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Urban-rural transformation and farmland conversion in China: The application of the environmental Kuznets Curve

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ABSTRACT

This paper investigates the way in which changes in social and industrial structures brought about by the urban-rural transformation process impact upon the relationship between farmland conversion and economic growth in post-reform China. Through this study, panel data analysis revealed that an inverted U-shape relationship existed between the factors of farmland conversion and economic growth in China in the period 2000–2009. The turning point, whereby decreasing farmland conversion is able to occur alongside economic growth, was found to have occurred in 2008, the year when China's per capita GDP exceeded 3000 US dollars. Moreover, rural-urban migration was not found to be significant with respect to this relationship, while the industrial upgrading from secondary to tertiary industries was found to help reduce farmland conversion. The paper highlights the important role that market and governmental forces play in initiating the shift from extensive to intensive and highly efficient land-use patterns.

1. Introduction

Land-use change is a measure which is able to broadly capture human-induced transformations in land conditions; it is also able to in turn describe the transformation of human socioeconomic activities themselves, through the shifting influence which they exert upon land (Mitsuda and Ito, 2011). The word "transformation" is a particularly pertinent term in any discussion of current socio-economic conditions in China, especially within the globalised context. China has in recent years undergone intense economic transformations (moving from centrally-controlled economy to a market-oriented economy) and born witness to wide-reaching social transformations, from a closed and traditional society to an open and modernised industrial and urban society (Li, 2011). These transformations, simultaneously economic and social, have resulted in remarkable land-use changes and modifications across the country (L.J., Liu et al., 2008; Y.S., Liu et al., 2008; Liu et al., 2010a,b). The area of built-up land in China (in both the cities and the countryside) has grown from 29.6 million ha in 1996 to 33.1 million ha in 2008, while arable land decreased by 8.4 million ha in the same period.[1] However, unlike the hyper-urbanisation seen in Latin American and Caribbean countries, or the rapid suburbanisation witnessed in a number of developed countries, Chinese urbanisation has rather been characterised by excessive farmland conversion for non-agricultural use purposes (Liu, 2006; Peng, 2008). During the 2000s, the total built-up area in urban areas of China increased by 50% while the total urban population increased by only 26% (National Bureau of Statistics of China 2010). This excessive growth in farmland conversion, when viewed relative to urbanisation growth rates, has triggered great concern in both academic and governmental spheres in China.

In 1955, Simon Kuznets suggested that an inverted U-shape relationship exists between per capita income and income inequality – this relationship, which is now known as the Kuznets Curve, indicates that whilst at first income inequality increases with per capita income, after a certain turning point it begins to decline (Kuznets, 1955). Since 1991, the Environmental Kuznets Curve (EKC) has become a vehicle for describing the relationship between per capita income and the use of natural resources and/or the emission of wastes (Grossman and Krueger, 1995). The EKC

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[1] The data is compiled according to the detailed land-use survey data at the county level, provided by the ministry of land and resources in each province (city) in the period 1996–2008.

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hypothesis postulates that as income grows, the use of natural resources and pollutions will initially increase, but subsequently decline beyond a certain turning point if economic growth proceeds well enough. During the past few years, this hypothesis has been analysed in relation to various environmental indicators like deforestation (Cropper and Griffiths, 1994), carbon emissions (Panayotou et al., 2000), oil exploitation (Esmaeili and Abdollahzadeh, 2009) and biodiversity conservation (Mills and Waite, 2009). However, studies have also failed to find any evidence of the existence of an EKC in countries like Spain and Turkey (Roca and Alcantara, 2001; Akbostanci et al., 2009), where both income growth and environmental quality are clearly endogenous and the EKC curve shows relative changes in both factors – i.e., where a low-income stage is accompanied by environmental deterioration, which negatively affects subsequent economic growth and income levels, when the carrying threshold of the environment has been exceeded (Arrow et al., 1995). While results differ as a result of the various pollutants studied and the methods of measurement used, and despite the Spanish and Turkish cases described above, it is generally easy to prove the existence of an EKC for certain environment indexes in a particular country or region (Brajer et al., 2011).

With increasing attention being paid to environmental problems in China, the importance of verifying the existence of an EKC for various regions and provinces has become a prominent task for research. In fact, by using farmland conversion rates as an environmental indicator, scholars have verified the existence of an EKC pattern between economic growth and farmland conversion in China during the post-reform era (L.J., Liu et al., 2008; Y.S., Liu et al., 2008; Li and Wu, 2008). Further, rapid economic growth in China has been accompanied by a series of urban-rural transformations, including large-scale rural-urban migration and rapid adjustments in employment and industrial structures in both urban and rural areas (Li, 2012; Li and Liu, 2013). In this process, the increasing agglomeration of population in cities and the development of non-agricultural industries both generate great demand for the conversion of existing farmland to various new uses such as housing, infrastructure, business and industrial zones, etc. (Hu et al., 2009). As a result, in the period 2005–2010 the Chinese government approved farmland requisition of 2.16 million ha, an annual land requisition of 360 thousand ha (Ministry of Land and Resources, 2005–2010). The transformation being seen in China's social and industrial structures can be expected to exert further influence upon the inverted U-shape relationship that has been found to exist between the processes of farmland conversion and economic growth in China.

Bearing the above analysis in mind, this paper investigates the way in which changes in social and industrial structures brought about by the urban-rural transformation process impact upon the relationship between farmland conversion and economic growth in China. Following the introduction, the second section provides a research basis for the paper. An empirical analysis of the relationship between farmland conversion and economic growth rates in China is set out in the third section of the paper. The paper closes in a discussion of the research results.

2. Research basis

2.1. The socioeconomic effects of farmland conversion

Generally, socioeconomic development affects the quality of the environment through three channels – the scale effect, the composition effect and the technique effect (Grossman and Krueger, 1995). Due to the different marginal rates of return between agricultural and non-agricultural sectors, scale effects promote rapid increases in the rate of farmland conversion in the primary stage of socioeconomic development. Subsequently, when the economy improves (thus reaching a middle stage of socioeconomic development), the economic structure tends to shift from a situation whereby industries rely on intensive land inputs to a condition wherein less land-intensive industries tend to dominate. As a result of this transition, the rate of farmland conversion starts to slow. Finally, technological progress in the third, mature, stage helps to substitute large-scale land inputs with man-made resources, bringing about improvements in land-use efficiency (L.J., Liu et al., 2008; Y.S., Liu et al., 2008). A study by Antweiler et al. (2001) indicates that changes in the composition of outputs, as well as pollution abatement (or resource reduction) efforts – the 'composition' and 'technique' effects – constitute the main factors that cause the EKC to bend downward after reaching its turning point. Since land is a finite resource, it therefore follows that farmland exploitation and utilisation when viewed relative to socioeconomic development should also follow an inverted U-shape curve.

The history of human development also provides evidence for the existence of such a relationship between farmland conversion and socioeconomic development. In the past two centuries, rapid industrialisation and urbanisation in developed countries has induced climbing demands for land. When human society approaches a highly developed stage, it appears that urbanisation no longer occurs in continuously growing metropolises, but rather predominantly occurs through the reclassification of existing rural settlements, as a result of cities' outward spread (Leeuwen et al., 2006). John Friedmann's work (2006) supports this thesis, posing that urbanisation in developed countries has now passed the stage of population agglomeration in urban areas and has entered the stage of urban civilization spreading and diffusing to villages. Through such a development, previous (drastic) processes of urban expansion are tempered and social inclusion becomes the main theme of human socioeconomic development. In the late 1980s, France implemented its first social inclusion policy to help newcomers to adapt to their new home in France. Subsequently, in 2000, the European Union (EU) initiated a ten-year program aiming at promoting social inclusion in the fields of employment, education and training, health, and housing within EU countries (Ga and Huang, 2009). Aiming to curb social exclusion and social closure (Burchardt et al., 1999), a social inclusion agenda plays an important role when urbanisation reaches a high level, and new urban residents need access to the equal opportunities, resources and social welfare which will enable them to be socially reintegrated into their new home cities.

In line with the preceding analysis, the relationship between farmland conversion and socioeconomic development can be depicted through an inverted U-shape (as illustrated in Fig. 1), the primary and middle stages of which would see rapid physical

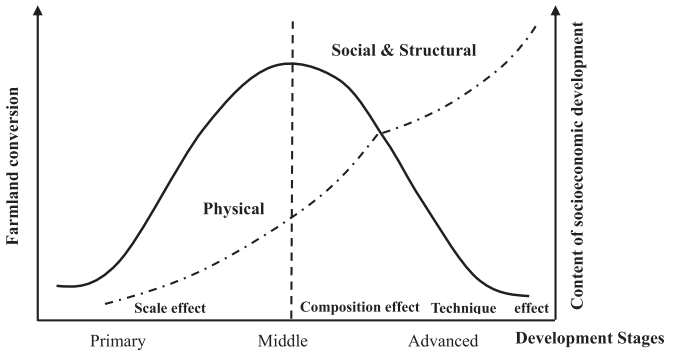

Fig. 1. The relationship of farmland conversion relative to socioeconomic developement.