institutions, *Review of Economic Studies*, **82**, 565-607, 2015.

De la Croix D. and M. Doepke, To Segregate or to Integrate: Education Politics and Democracy, *Review of Economic Studies*, **76**, 597-628, 2009.

De la Croix D. and M. Doepke, Inequality and growth: why differential fertility matters, *American Economic Review*, **93**, 1091-1113, 2003.

#### Most cited publications:

De la Croix D. and M. Doepke, Inequality and growth: why differential fertility matters, *American Economic Review*, **93**, 1091-1113, 2003. GS # citations: 547

De la Croix D. and P. Michel, *A Theory of Economic Growth: Dynamics and Policy in Overlapping Generations*, Cambridge University Press, 2002. ISBN 978-0521001151. GS # citations: 490

Boucekkine R., D. De la Croix and O. Licandro, Vintage human capital, demographic trends and growth, *Journal of Economic Theory*, **104**, 340-375, 2002. GS # citations: 402

**Appendix: All ongoing and submitted grants and funding of the PI (Funding ID)**  
Mandatory information (does not count towards page limits)

**On-going Grants**

<i>Project Title</i>	<i>Funding source</i>	<i>Amount (Euros)</i>	<i>Period</i>	<i>Role of the PI</i>	<i>Relation to current ERC proposal</i>
ARC project 15/19-063 on "family transformations: incentives and norms"	French-speaking community of Belgium	700,000 euros (2 post-docs, 3 docs, research money)	Sep 2015 – Sep 2019	Main Promotor (other promoters: Luca Pensieroso, Ester Rizzi, Fabio Mariani)	unrelated
Franqui Research Professorship on "Fertility choices: driving forces"	Franqui foundation	135,000 euros (full teaching buy out + small amount of research money)	Sep 2014– Sep 2017	Beneficiary	unrelated

**Applications**

<i>Project Title</i>	<i>Funding source</i>	<i>Amount (Euros)</i>	<i>Period</i>	<i>Role of the PI</i>	<i>Relation to current ERC proposal<sup>2</sup></i>
none					

## Section c: Ten-year track record

### BIBLIOMETRY

4,280 citations (G. Scholar), 1,148 citations in Scopus.

**h-index:** 29 according to G. Scholar, 18 according to Scopus.

In **Repec**, among the top 1% authors at the world level according to 38 criteria, among which: Number of Distinct Works, Number of Citations, h-index, Number of Journal Pages, Strength of students.

### TOP 10 SCIENTIFIC PUBLICATIONS in the last 10 years

De la Croix D., M. Doepke, and J. Mokyr, Clans, Guilds, and Markets: Apprenticeship Institutions and Growth in the Pre-Industrial Economy., *Quarterly Journal of Economics*, forthcoming.

*Compares growth under alternative institutions to deal with the moral hazard problem in master-apprentice relationship. Guilds and market-based systems allow knowledge to cross the family/clan boundaries. Guild adoption is more likely when initially in a nuclear family system.*

Baudin T., De la Croix D., and P. Gobbi, Fertility and childlessness in the United States, *American Economic Review*, **105**, 1852-1882, 2015.

*Theory of parenthood decisions which allows researchers to understand and measure the reasons behind childlessness, and analyze its change over time and across education groups in the US.*

De la Croix D. and F. Mariani, From Polygyny to Serial Monogamy: a Unified Theory of Marriage Institutions, *Review of Economic Studies*, **82**, 565-607, 2015.

*Explains the transition from polygyny to monogamy, and the rise of serial monogamy as following the urban revolution and Industrial Revolution.*

De la Croix D. and O. Licandro, The longevity of famous people from Hammurabi to Einstein, *Journal of Economic Growth*, **20**, 263–303, 2015.

*Describes a new database built from the Index Biobibliographicus Notorum Hominum (IBN), containing vital dates and characteristics of 300,000 famous people. Identifies the moment when adult longevity started to increase prior to the Industrial Revolution.*

De la Croix D. and F. Docquier, An incentive mechanism to break the low-skill immigration deadlock, *Review of Economic Dynamics*, **18**, 593-618, 2015.

*Design of a migration policy maximizing global welfare subject to the constraints that rich countries are at least as well off as in the current situation.*

De la Croix D. and O. Licandro, The Child is Father of the Man - Implications for the Demographic Transition, *The Economic Journal*, **123**, 236-261, 2013.

*Theory of the demographic transition and the Industrial Revolution based on the evidence that physical development during childhood is an important predictor of adult life expectancy.*

De la Croix D. and F. Docquier, Do Brain Drain and Poverty Result from Coordination Failures?, *Journal of Economic Growth*, **17**, 1-26, 2012.

*Analyzes whether a high brain drain can be the outcome of an expectations-driven poverty trap.*

De la Croix D. and M. Doepke, To Segregate or to Integrate: Education Politics and Democracy, *Review of Economic Studies*, **76**, 597-628, 2009.

*Studies why societies vary in their choices regarding the mix of private and public schooling, and how education and fertility decisions interact with voting on public schooling expenditures.*

De la Croix D. and D. Dottori, Easter Island Collapse: a Tale of Population Race, *Journal of Economic Growth*, **13**, 27-55, 2008.

*Proposes a new motivation to have children: developing military potential.*

Boucekkine R., D. De la Croix and D. Peeters, Early Literacy Achievements, Population Density and the Transition to Modern Growth, *Journal of the European Economic Association*, **5**, 183-226, 2007. Shows how increasing population density helped cover the fixed cost of schools and promoted education in England in the 16<sup>th</sup>-18<sup>th</sup> centuries, hence paving the way for the Industrial Revolution.

### RESEARCH MONOGRAPHS & chapters in collective volumes

De la Croix D., *Fertility, Education, Growth and Sustainability*, Cambridge University Press, 2012. ISBN 978-1107029590.

De la Croix D., Did Longer Lives Buy Economic Growth? From Malthus to Lucas and Ben-Porath, in *Demographic Change and Long-Run Development*, M. Cervellati and U. Sunde eds, MIT Press, chapter 5, 2016.

*Summary of the possible impact of increases in adult longevity on economic growth with a focus on two particular channels: the contact time effect and the incentive effect.*

### Ph.D. STUDENT MENTORING – COMPLETED 2007-2017 with their current employer

Carmen Camacho (CNRS), Alessandro Sommacal (U. Verona), Davide Dottori (Bank of Italy), Luca Marchiori (U. Luxemburg), Gül Ertan Özgüler (U. Izmir), Paolo Melindi Ghidi (U. Paris X), Paula Eugenia Gobbi (U. Brussels), Emeline Bezin (FNRS), Pierre Pecher (U. Aix-Marseille), Hamzeh Arabzadeh (U. Aachen), Robert Stelter (Max Planck Rostock), and Lucia Granelli (European Commission).

### PARTICIPATION TO INTERNATIONAL CONFERENCES (selected examples)

American Economic Association - ASSA Meeting (San Diego, Jan 2013, Philadelphia, Jan 2014)  
NBER Summer Institute (Jul. 2007)

Meeting of the Society for Economic Dynamics, Edinburgh June 2017, Toulouse June 2016, Toronto June 2014, Seoul, June 2013, Limassol June 2012, Montreal, July 2010, Cambridge MA, July 2008.

Conference on Growth and Development New Delhi, Indian Statistical Institute, (Dec 2015, Dec 2009)  
Barcelona GSE Summer forum (June 2016, June 2015, June 2014, June 2013)

### INVITATIONS TO WORKSHOPS (selected recent examples)

“Family Macroeconomics” Edesheim, Germany, June 22-23, 2015.

“Institutions, Culture, and Long-run Development”, Munich, Germany, November 13-14, 2015

“Deep-rooted Factors in Comparative Development”, Brown RI, USA, May 2016, May 2017

### EDITORIAL AND EXPERT ACTIVITIES

**Editor in Chief** of Journal of Demographic Economics (2015-)

Member of the **Editorial Board** of Fiscal Studies (2006-), Recherches Economiques de Louvain (1997-2014), Cliometrica (2006-).

**Associate Editor** of Journal of Economic Dynamics and Control (2004-2013), Journal of Development Economics (2011-), Journal of Public Economic Theory (2011-2015).

External **Expert** for the FNRS (Belgium), CNRS (France), the FCT (Portugal), the ISF (Israel Science Foundation), the SNF (Switzerland), and the European Commission (Marie-Curie, ERC).

Participation in **Ph.D. committees** as a foreign member: Uppsala University (Sweden), Vienna University (Austria), Ecole Polytechnique (Paris), EHESS (Paris), University of Aix-Marseille II, University of Paris 1 (France), University of Namur, University of Ghent (Belgium).

Participation to French and German “**habilitation**” **committees** at: University of Aix-Marseille II, Leipzig, Paris 1, and Toulouse.

### AWARDS (See CV)