The relevance of quantitative economic theory for historical demography

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I am an economist. As such, I am interested in unravelling long-term patterns and mechanisms that affect human choices in a variety of contexts, including the more or less remote past. Demographic history provides unique material for this approach, because of the wealth of carefully built-up data and detailed contextual information. It seems very natural as an economist to be interested in historical demography. Indeed, demographic variables are important determinants of economic choices and trends. Furthermore, as the British economic historian John H. Clapham said in 1922: "The economist is, willy-nilly, an historian. The world has moved on before his conclusions are ripe" (quoted from McCloskey 2014). If you are going to be a scientific economist, McCloskey adds, "the past should be your present".

Economists use various methods to understand reality, including a variety of statistical techniques, pure economic theory and quantitative theory. I think the latter is of particular relevance to the study of historical demography, which is precisely the point I would like to make in this paper. King noted as follows:

> "Quantitative theory uses simple, abstract economic models, together with a small amount of economic data, to highlight major economic mechanisms. Economic models are employed in two ways. First, they are used to organize economic data in a new and suggestive manner. Second, models are combined with economic data to display successes and failures of particular theoretical mechanisms" (King 1995).

A model is usually a mathematical representation of a maximization problem: some agent maximizes an objective function that is subject to a series of explicit constraints. The solution to the problem describes how the agent behaves; in other words, how he or she reacts to incentives provided by the outside world. A quantitative model amounts to looking at the data through the lens of this particular model; for example, by calibrating or estimating the parameters of the objective function and the constraints, and then analyzing the extent to which what we observe matches the behaviour predicted by the model.

The objective of this method is not to provide a complete explanation of a given phenomenon, but rather to evaluate how much we can explain by modelling one or a number of specific mechanisms. I will give two examples below. Before doing so, however, I would like to stress that, unlike statistical inferences, which (over) emphasize statistical significance, quantitative theory is more concerned with the size of effects; that is, with their economic or social significance. And unlike pure theory, it is interested in quantitative implications.

Unravelling the reasons behind childlessness

The first example where there are benefits to be had from using quantitative theory in a historical context is in the analysis of the reasons for being childless. There are two main types of childlessness discussed in the literature: 1) voluntary childlessness; namely, a utility-enhancing life choice for those who decide not to have children; and 2) involuntary childlessness. The latter involves situations in which people are physically unable to become parents and in which the lack of experiencing parenthood is likely to be a heavy burden. Involuntary childlessness depends on biological constraints and can be further divided into innate (or natural) sterility and social sterility. Social sterility occurs when fecundity is affected by poor living conditions and societal underdevelopment. It arises from poverty-related diseases or malnutrition and can be regarded as a measure of poverty. Voluntary childlessness, by contrast, is primarily prevalent in richer and more gender-equal societies.

In historical populations, childlessness is often regarded as a phenomenon driven solely by sterility. An exception can be found in Bardet (1983), who provides a comprehensive analysis of the population of Rouen in the seventeenth and eighteenth centuries. Bardet included a table (p. 300) with the percentage of childless women in Rouen by year of marriage and social class. Beyond a baseline of natural sterility of about 4%, childlessness increased over time for all social classes, but more so for the nobles, as well as for the shopkeepers who were eager to imitate them. Bardet interprets the rise in childlessness observed in Rouen as voluntary: the number of women refusing to have children was on the rise. Yet notwithstanding a very detailed analysis of this population, his study lacks a conclusion about the reasons behind this rise.

One main limitation of measurement without theory resides in the impossibility of distinguishing biologically and poverty-driven childlessness from voluntary childlessness in the data. We know that for Simone de Beauvoir it was a conscious choice to remain childless, while for King Baudouin and Queen Fabiola it was not. But, in general, we do not observe the reasons behind childlessness. Censuses never ask childless persons why they are childless. While surveys do sometimes ask this question, they only contain a limited number of observations. Furthermore, a significant number of respondents provide contradictory answers. Consequently, the interviewers are unable to determine the voluntary or involuntary nature of the childlessness. An alternative approach, which would enable us to unravel the reasons behind childlessness, is to use quantitative theory.

The structural model devised by Baudin *et al*. (2015) provides a way to use data in order to weight the various causes of childlessness. This model is essentially based on two assumptions. The first assumption is that the ability to have children increases with the standard of living, since the availability and quality of nutrition, shelter and hygiene are matters of importance for fecundity. The second assumption is that the main cost of children is the time it takes to rear them. This implies that children are more expensive for highly educated people, because of their high opportunity cost. The presence of the first mechanism can be confirmed and its size can be measured from the fact that childlessness is more prevalent among the very poor than among the middle classes (despite the fact that fertility among the poor is higher).The second assumption rests on a mechanism observed among the educated: namely, that the occurrence of childlessness increases with the mother's level of education. The fact that childlessness displays a U-shaped curve when plotted against the level of education of the mother allows us to identify (= quantify) the strength of the assumed mechanisms and to make quantitative predictions.

Breaking down childlessness into its causes helps us to understand how the phenomenon has

changed over the last century in the US. At the end of the nineteenth century, wages were low and people were generally poorly educated. This made levels of social sterility very high. In addition to the causes mentioned above, the Spanish influenza epidemics, which especially affected the generations born between 1890 and 1910, meant that pregnant women who were infected were particularly vulnerable to miscarriages. The Great Depression also impoverished these same generations, among whom voluntary childlessness was almost absent. The rise in both education and overall income allowed subsequent generations to escape from situations where couples were constrained from having children. As a consequence, rates of childlessness began to fall. Over time, the nature of childlessness gradually changed: it increasingly became the result of choice for many educated women. In the US, the social causes of childlessness have now completely disappeared for married women. However, this is not true for single women, who are usually poorer.

The fertility transition: the diffusionist view versus socio-economic theories

A second example concerns the possible role of quantitative theory in weighting explanations for the fertility decline observed in Europe over the last two centuries. Scientists are divided between those who believe that fertility was not subject to rational choice or control, and those who believe it was. Most economists are on the 'rational choice' side, while demographers tend to subscribe to the 'no choice' view (see Lee 2015). This divide overlaps with a divergence between socio-economic theories for the fertility decline on the one hand, and diffusionist/ cultural views on the other (again following the terminology of Lee 2015). The 'rational choice' approach of Nobel Prize winner Gary Becker clearly belongs to the first strand, while, for example, the Princeton study, which examined the timing of fertility change at the county level in Europe, concludes in favour of the diffusionist/cultural view.

Understanding which mechanism matters most is important for policy design. If, according to the diffusionist/cultural view, fertility is a question of culture and norms instead of incentives, policy focusing on incentives (family allowances, tax breaks for families, etc.) will have little impact.

In a current project (de la Croix & Perrin 2016), we are pursuing the following strategy. First, we develop a structural model for the optimal choice of children, in which parents maximize their well-being subject to a budget constraint and a time constraint. We then evaluate how much can be explained by relying strictly on this structural model. One original aspect of our approach is to assume that parents choose both fertility and education (education only became compulsory in the late nineteenth century). Unlike many atheoretical approaches that use regressions to analyze the determinants of fertility, our approach allows us to exploit the idea that fertility and education are joint decisions; for example, in counties where parents are more educated, theory predicts that they will have fewer children but will educate them more. Our method makes it possible to exploit the restrictions that link fertility and education behaviours in a precise way. Preliminary results indicate that, with this parsimonious 'rational choice' model, we can explain 38% of the variation of fertility over time and across counties, and 71% and 83% of the school enrolment for boys and girls respectively.

In a second step, we plan to correlate the part of fertility and school enrolment that was not explained by the 'rational choice' model with other determinants mentioned as important in the

literature, such as family structure, religion and cultural distance from Paris (where fertility control supposedly started). This analysis can be used for two purposes. First, it can be used to assess the importance of these factors in explaining family decisions. Second, it can be used to indicate the direction in which the theories of fertility decline should be developed further.

3. Conclusion

Many historians and demographers who want to increase the quantitative aspect of their research naturally lean towards the use of regression analysis. Such an approach is not based on theory (apart from knowing which variable to include in the regression) and focuses instead on knowing which explanatory variable is statistically significant. As an alternative, they may wish to consider giving a chance to quantitative theory. This latter approach aims at evaluating the quantitative importance of a limited number of specific mechanisms. It does not aim at providing a comprehensive understanding of the phenomenon under scrutiny, but instead aims at leading to cumulative research: "progress, do not regress" was the motto of Edward Prescott, one of the leading promoters of quantitative theory. In this sense, further research is always needed to look at the neglected implications of selected mechanisms, to discard previously developed theories, and to promote better ones.

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Biography

David de la Croix (born 1964, PhD 1992) is Professor of Economics at UCL (Louvain-la-Neuve, Belgium). He is the editor-in-chief of the *Journal of Demographic Economics*. His research interests cover demographic economics, development and growth. He is mostly interested in understanding household incentives in the past and in the present.