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Research Article

Which transition comes first? Urban and demographic transitions in Belgium and Sweden

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Abstract

BACKGROUND
Several theories compete to explain the main drivers of urbanisation, past and present, in relation to both demographic transition and economic development. One hypothesis is that rural-to-urban migration is the driver of urbanisation; another is that urban mortality decline actually triggered urban transition.

OBJECTIVE
This paper reconsiders the relationship between demographic (vital) migration and urban transitions by analysing the long-term contribution of natural and migratory movements to urban transition. The respective contributions of birth, death, and migration and their timing will indicate whether economic development, through labour force migration, or vital transition mainly determines urban transition.

METHOD
After examining the spatial dimension of the demographic transition theory, we use 19th and 20th century series on Sweden and Belgium to better identify the migration component of urban transition through the computation of growth difference between urban and rural areas, accounting for the often neglected reclassification effect.

RESULTS
In both Sweden and Belgium, migration is the direct or indirect (through reclassification) engine of urban transition and its contribution precedes the onset of vital transition, while the vital transition has a secondary, unstable, and negative role in the urban transition.

CONCLUSIONS
Changes in the economic sphere are reinstated as the underlying cause of population change, acting through the shift of human capital in space. Methodological

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consequences are then drawn for analysing vital and urban transitions in an increasingly interdependent world.

1. Introduction

Analysing demographic transition is a recurrent task in demography. Although it is regrettable that demographic transition is insufficiently scrutinised, and that no sufficient historical data are available for this purpose, a number of recent contributions have attempted to re-examine demographic transition theory and to confront it with historical evidence (Christiaensen, Gindelsky, and Jedwab 2013; Henderson, Roberts, and Storeygard 2013; Lee and Reher 2011; Lerch 2014). The present paper is a follow-up to these contributions and in particular to the attempt of Tim Dyson, following that of Jan de Vries, to link demographic transition and urbanisation in a comprehensive theory (de Vries 1990; Dyson 2011). The first section of the present paper is not an attempt at exhaustively reviewing the theoretical literature on the subject, but revisits the theory linking demographic and urban transitions, essentially using three milestones established by Wilbur Zelinsky (1971), Jan de Vries (1984, 1990), and Sean Fox (2012). The second section examines the components of urban-rural growth difference. It offers an alternative to Dyson's analysis on Sweden and adds new data on Belgium to the debate. Our analysis reconsiders the role of migration in urban transition for both Sweden and Belgium, accounting for the often-neglected effect of reclassifying spatial units from rural to urban. Theoretical considerations are then drawn on the relation between these transitions and economic development, with methodological consequences.

2. Demographic transition and urban development

Wilbur Zelinsky, a trained geographer, was probably the first to have theorised the spatial dimension of the demographic transition. He established the importance of spatial analysis in his seminal study of the demographic transition (Zelinsky 1971: in this section all page numbers are in reference to his article, unless otherwise stated). Zelinsky considered demographic transition as a macro propagation process that is at the same time temporal and spatial (he used the term 'diffusion', which refers nowadays to the micro process through which ideas and attitudes are disseminated among individuals by means of social interaction). Several analogical terms [3] such as 'pandemic' or 'tumorous cells' are used to explain the propagation of new demographic behaviours across space. The author justifies his spatial approach by the conviction that spatial distribution has a specific meaning (geographical axiom), by the concept of spatial diffusion/propagation of human innovations (anthropological axiom), and by the principle of least effort (economic axiom) (pp. 219–221). His article posits that "there are definite, patterned regularities in the growth of personal mobility through space-time during recent history [Zelinsky refers implicitly to the 20th century], and these regularities comprise an essential component of the modernization process" (pp. 221–222).

The insistence on the role of spatial mobility, which was new at the time, and the use of the term 'mobility transition' in the title is the origin of a frequent misunderstanding of Zelinsky's work. His paper is not just about migration. His main point is that mobility is embedded in, and not just parallel to, demographic transition. Zelinsky prefers 'vital transition' to name the conventional perspective that considers only fertility and mortality as the components of demographic transition. Demographic transition à la Zelinsky is in fact the integration of 'vital transition' and 'mobility transition' in an all-inclusive acceptance. It is actually abusing the term 'demographic transition' to refer to fertility and mortality transitions only. As Daniel Courgeau and Robert Franck remind us (2007), demography is the study of the combinations of fertility, mortality, and migration that explain population growth, decline, or stabilization. Many other individual- and social-level factors can influence population variations, but the analysis of demographic parameters (namely fertility, mortality, and migration) is a perspective particular to demography, say Courgeau and Franck (2007: 39–40). Using this argument, Zelinsky's terminology will be used in the present text: we will refer to 'vital transition' as the interplay of crude birth and death rates, while 'mobility transition' will mean the increase in population mobility. The term 'demographic transition' is therefore the sum of the 'vital transition' and 'mobility transition'. The term 'urban transition' refers to the change from a mainly rural to a mainly urban society.

Zelinsky establishes a correspondence between the different phases of the vital and mobility transitions (p.230). He mentions that this correspondence had been tested by Dov Friedlander (1969), who wanted to verify the hypothesis by Kingsley Davis (1963) according to which fertility levels are inversely proportional to migration opportunities. Zelinsky extends this relational hypothesis to the three demographic parameters, although he acknowledges that the empirical proof may reveal notable differences in time scale and intensity depending on the geographical and historical context. The

[3] The terminology of the 1960s used by Zelinsky needs sometimes to be translated into our contemporary language (e.g., 'developed countries' for 'advanced societies').

correspondence established by Zelinsky between the vital and the mobility transitions indicates their contemporaneousness and probably their interdependence (p.229). Several graphs (p.228) express the complementary nature and the intertwining of the temporal and spatial dimensions of vital and mobility transitions, unified in the demographic transition. As these transitions are continuous phenomena by construction – sudden breaks are the exception; the limits between the different phases are partly arbitrary and are meant only to ease presentation. The correspondence that Zelinsky establishes between transitions is only indicative of, in his own words, an "ideal nation" (echoing the 'ideal type' à la Max Weber), a historical mean of developed countries. Zelinsky recommends empirical studies to document the transition periods and the different mobility patterns that are sketched in his original article (p.233).

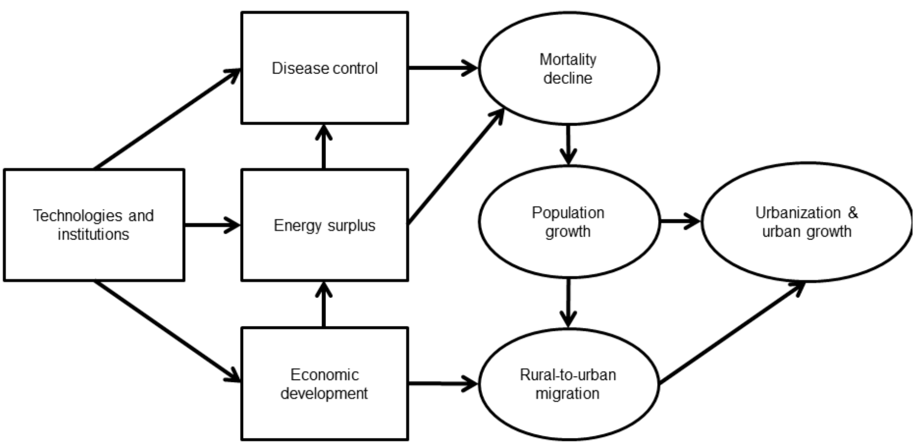
Although Zelinsky is rather vague on the precise mechanisms that link vital and mobility transitions, he posits that demographic transition (i.e., vital and migration transition) and other transitions (social and economic) are mutually interdependent and calls for a "general-systems approach" (p.249). There would be no direct causal relationship between these transitions but, as we would say today, a systemic relationship. In Zelinsky's explanation of urbanisation, "the implicit assumption seems to be that the modernization driving the demographic transition also loosens the constraints that immobilize labour, unleashing rural-to-urban migration for reasons unrelated to urban labour markets" (de Vries 1990:54). Urbanisation appears to be explained mainly by mobility transition while the contribution of vital transition is ignored.

Two flaws have been identified in Zelinsky's theory. First, the evolutionist perspective that considers past societies as immobile has been questioned (Skeldon 1997). Historical inaccuracies, especially regarding the assumed low and inconsequential mobility of ancient or developing societies, have been identified (de Vries 1984; Lucassen and Lucassen 2009). Second, urbanisation may result from the vital transition, i.e., from a difference of natural increase between urban and rural areas (de Vries 1984, 1990). In other words, migration's contribution to urbanisation might neither have been so crucial nor so new, while the role of natural increase has been neglected.

In Jan de Vries' theory of urban transition (de Vries 1990) urban mortality plays a key role in European countries. The four-stage stylized urban transition model is (Dyson 2011): 1) A 'demographic sink': when deaths exceed births, observed in urban areas in the pre-transition stage (this corresponds to the urban penalty characterized by high mortality; cf. Gould 1998); 2) A decline in urban mortality (essentially through the reduction of infectious diseases) that allows urban natural growth and makes urban areas more attractive to migrants; 3) High net migration in favour of urban areas while urban mortality is no longer an obstacle; and finally, 4) The role of migration is further enhanced through population pressure when mortality also declines in rural areas.

Sean Fox (2012) points out that innovation (in particular in agricultural productivity, transportation, and health) should not be confused with economic growth (as measured by GDP per capita) when analysing the forces behind urban transition. In the presence of innovation, there may be urban growth without economic growth, as has been observed in sub-Saharan Africa and other developing areas of the world. Population growth may contribute more to urban transition than economic growth. In particular, mortality decline may be a sufficient condition for urban growth, provided that innovation is sufficient to create a surplus of energy (essentially food and fuel). Fox's analysis of the effects of geographical characteristics on the proportion of urban population and urban population size confirms that energy surplus occurs more often in coastal areas and river valleys where this surplus is easier to achieve. One of his conclusions is: "The onset of the urban transition in any given country or region should therefore be understood as part of a global historical process linked to technological and institutional change and diffusion, not simply as a product of endogenous economic and demographic forces" (p293). Fox provides a useful conceptual diagram (Figure 1) that helps to understand how innovation in technology and institutions triggered disease control, energy surplus, and economic development, which then caused vital, mobility, and, subsequently, urban transition.

Figure 1: Conceptual diagram relating economic and population transitions



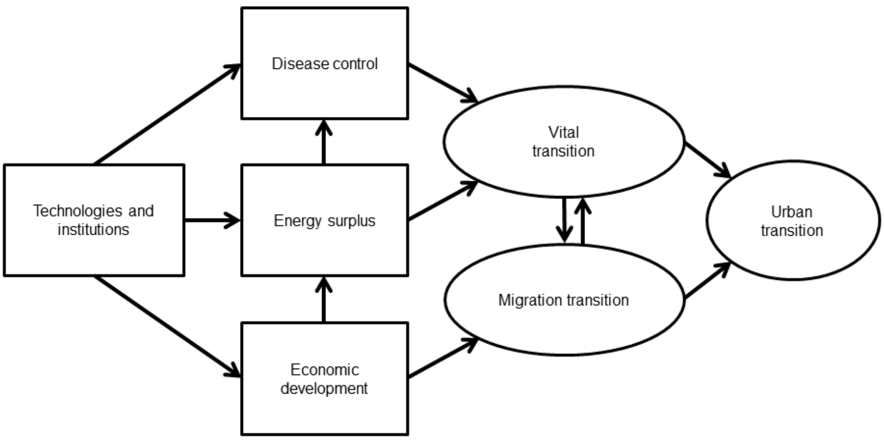
Source: Fox 2012

In line with de Vries, Fox attributes to mortality decline an essential role in urban transition: mortality decline is a direct and indirect cause of urban growth (through population growth). Another cause is migration, which itself is influenced by population growth and economic development. Under the condition that this web of causal relationships is true, the analysis consists in finding which of the different causes (squared boxes in Figure 1) may best explain urban transition. Based on empirical findings, Fox's conclusion is that "The fact that many of the technological and institutional changes that drive mortality decline and facilitate surplus expansion also drive economic development is the source of the spurious conclusion that urbanization is fundamentally a by-product of economic development" (p294). This conclusion concurs with that of de Vries: vital transition, rather than economic development, explains urban transition.

Yet the conceptual framework depicted in Figure 1 may give undeserved weight to vital transition in the urban transition process. The demographic components of urbanisation need to be identified more precisely than in Fox's figure. Our alternative conceptual diagram is represented in Figure 2. All economic variables (in rectangles) remain the same as in Figure 1. To clarify the discussion below, the group of the three factors disease control, energy surplus, and economic development will be named 'mode of production'. These production factors are considered as determinants of population change (in circles). The term 'urban transition' is preferred to 'urbanisation' or 'urban growth' to signify that it is the population growth differential between urban and rural areas (and not only the urban growth) that marks the transition from a mainly rural to mainly urban population. The term 'vital transition' is preferred to that of 'demographic transition' to refer to natural growth and avoid confusion with total population growth. To note, we did not separately identify mortality decline, since mortality is actually a component of natural growth as much as fertility is. The term 'migration transition' is also preferred to 'rural-to-urban migration' to account for urban-to-rural counter-flow. It is the resulting (implicitly positive) net migration that defines migration growth in urban areas: rural-to-urban migration contributes to urban growth inasmuch as it is higher than urban-to-rural migration. Mortality decline alone does not facilitate urban growth unless it is faster in urban areas than in rural areas. We account for a possible effect of vital transition on migration transition. Indeed, better chance of survival in urban areas may attract more rural migrants or encourage them to settle in urban areas rather than returning to rural areas. Moreover, higher population growth in rural areas may exert pressure on resources and translate into migration to urban areas. We also account for the effect of migration transition on vital transition, e.g., when positive net migration in reproductive age rejuvenates the structure of the urban population, thus boosting the vital transition effect on urban transition. So, unlike Fox, we do not posit that national natural growth will increase rural-to-urban migration.

Besides better survival prospects in urban areas, it is mainly economic development at large (i.e., changes in the structure of production) that increases net migration to the benefit of urban areas, through land pressure, productivity increase, institutional changes, etc. Disease control, energy surplus, and economic development cause urban transition inasmuch as vital and migration transitions induce faster urban growth than rural growth. In both our conceptual framework and Fox's, the primary cause of all changes is technological and institutional innovation, located on the far left of the diagrams.

Figure 2: Conceptual diagram relating economic and population transitions



Source: adapted from Fox 2012

This paper will not offer an alternative to Fox's empirical analyses of 20th century urbanisation in relation to its alleged demographic and economic determinants. In this paper we will rather concentrate on the identification of the respective effects of migration growth and natural growth on urban transition. We believe that clarification of population dynamics is needed before investigating further the economic and other determinants of migration and vital transition. In other words, we want to examine the population variables only (identified by circles in Figure 2) rather than the economic variables (rectangles). Using time series of demographic and urban transition in 19th century Sweden and Belgium, we will show that the above framework is able to tell which transition is a necessary (but not always sufficient) condition for the other transition to occur, using population indicators only in a deliberately descriptive but fairly easily replicable perspective. The respective contributions of birth, death, and migration and their timing will indicate whether economic development, through labour force migration, or vital transition mainly determines urban transition.

3. Methods and data: Verifying hypotheses on the timing of urban and vital transitions

Dyson's analysis of historical urban and rural demographic series on Sweden (1750–1956) and Sri Lanka (1891–1964) seems to conform to the hypothesis that mortality decline drove urban transition. Dyson used series of crude birth and death rates by urban and rural residence to conclude that in Sweden "until about 1850 the urban death rate was higher than the urban birth rate […] therefore the urban rate of natural increase was negative. […] So it was rural natural increase, through migration, that maintained […] limited urban growth […] Lower urban fertility also helped to explain why the urban sector was a sink. The urban death rate [fell from around 1800] much faster than the rural death rate" (Dyson 2011:43, Figure 2).

Barring data quality issues, his analyses seem to confirm that "mortality decline is the remote (i.e., underlying) cause of fertility decline" (Dyson 2011:37). Both de Vries and Dyson propose the hypothesis that vital transition and not economic growth explains urban transition since "in recent decades urbanization has been happening in places where there is little or no economic growth – in particular, sub-Saharan Africa" (Dyson 2011:38). "Urbanization is both an integral component and an outcome of the demographic [vital] transition" (Dyson 2011:47). The fact that "the speed of urbanization [in sub-Saharan Africa and Latin America] seems to have been significantly faster than was the case in developed countries historically [appears to confirm the expectation that a country would] urbanize faster under conditions of faster population growth" (Dyson 2011:48–50, Figure 4).

Our contention is that the time series analysis of crude birth and death rates by sector presented by Dyson are not appropriate to confirm that vital transition explains urban transition, for three reasons. These series do not show:

- the contribution of migration to urban transition. Because rural-to-urban migration is linked to economic growth in the urban sector, migration is a crucial indicator that needs to be estimated to evaluate the role of the economy in the urban and vital transitions.
- the difference between urban and rural growth resulting from the vital and urban transitions. Without these figures and their relation to migration, the role of the vital transition in the urban transition cannot be fully apprehended.

- the role of reclassification of rural areas to urban areas or vice versa. For lack of proper data, this aspect of urban transition if too often neglected and badly interpreted.

Although Dyson's analysis of historical demographic series on Sweden seems to confirm his hypothesis that vital transition explains urban transition, we will show how a re-examination of the basic demographic equation may lead to more comprehensive conclusions based on the same data.

3.1 Method

Using basic aggregated data on population, births, and deaths by area of residence, the migration component of population growth can be deducted without direct measurement of migrations. In the basic (or balancing) demographic equation:

$$P_{t+h} - P_t = B_h - D_h + I_h - E_h$$

the population *P* is circumscribed in a space and the outside world is defined by default (non-*P*) as the population from which immigration originates or to which emigration is directed. The non-*P* population is ignored in this equation. P_t and P_{t+h} are respectively the population at the beginning and at the end of the period *h*. Births in the interval *h* after the initial census *t* are represented by B_h, deaths by D_h, international immigration by I_h and international emigration by E_h. Now consider two related spaces, say *u* for urban and *r* for rural, in a modified set of basic demographic equations, assuming the same time interval *h* for simplicity:

$$P_{t+h}^r - P_t^r = B_h^r - D_h^r + M_h^{ur} - M_h^{ru} + M_h^{*r} - M_h^{r*}$$
$$P_{t+h}^u - P_t^u = B_h^u - D_h^u + M_h^{ru} - M_h^{ur} + M_h^{*u} - M_h^{u*}$$

where *M* stands for migration flow from *u* to *r* and from *r* to *u*, or from non-*P* (noted *) to *r* or *u*, and from *r* or *u* to non-*P*. This set of equations is meant to analyse the vital transition in a heterogeneous population $P = P^u + P^r$. Rates of increase in time interval *h* in rural and urban areas are defined as:

$$q_h^u = \frac{B_h^u - D_h^u + M_h^{ru} - M_h^{ur} + M_h^{*u} - M_h^{u*}}{P_t^u} = b_h^u - d_h^u + m_h^u + i_h^u$$

$$q_h^r = \frac{B_h^r - D_h^r + M_h^{ur} - M_h^{ru} + M_h^{*r} - M_h^{r*}}{P_t^r} = b_h^r - d_h^r + m_h^r + i_h^r$$

where the denominator P_t is the population at the beginning of the period h (prospective rates) but can indifferently be replaced by the mid-interval population at time $t+½h$. Prospective rates are generally preferred because they are easier to handle for projection purposes but alternatively the denominator can be replaced by the population at mid-interval. The rates b_h^r, d_h^r, m_h^r, i_h^r are respectively the crude birth rate, crude death rate, net internal migration rate, and net international migration rate, all in period h. Comparing trends of mortality, fertility, and migration rates from both areas are of particular interest for the joint analysis of the demographic and urban transitions.

An additional component of urban growth is the evolution of urban measurement over time. Definitions of urban areas always involve the use of arbitrary limits. Most of the time, to distinguish urban from rural areas, an absolute population threshold (e.g., 5,000 inhabitants) is applied to localities; i.e., usually the smallest administrative areas. In other cases, urban areas are defined using a functional approach (e.g., administrative function) that may be combined with some other relative threshold (e.g., percentage of active population working in the non-agricultural sector exceeding 50%). Whatever the urban definition, a locality may change category just by crossing a relative or absolute threshold or by decision of central authorities. Some urban localities may become rural, but most of the time rural localities become urban. This 'movement', although definition-driven, is often confused with migration in the absence of information on the localities that changed category. Whenever data permit it is better to explicitly account for this component, the urban reclassification growth:

$$c_h^u = \frac{C_h^{ru} - C_h^{ur}}{P_t^u},$$

noting that this component has the opposite sign (but not the opposite value) of the rural reclassification growth:

$$c_h^r = \frac{C_h^{ur} - C_h^{ru}}{P_t^r}$$

where C_h^{ur} is the urban population reclassified rural in period h, and C_h^{ru} is the rural population reclassified urban in period h. Using all the above equations, we can now derive the urban-rural difference in population growth as:

$$q_h^u - q_h^r = (b_h^u - b_h^r) - (d_h^u - d_h^r) + (m_h^u - m_h^r) + (i_h^u - i_h^r) + (c_h^u - c_h^r)$$

To ease reading of the figures below, each difference in urban-rural rate can be abbreviated:

$$\Delta G = \Delta CBR - \Delta CDR + \Delta intM + \Delta extM + \Delta R$$

where ΔG stands for urban-rural growth difference, ΔCBR for urban-rural growth difference in crude birth rate, ΔCDR for urban-rural growth difference in crude death rate, ΔintM for urban-rural internal net-migration growth difference, ΔextM for urban-rural international net-migration growth difference, and ΔR for urban-rural net reclassification growth difference. Rural to urban or urban to rural reclassification may itself occur as a result of cumulated growth over the years through migration, natural growth, or a combination of both. When administrative definition is used for urban areas, authorities often account for real or perceived growth to change the status of localities. ΔintM and ΔextM represent, respectively, the internal migratory and the international migratory attraction or repulsion of urban areas. It may be tempting to assume that the difference between urban and rural international net-migration is negligible. However, this assumption of negligible demographic interaction with the outside world is not necessary, since the sum of ΔintM and ΔextM represents the general migratory attraction or repulsion of urban areas, whatever the origin of migration flows. We will show later in the paper the importance of considering the non-*P* population when it comes to the analysis of population transitions in developing countries.

Interestingly, from a computational point of view, it is sufficient to know the urban-rural growth difference (ΔG) and the urban-rural natural growth difference (ΔN=ΔCBR-ΔCDR) to deduct the remaining components (ΔintM+ΔextM+ΔR) without knowing the reclassification component and the exact migration flows between rural and urban areas, and between these areas and the outside world; both components that are, admittedly, less often directly measurable:

$$\Delta \mathrm{intM} + \Delta \mathrm{extM} + \Delta \mathrm{R} = \Delta \mathrm{G} - (\Delta \mathrm{CBR} - \Delta \mathrm{CDR}).$$

De Vries (1984) implemented a similar method on 50-year intervals for European countries for the period 1500–1890. More recent applications on census data (usually 10-year intervals) are found in Lerch (2014) for Albania between 1950 and 2011, or in Henderson et al. (2013) for England (1700–1910) and developing countries (1960–2010). Using this interesting feature of the two-sector demographic equation, we graphed each parameter using Dyson’s data on Sweden (Figure 3, Table 1; see also in Figure A-1 a graph of the original rates as produced by Dyson) and using our own data on Belgium (Table 2, Figure 4; see also original in Figure A-2 a graph for direct comparison with Figure A-1 for Sweden).

Plotting urban-rural differences in vital and migration rates allows a much easier identification of the components (birth, death, migration, and, when possible, reclassification) of urban-rural growth difference, and therefore of the urban transition. To note, we are here not so much interested in the components of urban growth per se as in the components of urban-rural growth difference.

Data on reclassification (ΔR) were not available in the above-mentioned publications (including that of Dyson on Sweden), but we collected these data on

Sweden and Belgium so we can isolate the migration component for these two countries (Figures 5 and 6, Tables 2 and 3):

$$\Delta\text{intM} + \Delta\text{extM} = \Delta\text{G} - (\Delta\text{CBR} - \Delta\text{CDR}) - \Delta\text{R}$$

Our approach to the urban transition differs from previous approaches in that we used series of urban-rural growth differences to identify the components of urban transition, including reclassification decomposed, when possible, into its natural and migratory components.

3.2 Data

The population of Belgium (4.30 million in 1844) was about a third larger than that of Sweden (3.14 million in 1840) up to World War I (respectively 7.42 million in 1911 and 5.52 million in 1910), although Sweden's surface (449,964 km^2) is 15 times larger than that of Belgium (30,528 km^2).

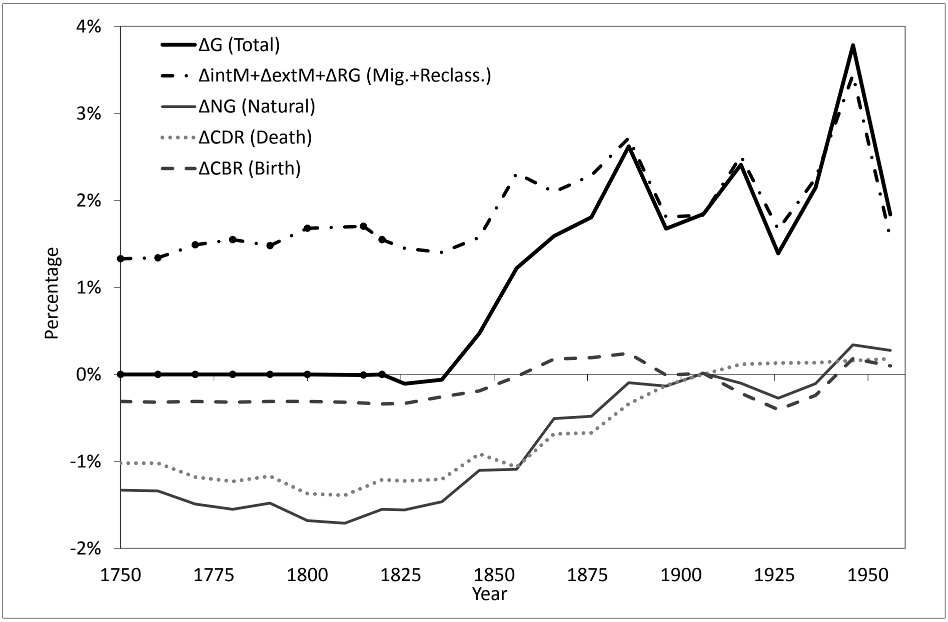
Swedish data quality issues are commented on at length in Dyson's paper. We will consider his data as good enough to serve his purpose and ours. Vital rate for the 1821–1960 period are mostly ten-year averages using statistical abstracts. For the 1750–1820 period Dyson used averages reconstructed by Friedlander (1969). Although no precise series before 1820 are available to confirm urban trends in Sweden, both Bairoch (1988) and Dyson (2011) consider that the percentage of urban population was constant between 1750 and 1820. Bairoch estimated it at 6.6% and Dyson at 9.8%. To complement Dyson's data on Sweden, we used historical series of population in cities and boroughs from 1800 to 1867 (Statistiska Centralbyrån 1969: Table 12), which is useful to identify the reclassification component. There was virtually no reclassification from 1750 to 1820 (two localities of about 100–150 people were added as 'boroughs' in 1786 and 1816) and, because precise urban statistics are only available from 1820, our figures that include a reclassification component start at this date. To note, no city had been downgraded to a rural areas before 1967. Therefore reclassification during our study period (1820–1960) is always to the benefit of urban growth. Urban reclassification was particularly active after World Wars I and II. Data were not available to compute birth and death rates for reclassified localities over the whole study period.

Data on Belgium has never been published before (Tables 2 and 3, Table A-1). Since the foundation of the Kingdom of Belgium in 1830, information on births, deaths and, to a certain extent, migrations has been collected through vital registration and the registers of communes (Poulain and Herm 2013). The Central Commission for Statistics has been collating this information in statistics books since 1841, available to us in different formats: original paper copies (1841 to 1848), microfilm (1857 to 1879) and electronic files (1880 to 1996). From 1841 the number of communes fluctuated around 2,600, until successive territorial reforms in the 1960s and 1970s reduced this number to 589 by a series of mergers. The average communal area before 1965 was 11.7 km^2, with 14.6% exceeding 20 km^2 and only 2.5% exceeding 40 km^2. We applied the official definition of urban areas used since 1867 to the period from 1841 to 1964: all communes with more than 5,000 inhabitants are considered urban. Before 1867 the urban communes had to be reconstructed from the original data to comply with the 5,000-inhabitant threshold.

Population estimates are often biased, due to the unreliable registration of migrations. In particular, out-migrations are badly registered, leading to an overestimation of the population (Poulain and Herm 2013). For this reason here we only considered total population data from census years, when population figures are most reliable. Censuses were conducted every ten years from 1846 to 1876 (on this last date a simple head count was conducted) and from 1880 to 1930, and in 1947, 1961, 1970, 1981, 1991, and 2001. We limit our study up to 1961, thus prior to the commune mergers. As for reclassification, the identification of communes that crossed the 5,000-inhabitant threshold either way was reliable from 1858 on, together with birth and death data. From 1841 to 1857 data are not available to distinguish migration from reclassification.

For the 1841–80 period, estimates of births and deaths are provided for the sampled years 1841, 1844, 1846, and 1848, and then 1858, 1861, 1864, and finally for all years from 1867 to 1880. Birth and death data exist for the 1851–56 period but were not available to us. Also, estimates of the total population are not reliable for 1841 and population registers were operational from 1st January 1847 only. Therefore we give estimates for the period 1844–1848 (births and deaths extrapolated from 1844, 1846, 1848 sampled years centred on the 1846 census), for the 1858–66 period (births and deaths extrapolated from 1858, 1861, 1864 sampled years framed by the 1858 and 1866 censuses), and for inter-censuses periods afterwards for which births and deaths are available for all years.

Figure 3: Urban-rural difference in mortality, fertility, migration cum reclassification, and total growth in Sweden (1750–1960)



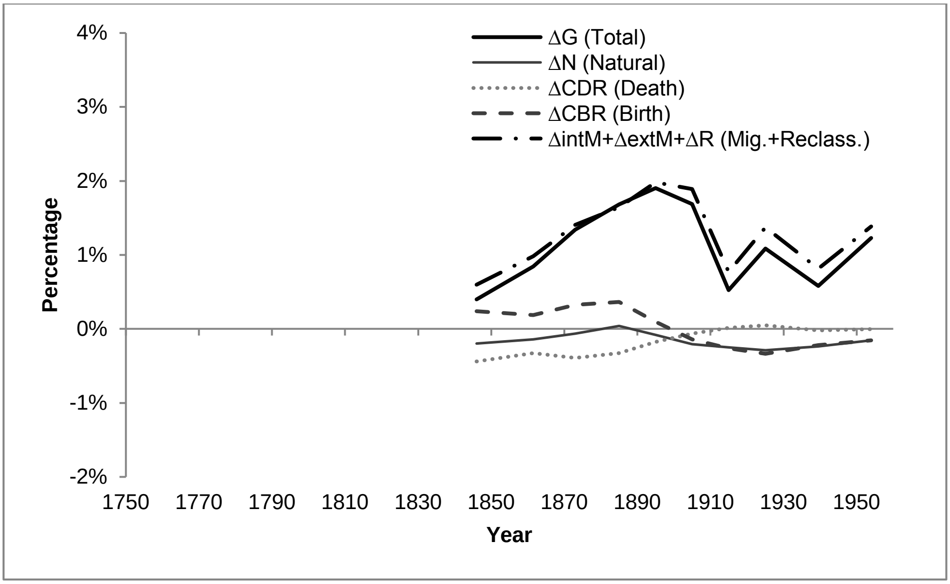
Source: Our own computation using original crude birth and death estimates by urban and rural areas compiled by Dyson (2011). Estimates assuming constant 9.8% urban population before 1820 are marked with large dots.

Legend: ΔG=urban-rural growth difference, ΔN=urban-rural natural growth difference, ΔintM=urban-rural internal net-migration growth difference, ΔextM=urban-rural international net-migration growth difference, ΔR=urban-rural reclassification growth difference, ΔCDR=urban-rural difference in crude death rates, ΔCBR=urban-rural difference in crude birth rates.

Table 1: Natural, migration, and reclassification components of urban-rural

Period	Mid-year	% urban pop.	ΔCDR (Death)	ΔCBR (Birth)	ΔG (Total)	ΔN (Natural)	ΔintM+ ΔextM+ ΔR (Migration + Reclass.)	ΔintM+ ΔextM (Migration)	ΔR (Reclassification)
1821–30	1826	9.78%	-1.23%	-0.33%	-0.11%	-1.56%	1.45%	1.45%	0.00%
1831–40	1836	9.70%	-1.21%	-0.26%	-0.06%	-1.46%	1.40%	0.67%	0.73%
1841–50	1846	9.88%	-0.91%	-0.19%	0.47%	-1.10%	1.57%	1.42%	0.15%
1851–60	1856	10.65%	-1.07%	-0.03%	1.22%	-1.09%	2.31%	1.73%	0.58%
1861–70	1866	12.06%	-0.68%	0.18%	1.59%	-0.51%	2.10%	1.74%	0.36%
1871–80	1876	13.98%	-0.67%	0.19%	1.81%	-0.48%	2.29%	2.29%	0.00%
1881–90	1886	16.86%	-0.34%	0.24%	2.62%	-0.10%	2.72%	2.26%	0.46%
1891–00	1896	20.10%	-0.13%	-0.01%	1.67%	-0.14%	1.81%	1.61%	0.20%
1901–10	1906	23.07%	0.00%	0.01%	1.84%	0.01%	1.83%	1.32%	0.51%
1911–20	1916	27.05%	0.12%	-0.22%	2.41%	-0.10%	2.51%	-1.40%	3.91%
1921–30	1926	30.98%	0.13%	-0.40%	1.39%	-0.27%	1.66%	0.56%	1.10%
1931–40	1936	34.88%	0.14%	-0.24%	2.15%	-0.11%	2.25%	1.34%	0.92%
1941–50	1946	41.83%	0.16%	0.18%	3.78%	0.34%	3.44%	1.57%	1.87%
1951–60	1956	48.83%	0.18%	0.10%	1.84%	0.28%	1.56%	1.55%	0.01%

Figure 4: Urban-rural difference in mortality, fertility, migration, cum reclassification, and total growth in Belgium (1840–1964)



Source: Our own computation using original crude birth, death and reclassification estimates by urban and rural areas (see Table 2).

Table 2: Natural, migration, and reclassification components of urban-rural growth difference (Belgium, 1844–1961)

Period	Mid-year	% urban pop.	ΔCDR (Death)	ΔCBR (Birth)	ΔG (Total)	ΔN (Natural)	ΔintM+ ΔextM+ ΔR (Migration + Reclass.)	ΔintM+ ΔextM (Migration)	ΔR (Reclass-ification)
1844–1848	1846	32.28%	-0.26%	0.15%	0.40%	-0.20%	0.60%	n.a.	n.a.
1858–1866	1861.5	35.15%	-0.33%	0.19%	0.84%	-0.14%	0.98%	0.35%	0.63%
1867–1880	1873	36.90%	-0.39%	0.33%	1.34%	-0.06%	1.41%	0.39%	1.02%
1881–1890	1885	41.40%	-0.32%	0.36%	1.68%	0.04%	1.64%	0.78%	0.86%
1891–1900	1895	45.55%	-0.18%	0.10%	1.90%	-0.08%	1.98%	0.65%	1.33%
1901–1910	1905	50.31%	-0.06%	-0.14%	1.69%	-0.20%	1.89%	0.48%	1.41%
1911–1920	1915	54.53%	0.01%	-0.26%	0.53%	-0.25%	0.77%	0.54%	0.23%
1921–1930	1925	55.83%	0.05%	-0.34%	1.09%	-0.29%	1.37%	0.24%	1.13%
1931–1947	1939.5	58.49%	-0.02%	-0.22%	0.58%	-0.24%	0.81%	0.27%	0.54%
1948–1961	1954	59.70%	0.00%	-0.15%	1.23%	-0.15%	1.38%	0.34%	1.05%

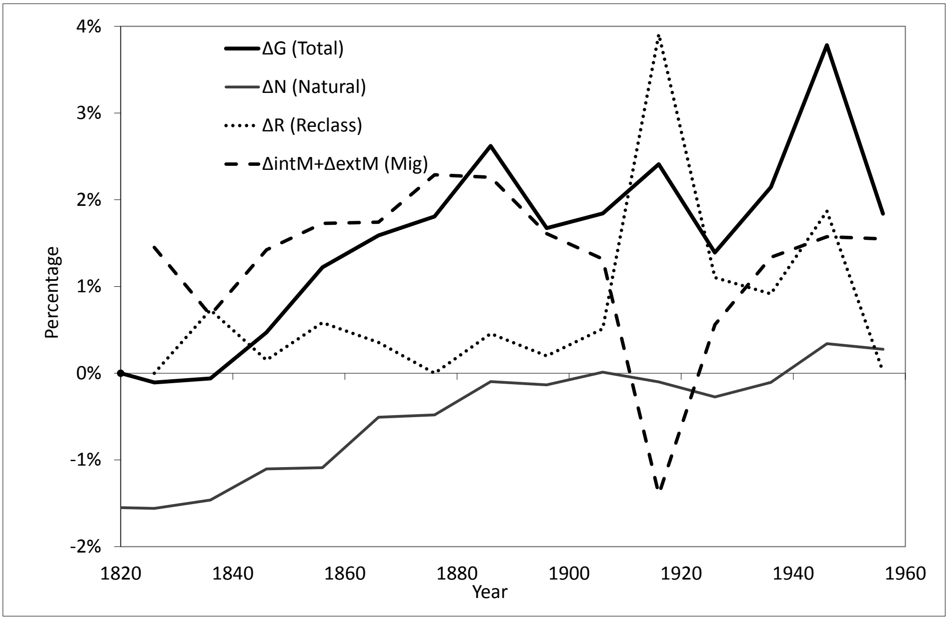
Note: n.a.: not available

4. Results in Sweden and Belgium: The contribution to urbanisation of migration, reclassification, and natural movements

Figure 3 and Figure 4 not only depict the difference in vital transition between urban and rural areas (ΔCBR, ΔCDR, and the resulting ΔN), but also the trends in urban-rural migration cum reclassification growth difference (ΔintM+ΔextM+ΔR). Figure 3 shows that in Sweden positive migration cum reclassification growth was very likely compensated by negative natural growth, resulting in virtually zero urban growth from 1750 to 1836. The ‘demographic sink’ (when ΔN was at its lowest) reached its deepest point (-1.71% difference annual natural growth at the expense of urban areas) around 1815. Confirming Dyson (2011), a higher crude death rate in urban areas compared to rural areas explains almost entirely this urban demographic sink. Urban-rural differences in crude birth rate are small over the whole study period. From about 1840 on the urban-rural natural growth difference reduced and from 1886 on hovered around zero (plus or minus 0.3%). But the most important feature of Figure 3 (see also Table 1) is that migration cum reclassification contributed to the urban-rural total growth difference (ΔG) and its variations in an essential manner. Certainly urban natural growth became positive thanks to the reduction of the urban-rural mortality differential in the early 19th century, but urban natural increase did not supersede rural natural increase in any significant way. The results appear contrary to de Vries’ hypothesis that rising urban natural growth diminishes “the importance of rural-urban migration as a source of urban growth” (de Vries 1990:58). Rather, the quasi-balance of urban and rural natural growth released the full potential of an already existing migration-cum-reclassification impact on total urban growth.

Although Figure 3 does not distinguish the migration component from the reclassification component, reclassification in Sweden was virtually non-existent from 1750 to 1820, so only migration compensated for the negative natural movements before the start of the urban transition. Figure 5 (starting from 1820) shows that throughout the 19th century, i.e., at the beginning of the urban transition, reclassification has a fairly marginal, albeit positive, contribution (0.3% on average from 1820 to 1910) while the migration contribution is five times higher on average (1.6% during the same period). Reclassification was very high after each World War, while the migration contribution dropped during World War I.

Figure 5: Urban-rural difference in direct natural, direct migration, reclassification, and total growth in Sweden (1820–1960)



Source: Our own computation using original crude birth and death estimates by urban and rural areas compiled by Dyson (2011) and historical series of population in cities and boroughs (Statistiska Centralbyrån 1969: Table 12).

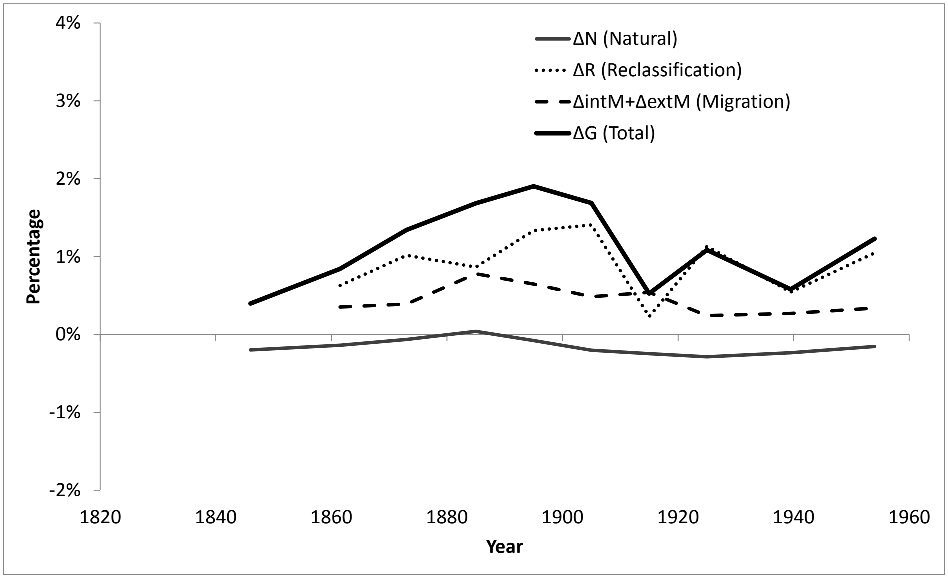
What the Swedish example teaches us is that migration not only intervened in an early phase of urban development in the 18th century (compensating for the urban demographic sink) but also was an essential component of the urban transition throughout the 19th century. These rather stable trends would confirm that "the rapid urban growth of the 19th century need not have been accompanied by a major change in migration flows", as shown in a simulation exercise by de Vries (1984: p233). However, this urban growth was not accompanied by a change from negative to positive natural growth. All that was necessary was that urban-rural difference in natural growth vanishes thanks to a reduction in the urban-rural mortality differential. To use a mechanical metaphor, the engine of the urban transition in Sweden was already running high with migration fuel when the natural growth brakes were released around 1840, allowing urban transition to run at full speed.

Trends in Belgium (Figure 4, Table 2) form an interesting contrast to those of Sweden (Figure 3, Table 1). In both countries the crude death rate was higher in urban areas before 1905. However, unlike in Sweden, in Belgium the crude birth rate was always higher in urban areas before 1900. In fact, the differences in birth and death rates were almost symmetrical in Belgium. In other words, higher urban crude birth rate was almost sufficient to compensate for higher urban crude death rate, leading to nearly negligible urban-rural differences in natural growth (ΔN): there is no evidence of pre-transitional urban demographic sink in Belgium. From 1900 on, differences in crude death rates (ΔCDR) were negligible, while crude birth rates (ΔCBR) were constantly lower in urban areas. In Belgium there was actually a weak, post-transitional (20^{th} century) urban demographic sink due to fertility, not mortality. The lowest urban-rural natural growth difference, -0.26%, was reached in the 1921–31 period.

The most noticeable feature in Belgium is the role of migration-cum-reclassification in overall urban growth. First, as in Sweden, these two components taken together were an essential component of urban growth throughout the 19th century. In Belgium, they contribute almost entirely to urban growth over the study period: the migration-cum-reclassification curve (ΔintM+ΔextM+ΔR) mirrors the total growth difference curve (ΔG). Second, contrary to Sweden, the vital transition has very little impact on urban growth: the absence of demographic sink (fertility compensating for mortality) allowed the urban transition to occur before mortality declined in urban areas. In Belgium, whereas mortality rates begun to fall around 1850 (Figure A-2), fertility transition started circa 1880 in larger communes and in some rural communes of Wallonia and just before World War I in other rural communes, notably in Flanders (Lesthaeghe 1977). Urban growth was actually slightly hindered in the first half of the 20^{th} century because of low fertility after the vital transition was well under way.

Table 3 and Figure 6 isolate, for Belgium and the years 1858 to 1964, the migration component (ΔintM+ΔextM) from the reclassification component (ΔR) and the natural component (ΔN) of total urban-rural growth difference (ΔG). The natural component contribution is relatively low and regular, while the reclassification and migration components explain most of the total urban-rural growth difference. In the period 1858–1911 the average ΔR (reclassification) was +1.05% against +0.53% for ΔintM+ΔextM (migration) and -0.09% for ΔN (natural). In the period 1911–1961 the figures were respectively +0.74% (reclassification), +0.35% (migration) and -0.23% (natural). Both the Belgian and Swedish cases show that in absence of data on reclassification it is wrong to interpret the difference between ΔG and ΔN as a measure of direct contribution of migration only. In Belgium, although with higher volatility over the period, reclassification generally contributed more than twice as much to urban-rural growth difference than the migration component. In Sweden, the contribution of reclassification is low before World War I, but the major reclassification after and between the two World Wars is on a par with the migration contribution.

Figure 6: Urban-rural difference in direct natural, direct migration, reclassification, and total growth in Belgium (1844–1961)



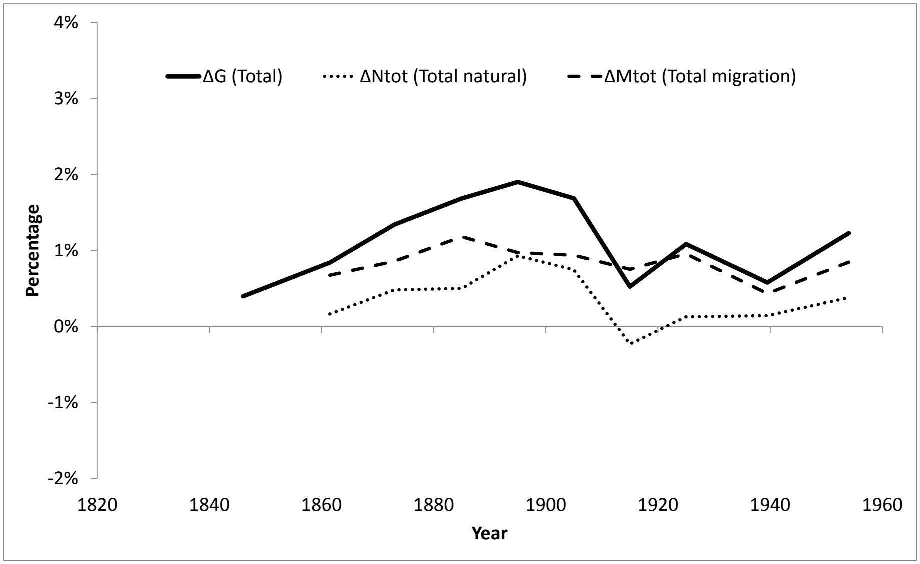
Source: Our own computation using original crude birth, death and reclassification estimates by urban and rural areas (see Table 2).

Table 3: Natural and migration direct contributions to urban-rural growth difference and indirect contributions through reclassification (Belgium, 1844–1961)

Period	ΔG (Total) [1]	ΔN (Natural) [2]	ΔintM+Δext M (Migration) [3]	ΔR (Reclass-ification) [4]	Natural contrib-ution to reclass-ification [5]#	Reclass-ification natural [6]= [4]*[5]	Reclass-ification migration [7]= [4]*(1-[5])	Total migration [8]= [3]+[7]	Total natural [9]= [2]+[6]	Total % migration [10]= [8]/[1]
1844–1848	0.40%	-0.20%	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.
1858–1866	0.84%	-0.14%	0.35%	0.63%	*48.4%*	0.30%	0.32%	0.68%	0.17%	*80.3%*
1867–1880	1.34%	-0.06%	0.39%	1.02%	*53.9%*	0.55%	0.47%	0.86%	0.48%	*64.0%*
1881–1890	1.68%	0.04%	0.78%	0.86%	*53.6%*	0.46%	0.40%	1.18%	0.50%	*70.1%*
1891–1900	1.90%	-0.08%	0.65%	1.33%	*75.6%*	1.01%	0.33%	0.97%	0.93%	*51.1%*
1901–1910	1.69%	-0.20%	0.48%	1.41%	*67.7%*	0.95%	0.45%	0.94%	0.75%	*55.7%*
1911–1920	0.53%	-0.25%	0.54%	0.23%	*8.2%*	0.02%	0.21%	0.75%	-0.23%	*143.5%*
1921–1930	1.09%	-0.29%	0.24%	1.13%	*36.8%*	0.42%	0.71%	0.96%	0.13%	*88.1%*
1931–1947	0.58%	-0.24%	0.27%	0.54%	*69.9%*	0.38%	0.16%	0.43%	0.14%	*75.0%*
1948–1961	1.23%	-0.15%	0.34%	1.05%	*51.3%*	0.54%	0.51%	0.85%	0.38%	*68.9%*

Note: See Appendix Table A-1, bottom-right column. n.a.: not available

Figure 7: Urban-rural difference in total natural, total migration, and total growth in Belgium (1844–1961)



Source: Our own computation using original crude birth, death and reclassification estimates by urban and rural areas (see Table 3 and Table A-1).

Both migration and natural movements may contribute to reclassification. Swedish data to identify births and deaths in the few localities reclassified in the 19th century were not available to us. However, data are available for Belgium from 1858 to compute for the reclassified communes the relative contribution of natural movements to their reclassification between two subsequent censuses. For any locality, crossing an arbitrary threshold (5,000 inhabitants in the case of Belgium) is neither related to the component of population growth (migration or natural growth) nor to the level of this growth. Crossing the threshold over a given census interval may take one individual or several thousand, and this number may be generated by either migration or natural movements. Table A-1 displays for the two types of reclassification (from rural to urban and from urban to rural, sometimes called declassification) the number of births, deaths, and migration (by difference with total population variation) during the inter-census period. The contribution of natural movements is then computed by dividing the balance of births and deaths by the total population variation between censuses. Although not easily interpretable for declassification, a negative contribution percentage means that natural movements (always positive in this period) contributed not as a loss but as a gain of population for communes declassified from urban to rural areas. The third part of Table A-1 is just the balance of part one and two and is useful for computing the total contribution of natural increase to total reclassification. Most of the time, natural movements over the 1881–1961 period make a higher contribution to reclassification than migration, except in the World War I period and its immediate aftermath. The natural contribution is used in Table 3 (column 5) to compute the overall contribution of natural and migration movements to urban growth.

Table 3 presents the direct contribution of natural movements (column 2) and migration (column 3) to total urban-rural growth difference (column 1) as well as the indirect natural (column 6) and migration (column 7) contributions using the natural contribution to reclassification (column 5, taken from the bottom-right column of Table A-1). The total migration (column 8) and natural (column 9) components of urban-rural growth difference are just the sum of direct and indirect contributions. These components are presented in Figure 7. The World War I period is the only period when natural movements had a negative contribution (hence a higher-than-100% contribution of migration in column 10). Otherwise, both total migration and natural components had a positive effect on urbanisation. Despite reclassification being mainly due to natural movements, the total of the direct and indirect contributions of migration is generally higher than that of the natural component: 77.4% on average for the whole 1858-1961 period, 69.2% if we exclude the admittedly disturbed 1911–21 period.

To summarise our empirical results on Sweden and Belgium:

In Belgium, natural movements generally have a negative direct effect and a positive indirect (through reclassification) effect, while migration always has a positive effect, whether direct or indirect. Although Swedish data were not available to us to compute the indirect effect of natural movements through reclassification, it would be negligible anyway over the 19th century, since reclassification was itself negligible before World War I. In other words, urban transition in Sweden was essentially due to the positive direct effects of migration and the reduction of the negative direct effect of natural movements, essentially mortality.

The correlation between trends in migration and natural growth differences in Belgium (82.4% excluding the 1911–21 period) indicates that migration may have driven part of the natural trends by modifying the population structure of urban areas. This effect is much weaker in Sweden (correlation of 22.5% excluding the 1910–20 period). In Belgium, rural-urban migration of youth of reproductive age may have had a multiplicative effect on ΔG in the first stage of urban transition through natural growth (for a recent illustration showing stronger migration effect on natural growth, see Lerch 2014).

It is possible that earlier mortality decline in rural areas as compared to urban areas could have created population pressure in rural areas, thus indirectly contributing to urbanisation through rural-urban migration. However, mortality started to decrease seriously from 1800 almost simultaneously in urban and rural areas of Sweden (Figure A-1), although at a faster pace in urban areas. Series are not sufficiently long in Belgium (Figure A-2) to tell. We would need evidence for more countries to test whether long-term population pressure in rural areas was indeed an indirect factor of rural-urban migration. Nevertheless, our data are sufficient to show that rural mortality decline had no short-term, triggering effect on rural-urban migration in the two countries at stake.

Reclassification above or below the 5,000-inhabitant threshold makes a large contribution to ΔG in Belgium, twice as large as the direct contribution of migration, except during World War I. It also explains most of the period-to-period variation. However, not all reclassification is due to natural movements, which contribute 51.7% to reclassification (57.1% excluding the 1911–21 period), migration contributing to the rest. In Sweden administrative reclassification played a negligible role before World War I, i.e., it did not contribute to the 19th century urban transition but contributed a lot to maintaining high urban growth immediately after and between the two World Wars.

It would be presumptuous to say that Sweden and Belgium are representative of, respectively, Northern Europe and Western Europe, but their comparison shows a contrasting effect of vital transition on urban transition. In both countries, migration is the direct or indirect (through reclassification) engine of urban transition, and its contribution precedes the onset of vital transition in the mid-19th century. In Sweden, reduction in mortality in urban areas (1840–1880) evidently unleashed urban transition in the 19th century, while lower urban fertility mildly hindered it between the two World Wars. In Belgium, higher urban mortality or lower urban fertility only slightly reduced the speed of urban transition respectively before and after the vital transition starting around 1880. The bottom line is that trends in both Sweden and Belgium confer on the vital transition a secondary, unstable, and negative role in the urban transition, while migration explains most of it in the long run.

By studying Belgium and Sweden, we wanted to see whether relevant conclusions could be made from simple but long data series. Population estimates, births, and deaths by area of residence are hopefully available for a number of countries for which statistical books are accessible. This would suffice to identify the direct role of natural movements, but extra data collection is necessary to identify the often-neglected reclassification effect and to break it into its natural and migration components in order to identify the direct and indirect effects of migration. That being said, our analysis is obviously constrained by the fairly simple data considered. The data used here cannot identify the complex effect of migration on natural growth through a change in age structure, although a positive correlation between natural and migration growth differences is a good indication of this effect. Also, much more complex data are needed to analyse the changes in fertility and health behaviour brought about by migration.

However, our analyses of Sweden and Belgium are sufficient to question de Vries' argument that spatially-differentiated vital transition led to urban transition, or, to use Dyson's words, that "shifts in the structure of employment are perhaps better seen as resulting from the demographic [vital] processes that bring about urbanization, rather than urbanization being seen as resulting from shifts in the structure of employment as a result of economic growth" (Dyson 2011). After giving a direct and positive role to migration in urban transition, and an indirect and negative role to natural growth, Zelinsky's hypothesis of mobility transition cannot be so easily dismissed.

5. Discussion: accounting for spatial hierarchies in the analysis of population transitions

However useful our approach may be in identifying the prominent role of migration over natural movements in European urban transition in the 19th century, can it be transposed directly to the analysis of urban transitions in the 20th and 21st centuries? How can 19th century Europe inform contemporary urban transitions and what are the methodological implications?

Our approach has limitations that need to be addressed before analysing more recent transitions. First, in our analysis of demographic interplay, urban and rural sub-populations are attributed core and peripheral roles. Using a set of basic demographic equations, at least two sub-spaces must be identified in a hierarchical way, whatever the national population at stake. The urban-rural divide is an obvious choice considering available data for 19th century Europe, but other hierarchies might be more relevant for more recent periods. For example, urban hierarchies according to the size of agglomerations could be used within countries as well as across countries. Second, applying the method to more recent periods without considering the global expansion of the urban transition would probably be a mistake. Although usually measured at country level, economic development, urban transition, and vital transition are less and less national and more and more global processes, both in terms of economic interests and geographical scale. Considering each and every country as separate entities across space and time is subjecting the analysis to a 'methodological nationalism' bias. As time goes by, the analytical scale has to be changed from national to international.

This last section opens the discussion for future research by considering the implications of spatial hierarchy and globalisation. Our contention is that a political economic perspective is needed in the analysis of urban transition in the 20th and 21st centuries. Indeed, the theory of demographic transition originates in the political economy of the relations between natural resources and population, between production and reproduction. The relation between contemporary demographic transition and world economic development cannot be ignored.

Following the tradition of historians that examined long-term, intertwined economic and social trends[4], Chase-Dunn (1998:xiv-xvi) identifies several structural constants of the world system that he uses to analyse urbanisation trends. They should also be useful in our interpretation of the relation between urban and vital transitions. Capitalism is an obvious one, and we take for granted that the reader knows the general characteristics of this mode of production. More relevant to the demographic transition are two other characteristics of the world system: interstate competition and centre-periphery hierarchy. These mean that to better understand the relation between vital and urban transitions we should place this relation within a system of hierarchical dependencies; i.e., a system where a space (say, a state or part of a state) depends on another with more economic and political power. Economic power is spatially concentrated in core countries and cities, by way of accumulation of physical and human capital. Urban areas obviously existed before the 19th century and far beyond Europe, but it is with the rise of industrialisation in Europe that they developed beyond the limits in which they were previously constrained. As in the Swedish example, urban development was limited by a number of economic constraints, chiefly the supply of production and reproduction inputs like wood, water, and food (van der Woude, Hayami, and de Vries 1990), as well as by demographic variables (excess urban mortality). Mortality and, more importantly, fertility decline in the centres of economic power indicate that the quality of human resources depends on their quantity. These centres are at the forefront of vital transition. Migration to urban areas can be considered as re-allocation of human resources to the centres of economic power in order to control the exploitation and trade of natural resources (e.g., mining cities, ports). The same mechanism can be observed at an international level, notably through colonisation of new territories. Production generated by peripheral areas (e.g., developing countries or rural areas within a country) is associated with the demand of core areas (e.g., developed countries or urban areas within a country). Urban areas will grow in peripheral areas inasmuch as they can contribute to core areas' economic

[4] The world-system theory, inspired by the Annales group of historians around Fernand Braudel (Braudel, F. (1958); Histoire et sciences sociales : La longue durée. *Annales. Économies, Sociétés, Civilisations* 13(4): 725–753, ibid.) was conceived by Immanuel Wallerstein and T.K. Hopkins (T.K. Hopkins and I. Wallerstein (1982); *World-systems analysis: Theory and methodology*. Bervely Hills, Calif.: Sage Publications; and Wallerstein, I.M. (2004). *World-Systems Analysis - An Introduction*. Durham London: Duke University Press) and later developed by Cristopher Chase-Dunn (1998), who analysed urban hierarchies in history as an indicator of centre-periphery relations and evolutions. Jan de Vries was also inspired by the Annales in his masterpiece on European urbanisation (de Vries 1984).

development. In other words, urban transition is the spatial manifestation of the changing relationships between demographic and economic systems.

With the consideration of hierarchies we come back the fundamental question: is economic development the cause or the consequence of transitions in the population domain? Drawing again on the examples of Sweden and Belgium, we agree with Dyson that urbanisation is the result of interactions between population movements (births, deaths, migrations). However, the central role of migration in the urbanisation process shows how sensitive the whole vital and urban transition is to economic relations between urban and rural areas. Therefore the economic transition to capitalism in the 18th and 19th centuries in Europe should be reinstated as the underlying cause of the vital and urban transitions, operating through the shift of human capital in the national space. While broadly agreeing with Reher's framework that relates vital transition, human capital formation, and social and economic change (Reher 2011), we question the reduction of the economic system to a mere contextual role.

What are the respective roles of mortality, fertility, and migration in urban transition? Our analysis of Sweden and Belgium indicates that mortality and fertility effects on urban transition are not constant in history, while migration has a more sustained effect. In reference to our conceptual framework (Figure 2) and supported by our results on Sweden and Belgium, we make the following propositions: technological and institutional innovation is a necessary and underlying condition for a change in the mode of production; a change in the mode of production (notably through human capital development that brings about disease control, energy surplus, and economic growth) is the necessary and underlying condition for the vital and mobility transitions; mobility transition is a necessary and underlying condition for urban transition; vital transition is an unnecessary contribution to urban transition. Therefore, it is not that "urbanization […] is an inevitable *outcome* of the demographic [vital] transition" (Dyson 2011:51, our emphasis), it is rather that vital transition is at times beneficial (e.g., through urban mortality decrease in Sweden) or detrimental (e.g., through urban fertility decrease in Belgium) to urban transition. Of course, this tentative conclusion drawn from Belgium and Sweden needs to be confirmed by replicating the analysis on the historical demographic series of other European countries.

Caution must be exercised in generalising conclusions from 19th Century Europe to 21st Century World. The transitional modalities depend on when, where, and how economic and institutional changes occurred, i.e., on the type of spatial hierarchical dependence at stake. In some periods and places reduction in urban mortality may have triggered vital and urban transitions; elsewhere it could be rural fertility, international migration, or any other combination of population behaviour in time and space. To note, the infamous urban penalty has not been observed at the outset of urban development in less developed countries (Gould 1998). For instance, in Africa urban under-five death rates have been lower than rural death rates and the urban penalty only re-emerged late in the 20th century as a significant phenomenon in the poorest urban neighbourhoods of these countries (Bocquier, Madise, and Zulu 2011; Garenne 2010; Van De Poel, O'Donnell, and Van Doorslaer 2009). Also, the long-run and underlying influence of economic changes on population transition do not exclude a feedback effect of vital transition on economic development, such as the ‘demographic dividend’ produced by a favourable age dependency ratio (Bloom, Canning, and Sevilla 2003) under the condition that sufficient investment in human capital has been made through education (Cuaresma, Lutz, and Sanderson 2014).

Hierarchical dependence also has a consequence on the choice of scale for analysis. A country may not always be the relevant spatial unit to analyse vital and urban transition occurring in the less developed countries, past and present. Transition modalities depend on when and where the transition started, and transition starts from a core and extends to the semi-periphery or periphery. Therefore, it is important to adapt the spatial universe for each particular analysis. For example, the urban-rural divide within national borders echoes well the economic hierarchy at the beginning of the vital transition as experienced in 19th century Europe, although some historians have argued for larger spatial systems (de Vries 1984). However, if the focus of the analysis is on more recent vital and urban transitions, the related populations can be defined along international dimension as sets of core-periphery spaces; e.g., Mexico-USA, Europe-North Africa, etc. By extension, the spatial demographic equations used in the present paper for urban and rural areas could be generalized to several equations for a more complex hierarchy of three or more spatial and hierarchical entities – admittedly a methodological challenge that we leave to future research. Our attempt in this paper is to describe at best a dichotomous (urban-rural) system for which data is available, while hierarchical systems may be much more complex and polytomous, especially in larger countries than Sweden and Belgium.

Urbanisation and vital transition observed at the country level are major population phenomena but, to understand their full extent, other hierarchical organizations of space may be relevant at the international level, such as sub-continental, continental, or multi-continental spaces. In other words, to analyse such demographic and urban transitions as global phenomena, it is necessary to depart from a methodological nationalism that restricts analyses to state boundaries. Even systematic comparison of national transitions would not suffice. Several attempts have been made to model national urbanisation trends using national indicators of urban natural increase, GDP per capita growth, education, etc. (Christiaensen, Gindelsky, and Jedwab 2013; Fox 2012; Henderson, Roberts, and Storeygard 2013), notably to explain the apparent paradox of the so-called ‘urbanisation without economic growth’ in sub-Saharan Africa. However, the methodology used in these studies using country as the unit of analysis fails to account explicitly for the economic hierarchy that operates well beyond state boundaries. The closest it is possible to get to the control of hierarchical dependency is when the model includes indicators of international relations such as trade shocks (Henderson, Roberts, and Storeygard 2013). Other indicators such as communication, imports and exports, foreign direct investment, etc., could well approximate international relations and economic dependence, barring data availability issue. To sum up, a gradual change of scale from the national to the global is necessary when it comes to analysing the whole history of vital and urban transitions.

This change of scale should be associated to the notion of economic dependence, and concepts of both scale and dependence should be integrated in the analytical tools used by economists and demographers to explain the timing and intensity of transitions in relation to each other as observed in the 20th and 21st centuries. Scale and dependence are not just extra variables to be included in existing models. They are concepts that call for a revision of the methodological foundation of demographic and economic transitional models.

6. Acknowledgements

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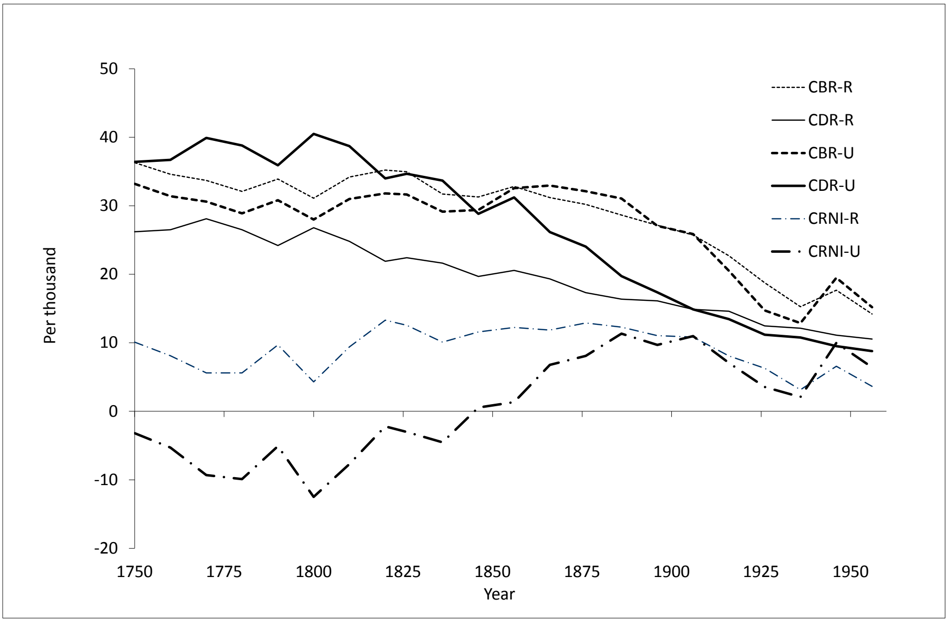
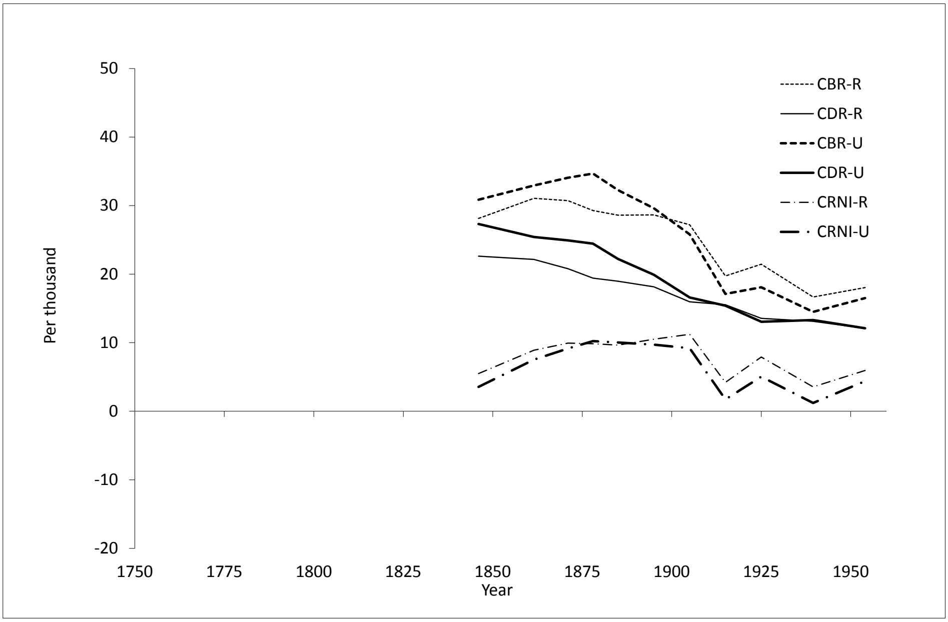
Appendix

Figure A-1: Urban and rural crude death, birth, and natural increase rates in Sweden (1750–1960)



Source: Dyson (2011)

Figure A-2: Urban and rural crude death, birth, and natural increase rates in Belgium (1844–1961)



Source: our own estimates by urban and rural areas (see Table 2).

Table A-1: Population, birth, and death of reclassified communes by period and contribution of natural increase to reclassification (Belgium 1858–1961)

	Period	Pop t-n	Pop t	Births	Deaths	Comm-unes	Δ total	Δ natural	Δ migration	Natural contribution
Rur->Urb	1858-1866	47458	61431	19546	12780	11	13973	6766	7207	48.4%
	1867-1876	136915	175588	52497	31671	39	38673	20826	17847	53.9%
	1881-1890	105631	130135	40450	24370	23	24504	16080	8424	65.6%
	1891-1900	174444	212573	67413	38575	39	38129	28838	9291	75.6%
	1901-1910	199920	252529	72072	35798	45	52609	36274	16335	69.0%
	1911-1920	73796	83692	17049	11660	16	9896	5389	4507	54.5%
	1921-1930	181283	236443	52191	27697	42	55160	24494	30666	44.4%
	1931-1947	170062	218090	72843	37218	39	48028	35625	12403	74.2%
	1948-1961	236772	305796	78774	42732	53	69024	36042	32982	52.2%
Total	1881-1961	1141908	1439258	400792	218050	257	297350	182742	114608	60.1%
Urb->Rur	1858-1866	0	0	0	0	0	0	0	0	0.0%
	1867-1876	0	0	0	0	0	0	0	0	0.0%
	1881-1890	11202	6925	2121	1457	2	-4277	664	-4941	-15.5%
	1891-1900	0	0	0	0	0	0	0	0	0.0%
	1901-1910	5108	4923	1482	930	1	-185	552	-737	-298.4%
	1911-1920	62061	41278	9194	6319	11	-20783	2875	-23658	-13.8%
	1921-1930	27612	22277	5594	3369	5	-5335	2225	-7560	-41.7%
	1931-1947	35400	33343	8776	8142	7	-2057	634	-2691	-30.8%
	1948-1961	5156	4965	1331	785	1	-191	546	-737	-285.9%
Total	1881-1961	146539	113711	28498	21002	27	-32828	7496	-40324	-22.8%
Balance	1858-1866	47458	61431	19546	12780	11	13973	6766	7207	48.4%
	1867-1876	136915	175588	52497	31671	39	38673	20826	17847	53.9%
	1881-1890	94429	123210	38329	22913	21	28781	15416	13365	53.6%
	1891-1900	174444	212573	67413	38575	39	38129	28838	9291	75.6%
	1901-1910	194812	247606	70590	34868	44	52794	35722	17072	67.7%
	1911-1920	11735	42414	7855	5341	5	30679	2514	28165	8.2%
	1921-1930	153671	214166	46597	24328	37	60495	22269	38226	36.8%
	1931-1947	134662	184747	64067	29076	32	50085	34991	15094	69.9%
	1948-1961	231616	300831	77443	41947	52	69215	35496	33719	51.3%
Total	1881-1961	995369	1325547	372294	197048	230	330178	175246	154932	53.0%