Rural exodus and fertility at the time of industrialization

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Abstract

Grounding on the literature in demographic and economic history, we develop a model of endogenous growth making the rural exodus a pre-requirement for human capital accumulation and sustained economic growth. Differential mortality as well as asymmetric technological progress between cities and countryside pull and push people from the countryside. We calibrate our model to fit the dynamics of fertility, urbanisation and production both in cities and countryside in Sweden and Denmark from 1760 to 1960. We show that mortality stalls in cities may have delayed both the demographic transition and industrialisation. Finally, we quantify the potential economic loss of policies limiting the rural exodus as those implemented in China during the last decades.

Keywords: Demographic transition, Industrialisation, Rural exodus, Mortality Differentials, Fertility Differentials.

JEL Classification Numbers: J11, J13, O41.

Extended Abstract

Research topic

Since the seminal contribution of Galor and Weil (2000), the Unified Growth Theory (UGT) has provided a consistent framework explaining how economies of Western Europe have left Malthusian stagnation to modern growth and how this take-off relates on the demographic transition. Roughly speaking, UGT posits that a technological progress has to take place to incite parents investing in the human capital of their children and reducing the number of these latter. Recent contributions refine the understanding about how technological progress, economic growth and the accumulation of human capital interact with each other. For instance, Squicciarini and Voigtlaender (2014) show that rising total factor productivity is not a sufficient condition to make the accumulation of human capital economically desirable and modern industries growing faster than other sectors. To reach such a situation, upper tail human capital and scientific knowledge have to be sufficiently high to impulse the transition towards modern economic growth. The present paper contributes to this recent literature by emphasizing the rural exodus as another pre-requirement for industrialisation, the economic take-off and the demographic transition.

If UGT has been rather silent about the role of rural exodus for economic modernisation, historical demographers like Dyson (2011) and economic historians like Bairoch (1997) show some regularities deserving a particular attention. First, before and during the demographic transition, cities killed people in the sense that mortality was significantly higher than in the countryside, see Woods et al. (1988), Woods (2003) or Knodel (1974). Second, the countryside was more fertile than cities as the number of births per women in rural areas exceeded this in urban areas. Third, despite cities killed more people and produced less newborns than the countryside, urbanisation took place: an increasing part of the population were located in cities. Knowing that international migrations were rather low at that time, urbanisation has been possible only because of a massive and sustained rural exodus. As modern industries concentrated in cities, the needs for human capital were stronger in cities giving a salient role to the rural exodus in the interactions between the industrial revolution, urbanization and the demographic transition.

Galor (2011) discards mortality dynamics as a driving force of economic take-off. Our theory complements this view by showing that variations of mortality in cities and countryside can accelerate or delay the rural exodus and then industrialisation and the demographic transition; nevertheless this take-off could not emerge without technological progress. A

recent paper by Bhattacharya and Chakraborty (2014) also complements the view of Galor (2011) by showing how, in Victorian England, the fall of child mortality has provoked a contraception revolution that may have impulsed, hand in hand with technological progress, a substitution of quality to quantity of children.[1] Greenwood and Seshadri (2002) are among the very few focusing on the rural-urban fertility differential (in the US). We complement their analysis by considering explicitly two living areas and mortality differentials between these latter. So we give to the rural exodus and mortality differentials the attention they deserve.

To assess the importance of rural exodus for the processes of industrialisation and demographic transition, we construct an overlapping generation model able to reproduce the economic and demographic dynamics of Sweden and Denmark from 19th century to present. Using this model, we estimate the intensity of the rural exodus in both countries and quantify the impact that limitations of this exodus would have had on the development schemes of these countries.

Data

For Sweden, we collect data from Historisk statstik för Sverige, SHiPs-database, national statistic yearbooks, the Princeton European Fertility Project and Swedish Historical National Accounts. For Denmark, our data issue from the Princeton European Fertility Project, works of Johansen (2002), Johansen (1985), official data (Danmarks Statistik, 1966) and National Accounts.

For a country like Sweden, infant mortality began to decrease in the countryside around 1760 and cities followed just after. In the countryside, it decreased continuously from this date to the mid of the 20th century while in cities, it experienced periods of rapid decrease followed by periods of stagnation. As a result, the mortality differential between cities and countryside has experienced strong variations during the process of development. We suppose that these variations may have play the role of push and pull factors for the rural exodus.

No significant urbanisation can be detected before 1830 while industrial production has exploded twenty years before. This explosion has not vanished until 1960 while the agricultural production has experienced a rather constant increase from the beginning of the 17th century

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[1]In frameworks where no difference is made between rural and urban areas, Strulik and Weisdorf (2014) emphasize the interaction of child mortality with fertility and economic development while Voigtlaender and Voth (2012) figure out, that mortality crises, like the black death, may explain divergent developments between Europe with "killer cities" and China. Mortality as well as technological progress also plays a central role in the transition towards sustained growth in Cervellati and Sunde (2007) focusing on Swedish data.
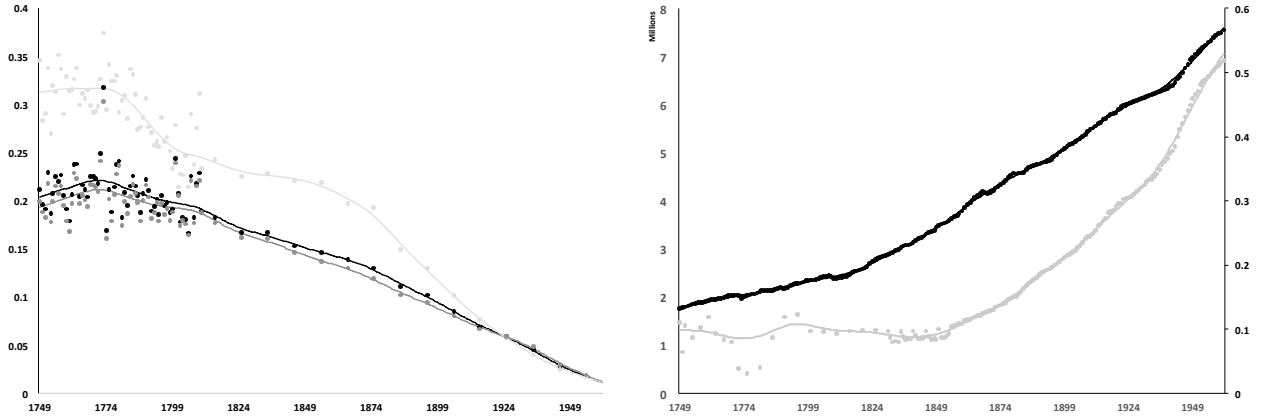
Figure 1: **Swedish data** Left Panel: infant mortality rates at the country level (black), in cities (light grey) and countryside (medium grey) by year. Right panel: population size of Sweden (black) and proportion of persons in cities (light grey) by year. Dots represent data points and solid lines smoothed data.
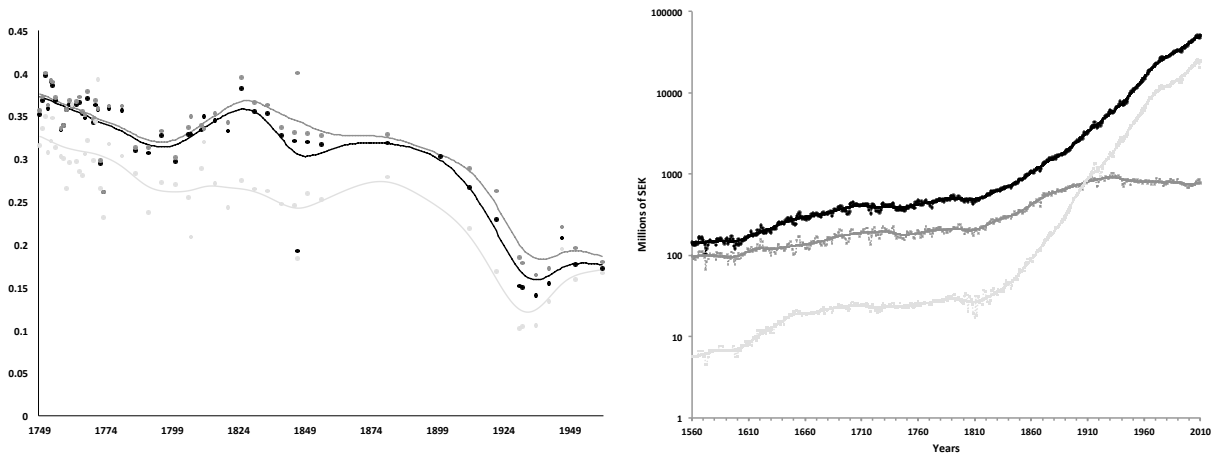

Figure 2: **Swedish data** Left Panel: Evolution of fertility approximated by Coale's index for Sweden (black), countryside (medium gray) and cities (light grey) of Sweden. Dots represent data points and solid lines smoothed data. Right panel: Total gdp of Sweden in black, countryside's total gdp in medium gray and cities' total gdp in light gray. Data are expressed in constant prices of 1910-12, dots represent data points and solid lines smoothed data.

and tend to stall since 1930. With no surprise and despite some temporary fluctuations, the price of industrial goods relative to agricultural goods has decreased during the take-off to modern growth. By estimating the parameters of our model, we will estimate the intensity of the rural exodus in Sweden and Denmark during the industrial revolution, an information that is not available in existing data to the best of our knowledge

Theory

To reproduce the economic and demographic dynamics of Denmark and Sweden and to evaluate the role of rural exodus in the process of economic and demographic development,

we construct an overlapping generations model that makes a distinction between cities where modern industries settle and the countryside where the production is agrarian. Obviously, assuming that industries settled exclusively in cities is a rather strong assumption. Indeed, Bairoch (1997) as well as Ogilvie and Cerman (1996) and Mokyr and Voth (2010) document a significant proto-industrialisation in Western Europe's countryside during and even before the industrial revolution. This is why we consider industrialisation as the development of modern industries needing mass production, efficient work organization, large labour force and human capital.[2]

Adults have to decide either to stay in their area of birth or to leave to the alternative one. Once they have settled down, they decide how many children they have, how much they educate them and how much to consume. We posit that only modern industries need human capital to produce and as a result, parents invest in the human capital of their children only if they expect them to settle in a city. As investing in human capital costs goods rather than time in our framework, rich people can invest in education before poor people. As a result, rural-urban migrants are better educated than those who stay in their area of origin. This is in line with the findings of Funkhouser (1998).[3]

In early stages of our economy, the share of individuals in cities as well as the contribution of industrial production to GDP are low. Most parents expect their children to work in the agricultural sector and so almost nobody invest in human capital. As a result, the vast majority of parents don't face any trade-off between the quality (education) and the number of children and average fertility increases with income; the economy is stuck in a Malthusian regime. Partly mimicking Galor and Weil (2000), our economy starts to experience an exogenous technological progress once the population size in one of the two areas reaches a threshold. Once the technological level is high enough, it becomes economically desirable, for persons living in cities, to be endowed with human capital. So, what distinguishes our theory from the one of Galor and Weil (2000) It is not sufficient that investing in human capital becomes economically desirable. Living in cities and so leaving the countryside has to be desirable, too. What can prevent this exodus? The mortality penalty that exists in cities: urban mortality crises that push people out of urban areas or refrain people from the countryside to move. Mortality peaks in cities can significantly lower urbanisation and industrialisation and require a more intense rural exodus while this latter is less desirable. As child mortality is endogenous and depends both on the density of population in each area

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[2]It may also be true that in some cases, urbanization has been a kind of consequence of industrialisation: because a big industry settled in countryside, a city developed around.

[3]For simplicity, we consider asexual reproduction and so we disregard the importance of local marriage markets. See Voigtlaender and Voth (2013) for a discussion.

and on the aggregate human capital, mortality picks can be generated by violent episodes of urbanization. We are also able to generate situations in which some urbanization occures without industrialization what is evidenced in some Sub-Saharan countries today (see Jedwab et al. (2014)).

To assess the quantitative accuracy of our theory, we calibrate the model to fit Swedish data. More precisely, our model should replicate the dynamics of GDP in urban and rural sectors, the dynamics of fertility in both areas as well as the share of persons in each area.

Partial conclusion

We will finally use our calibrated model for measuring the effect of policies limiting the rural exodus as those implemented by China during the last 10 years. We want to quantify what would have been the impact of artificial limitation of migration from countryside to cities in countries like Sweden and Denmark. We show that industralization and the demographic transition would have been strongly delayed and that the required technological jump needed for the take-off to occur would have been much more important.

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