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Sequential city growth in the US: Does age matter?☆

María Sánchez-Vidal [a,*], Rafael González-Val [b], Elisabet Viladecans-Marsal [a]

[a] Universitat de Barcelona & Institut d'Economia de Barcelona (IEB), Facultat d'Economia i Empresa, Avinguda Diagonal, 690, 08034 Barcelona, Spain
[b] Universidad de Zaragoza & Institut d'Economia de Barcelona (IEB), Departamento de Análisis Económico, Facultad de Economía y Empresa, Gran Vía 2, 50005 Zaragoza, Spain

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ABSTRACT

We provide empirical evidence of the dynamics of city size distribution for the whole of the twentieth century in U.S. cities and metropolitan areas. We focus our analysis on the new cities that were created during this period. The main contribution of the paper is the parametric and nonparametric analysis of the population growth experienced by these new-born cities. Our results enable us to confirm that when cities appear they grow very rapidly and, as the decades pass, their growth slows or even falls into decline. Moreover, the nonparametric analysis shows that most of the growth differential is driven by the cities' first decade of existence. This evidence is consistent with the theoretical framework regarding mean reversion (convergence) in the steady state and with the theories of sequential city growth.

1. Introduction

The dynamics of city size distribution and, in particular, the analysis of Gibrat's law – that a city's population growth rate is independent of its initial size – has attracted the attention of researchers for many years. In fact, there are many studies evaluating the performance of Gibrat's law for different countries and periods. Ioannides and Overman (2003) find that Gibrat's law holds for the US, Eeckhout (2004) concludes the same when including all cities without size restrictions, and so does Giesen and Südekum (2011) for the case of Germany. Others such as Black and Henderson (2003) or Bosker et al. (2008) find that this is not the case for either the US or West Germany respectively. Despite the amount of literature quantifying the size effect on growth, there is little evidence of the effect of a city's age on its growth. In this context, this paper adopts parametric and nonparametric techniques to evaluate the age-dependent patterns of urban growth using data from US cities and Metropolitan Statistical Areas (MSAs) for the period 1900 to 2000. Moreover, the non-parametric analysis provides additional empirical evidence for the above-mentioned theories regarding the acceptance or rejection of Gibrat's law focusing on the role of new-born cities.

The inclusion of new cities is of special relevance for the US which saw its cities grow in number from 10,496 to 19,211 over the twentieth century. At the same time, these cities increased in population and size. Fig. 1 shows the evolution of the total number of US cities throughout the twentieth century as well as Fig. 2 shows it for MSAs. At first glance, we can see that the number of cities grows over time but this growth is not the same throughout the period. In fact, the graph shows that this growth is concave, being higher during the first third of the century[1] and becoming more stable in the years after, while in the case of MSAs we can observe less concavity. There are many examples of cities appearing during the twentieth century. For instance, Long Beach in the state of New York, was incorporated in 1922, and today is the 15th biggest city in the state (the 18th in 2000). With a population of 35,462 inhabitants (2000), it enjoyed an annual growth rate of between 4.5 and 5.5% during its first three decades of existence, though this rate slowed down to 0.5% in the 1990s. The second half of the twentieth century is characterised by a suburbanization process and a proliferation

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* Corresponding author. Tel.: +34 934 020 826.
E-mail address: mariasanchez@ub.edu (M. Sánchez-Vidal).

[1] In fact, 62.26% of the new cities in the whole century were born in the first three decades, while the average rate of new creations for the rest of the period stands at around 5% per decade.

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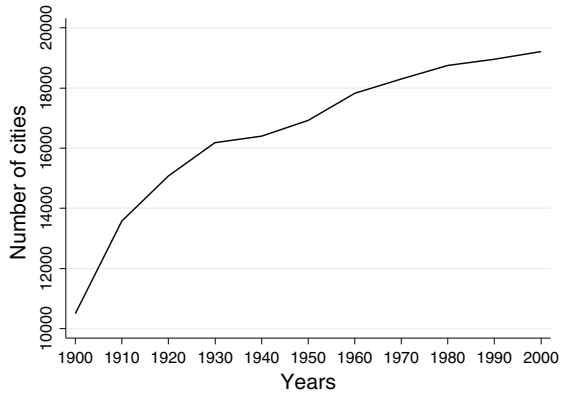
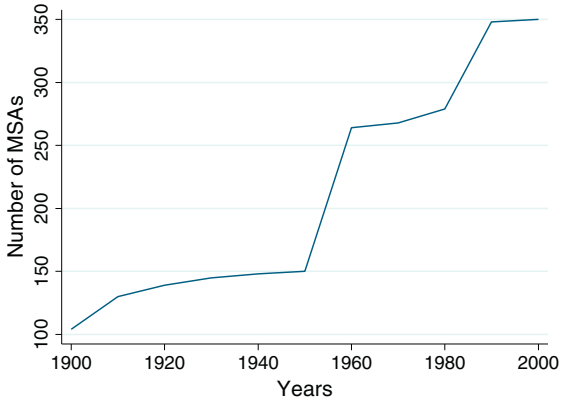


Note: Data from incorporated places. Own calculations based on the censuses published by the US Census Bureau.

Fig. 1. Evolution of the number of cities in the US over the twentieth century.

of cities in the south of the country. Good examples of this phenomenon are Carson City and San Marcos, two cities in California, which are suburbs of Los Angeles and San Diego respectively. They were created during the 1960s as a consequence of the Sun Belt development. Carson City was incorporated in 1968, grew at an annual rate of 1.3% during its first decade of existence and then at a slower rate up to 2000. The case of San Marcos differs slightly. The decline in its growth rate with the passing decades was similar to that of Carson City, but its annual growth rates have been much higher: ranging from 15% on average for the first decade of its existence to 3% over the last decade, growing from a settlement of just 3896 inhabitants in 1970 to 54,977 in 2000. These are just three examples from our dataset but there are almost 9000 similar cases.

However, we are not the first to analyse new cities. Previous works by Dobkins and Ioannides (2000) and Henderson and Wang (2007) also include new cities in their datasets when they cross a particular threshold. Nevertheless, the inclusion of all new cities without any threshold restriction is only considered by Giesen and Südekum (2013) who use data about the exact foundation dates of 7000 American cities for the period 1790 to 2000, and Desmet and Rappaport (2013) whose data involves US counties and MSAs from 1800 to 2000. Our work is closely related to both studies. Giesen and Südekum (2013), by means of a theoretical model, find that the distribution of city sizes is systematically related to the country's city age distribution. They point out



Note: Data from MSAs. Own calculations based on the censuses published by the US Census Bureau.

Fig. 2. Evolution of the number of MSAs in the US over the twentieth century.

that young cities initially grow faster but in the long run all the cities grow at the same rate (Gibrat's law). Desmet and Rappaport (2013) argue that in earlier periods smaller counties converge and larger ones diverge but, taking into account the changes in age composition over time, both convergence and divergence dissipates and Gibrat's law gradually emerges. The results of our paper are very much in line with theirs. We find that young small cities tend to grow at faster rates but, as decades pass, their growth stabilises or even declines. Moreover, this high level of growth rates is spread across ages but is especially important in the first years of existence. After that, Gibrat's law tends to hold more firmly.

Our work thus shows a sequential growth pattern of cities according to their age. To grow sequentially means that, within a country, a few cities initially grow much faster than the rest, but at some point their growth slows and other cities start to grow in their turn, and so on. This fact has been theoretically documented by Cuberes (2009) and Henderson and Venables (2009) using theoretical models in which cities grow sequentially, allowing for the entrance of new cities to the sample in the case of Henderson and Venables (2009) or for exogenous population shocks in the case of Cuberes (2009). The only empirical approach to these theories until now has been Cuberes (2011) who, drawing on data for cities from 54 countries and on data for metropolitan areas from 115 countries, shows that urban agglomerations have followed a sequential growth pattern. This study focuses on the sequential pattern driven by the size of the city, however, while our work traces the age-dependent patterns.

Furthermore, we reproduce the analysis for metropolitan areas, the same geographical unit used in Cuberes (2011). Our results do not confirm our earlier findings for cities, however. This could reflect the fact that a metropolitan area is an aggregation of different cities; even if the area is new, the cities within it might not be. Moreover, it is not possible to know how old an area is since it does not enter the sample until it reaches the minimum population threshold of 50,000 inhabitants. As such, larger – and, therefore, more mature – cities within the area, have lower growth rates than smaller cities within the same area, and the aggregate effects may disappear.

The rest of this paper is structured as follows. Section 2 presents the data. Section 3 explains the parametric empirical methodology and Section 4 discuss its main results. Section 5 provides the nonparametric analysis and its results. Section 6 concludes.

2. Data

We use data from US cities and Metropolitan Statistical Areas (MSAs) for the whole of the twentieth century. The database is the same as that used by González-Val (2010) with the addition of extra periods in the MSA dataset. The information for both geographical units was obtained from the annual census published by the US Census Bureau. A city can be defined in many different ways. Here, for our analysis, we use the word to mean 'incorporated place'. According to the census, an incorporated place is *a type of governmental unit incorporated under state law as a city, a town* (*except in New England, New York and Wisconsin*), *a borough* (*except in Alaska and New York city*), *or a village and having legally prescribed limits, powers and functions*. The Census Bureau recognises incorporated places in all American states except Hawaii, which is thus excluded from our sample. In addition, the territory of Puerto Rico and the state of Alaska are excluded as they (together with Hawaii) were not annexed until the second half of the twentieth century. As Eeckhout (2004) stresses, the whole sample of cities in each state without size restrictions needs to be considered since otherwise a truncated distribution can produce biased results.

To take into account the part of the population which lives outside cities, we also use data from MSAs. This allows us to compare results of both geographical units. In line with Ioannides and Overman (2003), for the period from 1900 to 1950, we use data from Bogue (1953). This is based on the definition of Standard Metropolitan Areas