The causal effect of urbanisation on metropolitan water consumption: Theoretic model and evidence from Guangzhou, China

There is an emerging body of research on the relationship between water and urbanisation. However, there are few studies that examine the relationship between water, urbanisation and economic growth. Dr Yiming He from South China Agriculture University aimed to address this gap in the literature by investigating the impact of urbanisation and economic performance on water consumption in Guangzhou, China.

The literature on water, urbanisation and economic growth is disjointed. Studies which have explored the relationship between water consumption and economic growth have largely ignored the effect of urbanisation. Studies focused on water consumption and urbanisation refer to the link between the two but not the influence of economic performance on this relationship. Dr Yiming He sought to link these two areas of the literature by exploring the interactional relationship between urbanisation, economic performance and water consumption using aggregated annual data.

 existing research on water consumption and urbanisation

There is relatively little research on the relationship between water consumption and urbanisation. Previous studies have discussed definitions of water use, the history of water use around the world, problems with collecting and analysing water use data as well as ways to improve water use efficiency and productivity in different regions and economic sectors. Such research found no discernible relationship between water withdrawals and income.

Other research has developed a growth model which conceptualises water as a productive input for private producers. Water is defined as a congestible non-excludable good. Congestible goods are those that act like public goods when scarce and like common resources when in abundance. Non-excludable means that one person having access to the good does not prevent others from using it. In this model, growth is negatively affected by the government’s appropriation of output to supply water but is positively influenced by the contribution of increased water use to capital productivity. This creates an inverted-U relationship between economic growth and the rate of water utilisation. Cross-country estimations have confirmed this relationship. This suggests that for most economies, the current rates of fresh water utilisation are not yet constraining growth. However, in countries where water is scarce, there seems to be little evidence that there are severe diminishing returns from allocating more output to provide water, which would lead to falling income per capita. These results suggest that studies proposing evidence of a widespread global water crisis should be taken with caution.

Some studies have explored how technology, processes of input substitution and changes in final demand (all of which underlie economic growth) influence water consumption. An analysis of the relationship between these factors in Spain was conducted between 1980 (the beginning of the democratic era) and 2007 (the onset of the current economic crisis). Researchers used structural decomposition analysis, which can determine the degree to which changes in certain factors contribute to changes in a specific variable. The method uses an input and output table and is able to exclude indirect effects from the analysis. From their analysis, researchers found that the growth in Spanish demand would have suggested an increase in water consumption almost three times higher than the rate actually observed. However, this demand effect was largely offset by technology and intensity effects, mainly due to changes in agricultural crops. Research on other areas, such as Sub-Saharan African countries, has suggested that economic growth is driven mainly by water and labour. In these areas, capital and energy have not been found to be significant in influencing economic growth.

Despite research on the topics of urbanisation, economic performance and water consumption, it is unclear exactly how these are related. Studies have tended to explore water consumption and urbanisation or water consumption and economic growth. Dr Yiming He thus aimed to add to the literature by exploring the relationship between urbanisation, economic performance and water consumption in Guangzhou, China. Specifically, he sought to investigate the effect of urbanisation and economic performance on metropolitan water consumption using aggregated annual data from 1949 to 2014.

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Two hypotheses were generated from these economic models about the relationships between urbanisation, economic performance and metropolitan water consumption in Guangzhou, China. Guangzhou, also known as Canton, is the capital and most highly populated province of Guangdong in southern China. The first economic model used in the research was a social optimal model which proposes that water is used by most industries, when production increases so does water consumption, and this is relative to income being generated. This model is based upon dynamic factors because production will continually increase or decrease. The second model used was an individual’s optimal model, which assumes that an individual’s water consumption increases when production increases and the individual’s income is generated. This involves applying statistical models to economic data to gain empirical evidence of economic relationships between factors. In this study, the statistical models applied were the social optimal model and the individual’s optimal model. The data used was water consumption, urbanisation and economic performance in Guangzhou. Results from the econometric analysis showed that metropolitan economic performance and urbanisation were both positively related to water consumption in Guangzhou over the long term. This suggests that metropolitan economic performance and urbanisation play a key role in increasing water consumption in the area. Both hypotheses were therefore supported by these findings. Analysis also demonstrated that metropolitan economic performance does not push up the water consumption immediately but instead has a delayed impact that is visible four years later. These findings can therefore be used to predict how water consumption will be affected by both metropolitan economic performance and urbanisation over the long term. This study makes an important contribution to the economic literature by adding clarity to the relationship between urbanisation, economic performance and metropolitan water consumption. As this research was based on Guangzhou, further research could explore whether results are similar in other areas of China and other countries around the world.

References