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Comments on Mulligan's "Revisiting the urbanization curve"

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ABSTRACT

In a recent paper published in this journal, Gordon Mulligan has presented a methodology for better understanding the general pattern of urbanization, familiar as an S-shaped curve. While we agree with most of the statements made by the author, his article deviates from Northam's original urbanization curve. Our commentary suggests that the upper limit and speed of change of the urbanization process should be revisited.

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Introduction

If the transformation of human society since the industrial revolution is to be summarized by no more than one word, there is no better alternative than 'urbanization'. The global urban population now exceeds 50% and will rise even more in the next three decades (Bloom, Canning, & Fink, 2008). In his recent article, Mulligan provides us with a perspective to further understand the general pattern of this urbanization process (Mulligan, 2013), presenting a discussion of the well-known S-shaped urbanization curve. In the paper, the urbanization curve is given first [see Fig. 1] and various driving forces are considered, such as the population transition and rural–urban migration. Then the methodology of the logistic model is addressed, and several additional issues discussed in depth: data truncation, the upper limit, city definition, and other variables.

The logistic model was adopted to project contemporary global urbanization, and the historic rates of urbanization in Europe were used for verifying the methodology. The research results clearly indicate that the robust logistic method is flexible enough to depict urbanization process across nations at different development stages.

The exploration of general rules of urbanization processes is essential for achieving sustainable urbanization in the world. Curve-fitting and quantitative analysis play a central role to ensure its success. The urbanization process has received much attention and the number of research papers has exploded since 1991 in

the interdisciplinary field (Wang, He, Liu, Zhuang, & Hong, 2012). There is a growing recognition that different patterns, processes and underlying driving forces have existed across nations (Chen, Liu, & Tao, 2013; Chen, Lu, & Zha, 2010; Hope, 1998; McGee, 2006; Seto, Güneralp, & Hutyra, 2012; Vias, 2012). However, scholars have given very little attention, as pointed out in the paper, to the general rules of the urbanization curve (Mulligan, 2013). The significance of the latter article lies in the following three contributions: exploring general pattern of urbanization processes; establishing the methodology of logistic model regression; and identifying the separate urbanization clubs in different countries.

There are two issues that require further discussion. Although the article was well performed and its analysis was well interpreted and discussed in depth, Mulligan's article has two issues which need further discussion: the upper limit and the speed of change of urbanization curve.

The upper limit of the urbanization curve

A motivation for writing this is to comment on the figure of the urbanization curve presented by Mulligan; we speculate that the author has not in fact referenced the figure presented by Northam (1975, 1979). In Fig. 1 of his paper (reproduced here as Fig. 1), he outlines the urbanization curve, which is S-shaped with three identifiable stages: initial, acceleration, and terminal, with the upper limit of urbanization curve set as 100%. Nevertheless, the appearance of Northam's urbanization curve (as we show in our Fig. 2), has obvious differences. First, Northam portrayed the urbanization process as an attenuated S-shaped curve, which is flatter in the first

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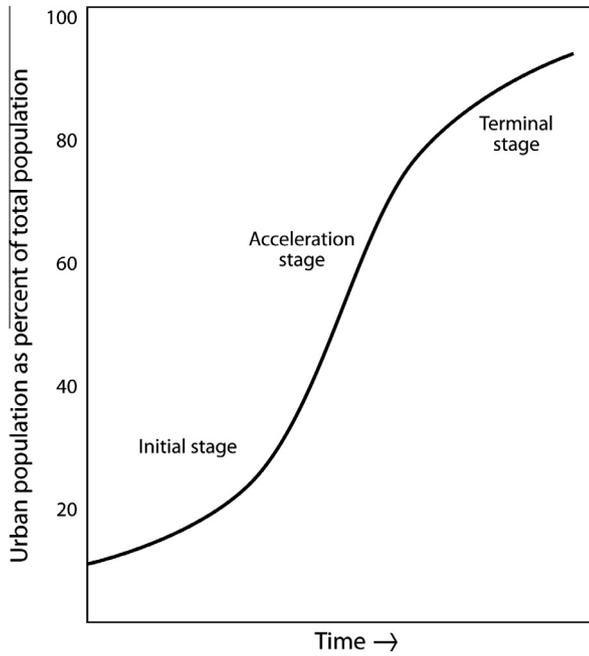


Fig. 1. The S-shaped urbanization curve [source Mulligan, 2013].

stage and the third stage, indicating that the evolution of urbanization is a slow and gradual process. And more importantly, the upper limit of Northam’s urbanization curve is capped at around 80%. It is interesting to note that Northam draws a dotted line and added a question mark in the terminal phase of his urbanization curve; he assumed that once the urbanization curve approaches 100%, it will invariably begin to level, thus creating a flattish upper portion of the curve. As one example, since about 1900, the urbanization curve for England and Wales has tended to flatten at around 80% (Northam, 1975). A possible explanation is that the “flight to the city” might be replaced by the “flight to the countryside”.

This distinction is very important because the upper limit of urbanization processes has a greater effect on the policy choices linked to urbanization, especially in many developing countries. An incorrectly estimated urbanization curve may make policymakers mistakenly assume that each country and region will eventually achieve 100% urbanization. In other words, they may assume the higher the level of urbanization, the better. The policies of accelerated urbanization, with the aim of boosting economic growth, are widely found in developing countries, and growing urbanization levels are often hailed as a sign of progress (Chang & Brada, 2006; Friedmann, 2006). Taking China as an example, ‘urbanization to the horizon’ (‘Quan yu cheng shi hua’ in Chinese) is proposed in many cities, implying the elimination of rural areas in the whole region. Indeed, it is useful, as pointed out in Mulligan’s paper, to recall the rural–urban balance in most countries. Although the upper limit varies from nation to nation, only a few can achieve 100% urbanization, such as Singapore.

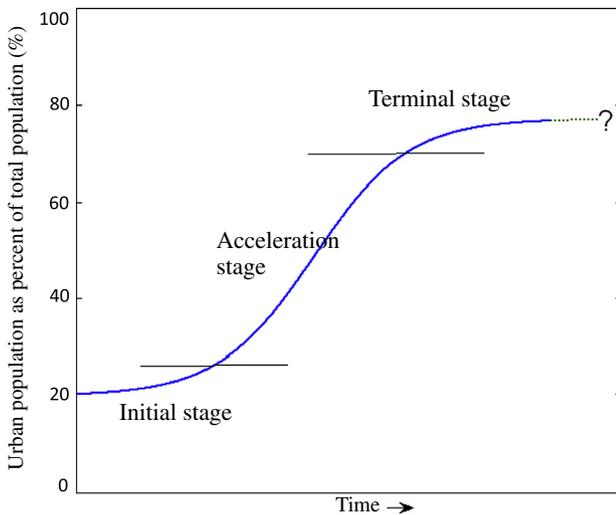


Fig. 2. The urbanization and its stages, after Northam.

Speed of change of the urbanization curve

The derivative is one of the core calculus concepts, and also is extraordinarily useful in physics and economics. Some important concepts can be understood and quantified by the derivative, such as acceleration and the marginal effect. Assuming the equation of the urbanization process ($y = F(x)$), then the equation of the speed of urbanization is $y' = dF(x)$. Mulligan’s paper has shown that logistic models do a good job in regression analysis of urbanization processes. The logistic function is typically represented by the following formula: where t is time, x_0 is the minimum urbanization level, x_m is the maximum urbanization level. We take the derivative of formula:

$$x(t) = \frac{x_m}{1 + \left(\frac{x_m}{x_0} - 1\right)e^{-rt}} \tag{1}$$

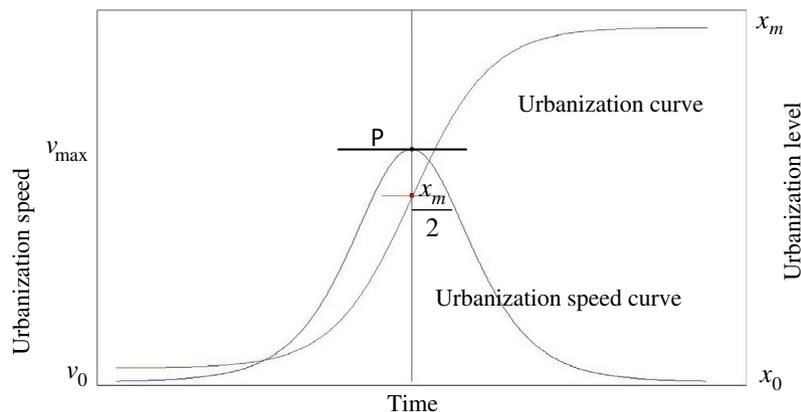


Fig. 3. A schematic diagram of the urbanization curve and speed of urbanization curve.

We take the derivative of formula (1):

$$x'(t) = \frac{rx_m \left(\frac{x_m}{x_0} - 1 \right) e^{-rt}}{\left[1 + \left(\frac{x_m}{x_0} - 1 \right) e^{-rt} \right]^2} \quad (2)$$

Formula (2) is the functional expression of speed of urbanization. Using Matlab software, the curves of urbanization process and speed are drawn (as in Fig. 3). The curve of the speed of urbanization is proposed, which is shaped as a distorted and inverted “U”. From a theoretical standpoint, the urbanization speed gets the inflection point, which is also the maximum of speed, when the urbanization level reaches the half value of x_m . For this reason the expression of the second stage in Northam’s urbanization curve—the “accelerated stage”—is misleading as it suggests that the speed of urbanization continues to accelerate when a country is in the second stage. The second stage of the urbanization process, however, includes not only an accelerated sub-stage, but also a decelerated sub-stage. We note that the expression in Gordon Mulligan’s paper is more accurate: urban shares first rise slowly, then rapidly, and then slowly again. Therefore, we suggest that the second stage of the urbanization curve should be re-named from “accelerated stage” to “rapid stage”.

Conclusions

International efforts to achieve global sustainable urbanization are mainly concerned either with diversified phenomena, different characteristics and implicit regional economic-social-cultural-institutional driving forces, or the general rules of the urbanization effects on global climate change, ecosystems and energy demand across nations. Given the importance of current unprecedented urbanization processes for global economic growth and social transformation, little scholarly attention has been paid, to the general rules of the urbanization process itself and the urbanization curve. The paper by Gordon Mulligan is valuable in rediscovering the treasures implicit within the urbanization curve and for developing an attractive methodology; it contributes a perspective to the quantitative analyses presented to the urbanization curve, and further strengthens, as a consequence, the related research. The paper, however, can be further discussed for two reasons. First, there is a different figure than Northam’s urbanization curve, while second, Mulligan does not address the relative importance of changes in the speed of urbanization, although the author has noted that the second stage of urbanization shows rapid rather than accelerated development, compare to the other two stages.

This comment suggests two issues in which this important and policy-relevant area of urbanization research can be usefully

extended. First, the upper limit is a key variable in quantitative analysis of the urbanization curve. According to World Bank data (<http://data.worldbank.org/>), there are only four countries or regions (Singapore, Bermuda, Cayman Islands and Hong Kong SAR, China) reaching an urbanization level of 100% in the world in 2011. Indeed, the urbanization level of most countries cannot reach the maximum of 100%. In addition, the curve of the speed of urbanization is shaped as a distorted and inverted “U”. Consequently, we suggest that the second stage is renamed—from “accelerated stage” to “rapid stage” in Northam’s urbanization curve. Our findings weaken the rationale for, or pursuing, panoramic urbanization (100% urbanized) or encouraging accelerated urbanization as part of a strategy for sustainable urbanization in developing countries.

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