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Sources of Chinese labor productivity growth: A structural decomposition analysis, 1987–2005

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ABSTRACT

We decompose labor productivity growth from 1987 to 2005 by examining six partial factors (both supply and demand): changes in value-added coefficients, labor inputs, shares of sectoral demands that are fulfilled domestically, input mix, and the intra-sectoral shares and intersectoral mix of final demand. Our analysis confirms that simply by virtue of its size and extremely low level of labor productivity, China's farm sector continues to weigh heavily in China's overall economic advances. Labor savings have levied the largest influence on the labor productivity on all sectors across all three study subperiods. We find that this transition is highly correlated with capital deepening that accompanies China's opening up process. Still, changes in the intra-sectoral shares and the intersectoral mix of China's final demand also have become quite strong, especially in recent periods. Due to ever-increasing competitive pressures as China continues to open, changes in industries value-added coefficients have tended to counteract some of the positive benefits of labor savings for most sectors. The effects on changes in labor productivity of technology change and changes in the use of imports have been comparatively negligible and any variation in their sectoral effects have been waning over time.

1. Introduction

For 2009, China's Government announced that its GDP growth was 8.7% (The Economic Times, 2010). In developed countries such growth would be a pipe dream. In a rapidly developing country like China, it is moderate growth and GDP growth on the order of 5.0% is a nightmare. In fact, since 1978 or so Beijing typically has viewed GDP growth of 8% as a minimum desired threshold. It has a real concern that, with low or no growth, rising unemployment could pose a threat to social stability and the legitimacy of government. With this in mind, it is clearly important, at least in the near term, for Chinese officials to get a better understanding of the factors that enable sustained GDP growth in China.

Much of its leaders' concerns stems from China's relatively low-income per capita. In 2008 its GNI per capita in terms of purchasing power parity (PPP) was only 12.8% of that of the United States, 17.1% of Japan, 21.4% of Korea's, and 59.6% of Brazil's (World Bank, 2009). But Beijing's concerns are heavily mitigated when the purchasing power of most households edges upward at a sufficient pace, as it did even between 2007 and 2008 when it gained PPP by at least a percentage point against each of the above countries. Fortunately, countries at China's present distance from the technology frontier have the capacity for rapid growth if they can exploit and allocate available resources effectively. To do so, countries like China must adapt foreign technology efficiently and find a specialized niche in the world's market economy (Maddison, 2007).

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Researchers have in fact attributed China's economic success largely to the country's federal policies of pushing educational attainment, household savings, and the shipment of exports (Zheng, Bigsten, and Hu, 2008). At least through the early to mid 1990s, China's long-run economic growth was sustained by rising productivity across most, if not all, industries. This growth by industry was accompanied by a wholesale structural shift nationwide from low-productivity sectors toward those with higher productivity (Fan et al., 2003). Indeed, the shifts in employment and investments among industries in China lead to a distinctive regional development pattern, which yielded important policy implications regarding spatial disparities in economic growth and income (Yang and Lahr, 2008; Liu et al., 1999). Wang and Szirmai (2008) found that the structural shift premium amounted to about a 20% of total growth from 1980 to 1990.

Wu (2006) and others, however, have expressed some concern about recent evolutions in China economy into a pattern of so-called "extensive" growth, which is characterized by an expansion of imported inputs and less by domestic productivity growth. Zheng, Bigsten, and Hu (2008) attribute this extensive growth to China's various waves of reforms favoring short-run, capital-intensive growth. Lo (2007) suggests that in order for such capital deepening to be a viable economic trajectory in China, special care must be taken to assure that labor force growth does not outpace employment growth in the short to medium run. Zheng, Bigsten, and Hu (2008), therefore, advocate balancing short- and long-run total factor productivity (TFP) improvements and less strictly on capital deepening.

Research focusing upon productivity and structural change in China is fairly thick. Still most of the focus on the national economy is at a very coarse level of industry definition. For example, most consider either manufacturing's share of the whole economy or a basic economic break out into just three sectors—primary, secondary, and tertiary industries. In fact the literature on structural change in China examines the country's labor shifts out of agriculture (Li and Haynes., 2008), which is dominated by small farms with constant returns to scale. In the main, the structural change literature ignores the interdependence of China's industries and regions.

Because of a lack of literature on the effect of detail and industry interdependence on productivity changes in China, we opt to employ China's series of input–output tables to examine the country's economic change. Input–output tables often reflect the greatest industry detail possible for a country in order to capture the essence of industry interdependence. Employing input–output tables for structural decomposition analyses can reveal the fullest extent to which changes in industries' input requirements and final demand lead to changes in overall productivity growth. Such analyses follow the thought of Krüger (2008) and Silva and Teixeira (2008), who by using formal analysis emphasize that supply-side and demand-side factors closely interact to shape the process of structural change. Empirically, however, most contributions lean heavily on neoclassical growth theory, which puts great emphasis on technology-driven growth and lacks treatment of demand-based factors. By invoking both the demand- and supply-side perspectives simultaneously, our research is differentiated from prior analyses of productivity change in China.

Hu and McAleer (2004) also apply an input–output framework to study China's structural change. They focus upon the nation's growth of gross output from 1992 to 1997, however. While somewhat connected, the focus of our research is productivity change, not change in gross value of shipments, which is akin to net business revenue. In the end, an input–output approach allows us to bring more information to bear upon the study of the sources of productivity change in China.

At this point China has produced input–output tables from 1987 to 2005. Using concordant employment data for those years, we decompose the sources of changes in labor productivity growth into changes in value-added coefficients, labor inputs, domestic supplies, technology, intra-sectoral input shares, and interindustry mix.

The paper is organized as follows: we begin with the description of the decomposition method applied in the paper. Next is the data introduction and treatment. We overview how productivity has changed in China and perform the decomposition analysis. The final section concludes the paper.

2. Research approach

In this paper, we use a decomposition based on Jacob' (2003), where

n	represents the number of industries;
$\mathbf{v}$	vector of value added ($n\times 1$ vector);
$\mathbf{e}$	vector of labor inputs ($n\times 1$ vector);
$\boldsymbol{\lambda}$	labor productivity (where $\boldsymbol{\lambda}=v_i/e_i$) ($n\times 1$ vector);
$\mathbf{A}$	matrix with input coefficient ($n\times n$ matrix), with typical element of a_{ij} denoting the input of product i per unit of output in industry j;
$\mathbf{I}$	identity matrix ($n\times n$ matrix) with "1" in the diagonal and "0" elsewhere;
$\mathbf{B}$	Normalized final demand ($n\times k$ matrix), where each cell is derived as the ratio of the corresponding cell in the final demand matrix to its respective column sum;
$\mathbf{y}$	aggregate final demand for each of k categories (rural consumption, urban consumption, government consumption, gross fixed capital formation, inventory stock, export and other) ($k\times 1$ vector);
$\hat{\mathbf{E}}$	diagonal matrix with elements e_i as the labor input per unit of output in industry i in the diagonal and "0" elsewhere ($n\times n$ matrix);
$\hat{\mathbf{V}}$	diagonal matrix with elements v_i as the value-added per unit of output in industry i in the diagonal and "0" elsewhere ($n\times n$ matrix); and
$\hat{\mathbf{P}}$	diagonal matrix with elements ρ_i as the domestic supply ratio (ratio of the total output minus export to total supply, that is, total output minus export and then plus import) in industry i in the diagonal and "0" elsewhere ($n\times n$ matrix).