

According to Barro and Sala-i-Martin (1992), there is beta-convergence if states with lower levels of productivity tend to grow faster than the technology leaders, and sigma-convergence if the dispersion of their relative TFP levels tends to decrease over time. Thus, beta-convergence is a necessary but not a sufficient condition for sigma-convergence. An important implication of this result is that income inequality across states or regions may persist due to shocks (e.g., cyclical fluctuations in economic activity) that tend to increase dispersion.

This paper explores the relationship between the business cycle and convergence in levels of agricultural productivity. Two alternative explanations have been proposed in the literature to explain why convergence patterns may be related to the business cycle. The first is based on the pro-cyclical nature of the innovation process and the time lags between technological innovations and diffusion processes. According to this argument, productivity leaders tend to innovate more during periods of expansion in response to positive demand shocks. However, due to the existence of informational barriers, productivity followers, who tend to learn by imitation, postpone the adoption of innovations until economic downturns.

The second explanation is based on the relation between competition and productivity. Productivity followers have more incentive to reduce their costs during downturns when negative demand shocks increase the probability that these firms will exit the industry.

Overall, these arguments point to faster rates of convergence during contractions in economic activity and to slower rates of convergence, or even divergence, during periods of expansion. Despite these arguments, few researchers have estimated the impact of the business cycle on productivity convergence.

An exception is provided by Escribano and Stucchi (2008). Using firm level data for the Spanish manufacturing sector, the authors test the catch-up hypothesis across different phases of the business cycle. They find strong evidence in support of the innovation-imitation hypothesis. Firms tend to diverge during periods of expansion and to converge during recessions, a result of both time lags in the diffusion of technical information and the pro-cyclical nature of innovation.

In this paper, we closely follow the methodology of Escribano and Stucchi (2008). First, we test the catch-up hypothesis using a model specification that ignores the business cycle (i.e., the benchmark model). Then we investigate the possible impacts of the business cycle on the convergence process.

We find strong evidence of "catching-up" across the business cycle. Moreover, the speed of convergence was greater during periods of contraction in economic activity.

#### References

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## **Assessing the profit inefficiency among urban and peri-urban vegetables crop producers in the Southern Benin: a directional distance bootstrap approach**

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In West Africa, the rapid population growth, infrastructure development and urbanization provide increasing opportunities for the intensification of agricultural systems in urban regions. A wide range of vegetable crops are grown, traded and consumed in urban and peri urban zones of Benin. However, the potential of urban vegetables production is limited by technical, allocative and marketing inefficiency. In addition, with the food crisis that started this last decade in Africa, agriculture has gradually returned in the global development agenda. Hence,

urban agricultural sector productivity analysis is crucial for food security and poverty reduction. By contrast, the vegetables sector traditionally received far less attention from research and extension than either industrial or staple food crops. These trends provide increasing opportunities for agricultural development and the intensification of agricultural systems around urban centers. The objective of this paper is to estimate the level of profit inefficiency among urban and peri urban vegetable crop producers in the South of Benin. We collected data from 310 producers in six cities and towns in the South of Benin during agricultural production year 2009/2010 using a two-stage stratified random sample procedure. Variables collected from the farmer survey are outputs, inputs, farm characteristics and socio-economic information of the farmer and farm household. We employed a dual approach to estimate and decompose short-run profit. This framework also accommodates multiple outputs and multiple inputs which characterises urban vegetable crops production. We adapt the (first stage) smooth bootstrap approach to the directional distance function to improve statistical inference. The bootstrap method appears to be robust and useful for investigating inefficiency in cross section data. In semi-parametric efficiency analysis, the directional distance function is becoming a more popular approach to measuring profit inefficiency. The directional distance function is derived from the shortage function which generalizes the profit function in the short-run. Since overall profit inefficiency analysis is based on difference rather than ratio in Farrell cases, the directional distance function is practical due the fact that both maximal and observed profit may equal zero. In addition, the fact that the directional distance function combines features of both an input-oriented and an output-oriented model, generally leads to a more complete ranking of the observations. The results show that although urban and peri urban vegetable crop production farming is input intensive, there is a need to reduce loss of profit of producers. We found evidence of substantial profit inefficiency among urban vegetable crop producers. The paper also provides empirical support for reducing urban agriculture inputs use inefficiency to address urban food insecurity problems in Benin.

## **Agricultural Productivity and Production Bias: Policy and Infrastructure in Henan, China**

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Food demand in China has expanded dramatically in the past few decades due to rapid urbanization, income growth, and steady population growth. At the same time, limited scope of land expansion has made increasing productivity the only feasible way to achieve steady agricultural growth in the long run. The government has implemented comprehensive policies to encourage domestic agricultural production, including agricultural tax elimination and subsidies. In particular, China has invested heavily over the last decade in major infrastructure such as roads, railway, airports and dams. The scale and intensity of investment in infrastructure is unprecedented in the world. There is an urgent need for knowledge on the effectiveness of policies and infrastructure in stimulating agricultural productivity, which can guide policy formulation in the process of economic transformation to ensure stable growth.

There is a vast amount of literature on the sources of agricultural productivity growth in China (Fan and Chan-Kang, 2005; Brummer, Glauben and Lu, 2003), however, these studies do not address spatial, biophysical and policy factors in a comprehensive manner. This paper contributes to the understanding of the impact of policies and investments on agricultural productivity growth in China by using detailed information on disaggregated county-level agricultural production information and distinguishing infrastructure and policy, generating a more nuanced picture of TFP evolution over time. It also captures the nature of technical change during fast economic transformation by calculating output and input bias in technical change, the shifts of the output combination corresponding to changes in farmer's output and input sets. Instead of traditional non-parametric approach, this paper addresses the statistical reference issue through parametric distance function estimation. China's experience can be useful for other developing countries facing similar food security concerns, serving as guidelines for policy planning.