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Agricultural productivity, structural change, and economic growth in post-reform China ☆

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ABSTRACT

We examine the role of agricultural productivity as a determinant of China's post-reform economic growth and sectoral reallocation. Using microeconomic farm-level data, and treating labor as a highly differentiated input, we find that the labor input in agriculture decreased by 5% annually and agricultural TFP grew by 6.5%. Using a calibrated two-sector general equilibrium model, we find that agricultural TFP growth: (i) accounts for the majority of output and employment reallocation toward non-agriculture; (ii) contributes (at least) as much to aggregate and sectoral economic growth as non-agricultural TFP growth; and (iii) influences economic growth primarily by reallocating workers to the non-agricultural sector, where rapid physical and human capital accumulation are currently taking place.

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1. Introduction

Market-oriented reforms have brought unprecedented growth to China. China's economic growth has been accompanied by far-reaching changes in the structure of output and employment, and by a rapid spatial reallocation of labor toward urban areas. China's growth experience constitutes one of the most striking economic episodes in modern history. Understanding the sources of China's growth is important if not least because China's experience could shed light on the growth potential of other developing countries. This paper studies the role of agricultural productivity in China's economic growth and related structural changes during the reform period. The role of agriculture in China's growth is particularly important. The related theoretical literature and policy debate are both conflicted on the subject of agriculture. Is agricultural growth a necessary condition for overall economic growth? Or is agriculture pulled along by the productivity growth taking place in non-agricultural sectors?

Crucial for understanding China's transformation are the total factor productivities of agricultural and non-agricultural sectors. Young (2003) carried out a careful growth accounting exercise for China's non-agricultural sector. So far, however, no similar exercises are available for the agricultural sector. The existing macroeconomic literature approaches Chinese agriculture by examining aggregate data only; see, e.g., Chow (1993), Fan and Zhang (2002), Fan et al. (2003), and Dekle and Vandenbroucke (2010, 2012). Aggregate data, however, fails to provide a proper measure of the growth of the labor input that accounts for differences in the workforce's human capital. Since variations over time in the composition of the labor input are likely to explain China's agricultural growth, in order to measure effective labor units, we need to control for the changing characteristics of agricultural workers.

Constructing a proper measure of the labor input in agriculture is challenging. The fundamental difficulty is that in China, as well as in most developing economies, a large proportion of the income of an agricultural household comes from the combination of factor rewards (land, labor, and capital) rather than from wage income. This implies that there is no explicit observable individual wage, excepting a small and highly selective sample of agricultural workers. Without agricultural wages, it is not possible to quantify the relative productivities of different types of labor, and hence their contribution to the aggregate labor input. In the absence of wage data, it is not possible to measure

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agricultural productivity using the standard approach, such as that used by Young (2003, Section II).[1]

The first contribution of this paper is to estimate the total factor productivity (TFP) growth of China's agricultural sector between 1991 and 2009, accounting for the fact that labor is a highly differentiated input. Using the China Health and Nutrition Survey (CHNS), we obtain detailed measures of income for all household members and for households themselves. The CHNS also reports detailed time-use data. The main methodological novelty of our strategy is the use of the average product of labor to measure the aggregate labor input in agriculture. We find that between 1991 and 2009, China's agricultural labor input decreased at a rate of 4.5–5.5% annually and that, on average, agricultural TFP grew by 6.5%. This growth rate is more than four times the level Alwyn Young estimated for the non-agricultural sector in China (1.4%) and twice as large as the estimate of non-agricultural TFP in China based on official data (3.0%); see Young (2003, Table 24).

China's rate of growth in agricultural TFP is not unprecedented, especially within the context of the rapidly growing economies of Southeast Asia. However, despite the broad scope of reforms and reduced state control over labor mobility, the Chinese economy has remained distorted. Thus, any attempt to measure agricultural productivity in China has to deal with market distortions. To ensure that our measure of the effective labor of the various types of workers is robust, we perform a number of checks.[2] We examine the influence of state controlled prices on the estimated wage profiles, and we consider rural coastal and rural inland areas separately. State controlled prices, where available, provide a direct measure of the price distortions confronting farmers. Similarly, we employ the estimated differences in the effective labor units across regions as an indirect assessment of the significance of labor mobility restrictions. Our estimates of the labor input and TFP are remarkably stable across specifications.

The second contribution of this paper is to quantify the importance of agricultural and non-agricultural TFP in contributing to China's growth and its structural transformation during the reform period. These questions require an economy-wide representation of the Chinese economy. The economic growth literature describes structural change as occurring primarily in two ways: through non-homothetic preferences and through sectoral differences in the production functions.[3] In this paper, we rely on a two-sector model that draws insights from both of these literatures. Using a calibrated version of the model, we first reproduce key patterns of the Chinese economy between 1978 and 2008. To examine the role of agriculture in China's transformation, we ask: if agricultural and non-agricultural TFP had not changed during the reform period, what would be the sectoral distribution of output and employment, and the overall and sectoral growth rates of output?

The majority of the sectoral reallocation of output and employment toward non-agricultural sectors is due to China's rapid TFP growth in agriculture. Moreover, agricultural TFP is as important as non-agricultural TFP in accounting for China's overall growth rate, and more important than non-agricultural TFP in accounting for the growth rate of the non-agricultural sector. Agricultural TFP contributes to aggregate and non-agricultural growth by reallocating workers to the non-agricultural sector, where capital accumulation takes place. This mechanism is well-known in the development literature, but it is especially important in China for two reasons. First, as much as 35% of the labor force is still in agriculture. Thus, there are still potential gains through labor reallocations. Second, Chinese physical and human capital accumulation have proceeded at rapid rates with apparently little change in the rates of return to these investments; see, e.g., Bai et al. (2006), Li et al. (2009), Song et al. (2011), and Whalley and Zhao (2010). Under these circumstances, due to the complementarity between capital and labor, a faster transfer of workers toward non-agricultural activities fosters economic growth.

1.1. Related literature

Sectoral reallocations out of agriculture have been a major component of the rapid growth in Taiwan and South Korea, and they characterize the modern growth experience of the majority of nations, including the U.S.; see Young (1995), Caselli and Coleman (2001), and Gollin et al. (2002). Sectoral reallocations out of and rapid productivity growth in agriculture are also typically seen as important factors in China's rapid growth. This view has been most prominently ascribed to Young (2003). According to Young (2003, p. 1260): "[d]espite the popular academic emphasis on industry and exports, a deeper understanding of the success of the world's most rapid growing economies may lie in that most fundamental of development topics: agriculture, land, and the peasant." Young (2003), however, did not go any further in the sense of actually investigating the agricultural sector. We directly confront agricultural changes.

A series of recent studies have focused on China's economic growth using a macroeconomic approach.[4] An emphasis in the literature has been on reallocations between private firms and state-owned enterprises (SOEs); see, e.g., Song et al. (2011) and Dekle and Vandenbroucke (2012). Song et al. (2011) focuses on capital markets and the interplay between high-productivity private firms, with limited access to credit markets, and SOEs, which have much better access to credit. They show that this interplay is consistent with high savings rates and a trade surplus, such as is observed in China. Hsieh and Klenow (2009) also examine the role of reallocation in China. They uncovered large misallocations within manufacturing and the potential for a 50% increase in manufacturing

[1] One way to approach this problem is to assume that, on the margin, the return to agriculture workers is equal to the wage paid in the rural industry; see, e.g., Johnson and Chow (1997), and Dekle and Vandenbroucke (2010). However, such a wage rate is not a good proxy for the marginal productivity of Chinese peasants. In order to absorb excess labor from agriculture, the Chinese central government encourages local rural officials to develop township and village enterprises (TVEs), which are owned by the local rural citizens and operated by the local government. Right now, TVE employs about 138 million people. However, it is difficult to classify TVE as a market-oriented sector. Because of the fragmented labor market and official obstacles to both rural–urban and rural–rural migration, TVE contributes significantly to local employment. Due to the underdevelopment of financial institutions and the imperfect capital market, local governments use their political connections with the central banks to channel loans to TVEs; see Byrd and Gelb (1991) and Chang and Wang (1994) for more details. The strong political influence and the many other distortions mean that the rural industrial wage rate may be a poor proxy for agricultural wages in China.

[2] We also estimate the labor input using a "shadow wage" approach; see, e.g., Jacoby (1993) and Skoufias (1994). The shadow-wage approach assumes the existence of a household production function that has different types of labor as distinct inputs, that is, by sex, age and education. The shadow wage of each farmer is simply the marginal product of labor, estimated using the agricultural production function. Both methods yield similar results.

[3] Examples of the first class of models are Matsuyama (1992), Echevarria (1997), Laitner (2000), Kongsamut et al. (2001), and Caselli and Coleman (2001). In these models, an increase in income is associated with a smaller share of spending in agricultural goods (e.g., Engel's Law). The second class of models includes Irz and Roe (2005), Ngai and Pissarides (2007), and Acemoglu and Guerrieri (2008). In these models, employment moves to the sector with the lowest productivity growth as a compensatory mechanism. The closest model to ours is that of Hayashi and Prescott (2008), which reviews patterns of Japanese economic development. They argue that the Japanese miracle did not take place before World War II because of cultural barriers that kept agricultural employment constant throughout the pre-war period. Our emphasis is on the role of differences in productivity in China.

[4] There is a numerous amount of microeconomic literature on Chinese agricultural productivity. Overall, the literature has documented large positive growth rates in agricultural TFP. For example, Fan (1997) showed that agricultural productivity increased 3.9% per annum between 1985 and 1995. Wu et al. (2001) found an increase of 3.6% between 1990 and 1995. Jin et al. (2002) found that productivity of wheat increased by more than 20% between 1990 and 1995. Nin-Pratt et al. (2010) showed that agricultural TFP growth in 1990s was about 4.4%. Both Fan and Pardey (1997) and Jin et al. (2002) emphasized the importance of investment in agricultural R&D for TFP growth. Lin (1992) and Huang and Rozelle (1996) emphasized institutional reforms as the main source of agricultural growth during the early 1980s.