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ISBN 978-81-9303-7645-0

9 788193 037645

2018

Patterns of Structural Transformation and Agricultural Productivity Growth

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(With Special Focus on Brazil, China, Indonesia and India)

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Gokhale Institute of Politics and Economics
Publication No. 75

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Gokhale Institute of Politics and Economics (GIPE)
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BMCC Road, Pune 411004

First Published 2018

ISBN 978-81-930376-4-5

Rs. 500/-

Published by
Rajas Parchure
Gokhale Institute of Politics & Economics (GIPE)
(Deemed to be a University),
BMCC Road, Pune 411004 (India)
Pune 411 004 (India)

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Preface

The findings of this study were first presented at the conference on "Policy Options and Investment priorities for Accelerating Agricultural Productivity Growth", organized jointly by the Indira Gandhi Institute of Development Research and Institute for Human Development in collaboration with the Planning Commission of India, Food & Agriculture Organization and World Bank, in New Delhi (November 9-11, 2011) and was carried out as background work for the World Bank (2014) Report "Republic of India: Accelerating Agricultural Productivity Growth". This book's analysis covers 109 countries for the period 1980-2011. It led to an outgrowth of other papers we published on Africa "Lessons of the Global Structural Transformation Experience for the East African Community" for the International Symposium and Exhibition on Agriculture, organized by Kilimo Trust, Kampala, Uganda (November 5–7, 2013) and an updated version on India using data for 127 countries and 34 years (1980-2013), in the form of a Power Point Presentation at the Conference on "Innovation in Indian Agriculture: Ways Forward", organized by the Institute of Economic Growth and International Food Policy Research Institute, New Delhi (December 4-5, 2014).

The FAO has stopped publishing data in this form since 2014 (i.e., economically active population in agriculture) and instead publishes data on employment in agriculture as part ILO-Global Employment Trend (ILO-GET) data. These latter contain data on three sectors: agriculture, service and manufacturing, and are based on surveys. Therefore, such analysis can only be conducted up to 2013.

Since then, using ILO data, Lele, Goswami and Nico (2017) published a paper "Structural Transformation and the Transition from Concessional Assistance to Commercial Flows: The Past and Possible Future Contributions of the World Bank" (Chapter 16) In Agriculture and Rural Development in a Globalizing World: Challenges and Opportunities, edited by Prabhu Pingali and Gershon Feder, London: Routledge. The paper covers 139 countries over the 1991-2014 period.

In short, this study is the foundation of our work on structural transformation, and we are pleased to see it being broadly available.

We are grateful to colleagues, in particular, Peter Timmer on whose work our first work was based. Madhur Gautam provided critical comments, and Keith Fuglie and his colleagues at USDA shared their analysis. We are grateful to the Gokhale Institute of Politics and Economics for publishing this study.

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ABBREVATIONS

ADB	Asian Development Bank
AQUASTAT	FAO's global water information system, developed by the Land and Water Division.
ASTI	Agricultural Science and Technology Indicators
BASIX	Bhartiya Samruddhi Finance Ltd
CEO	Chief executive officer
CGIAR	Consultative Group for International Agricultural Research (formerly)
CSO	Central Statistics Office
EMBRAPA	Brazilian Agricultural Research Corporation / Empresa Brasileira de Pesquisa Agropecuária (A state-owned research corporation affiliated with the Brazilian Ministry of Agriculture)
EU	European Union
FAO	Food and Agriculture Organization of the United Nations
FAOSTAT	FAO Statistics Division
GCF	Gross Capital Formation
GDP	Gross domestic product
GM	Genetically modified
IBGE	Instituto Brasileiro de Geografia e Estatística/ Brazil's Institute of Geography and Statistics
ICAR	Indian Council of Agricultural Research
IFPRI	International Food Policy Research Institute
IT	Information technology
IWMI	International Water Management Institute
KEI	Knowledge Economy Index
LAC	Latin America and Caribbean
MDGs	Millennium Development Goals
NITI Aayog	National Institution for Transforming India
NREGA	Mahatma Gandhi National Rural Employment Guarantee Act
NSS	National Sample Survey
PMES	Performance Monitoring and Evaluation System
PRIA	Society for Participatory Research in Asia
R&D	Research and development
RBI	Reserve Bank of India

REDD+	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (UN)
SSA	Sub-Saharan Africa
TFP	Total factor productivity
TOT	Terms of trade
TQM	Total Quality Management
UK	United Kingdom
UN	United Nations
US	United States
USDA	United States Department of Agriculture
VA	Value added
VCs	Vice Chancellors
WDI	World Development Indicators
WDR	World Development Report
WTO	World Trade Organization

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Introduction

The study attempts to explore the policy and investment options for accelerating agricultural productivity growth in India. Not only does it contain a larger number of undernourished, 225 million, compared with China's 130 million, its agricultural productivity growth has also been slower. It has one of the highest incidences of child mortality. Clearly, growth alone has not been enough to raise indicators in India. Agricultural productivity growth is important because 75 per cent of poverty is in rural areas and much of urban poverty is a result of migration from rural areas.

Scope and method

The study follows a three-pronged approach. First, building on earlier studies of structural transformation, we have based our analysis of agricultural performance against the background of evidence from an analysis of panel data of 109 countries over the 1980 to 2009 period. Structural transformation has several distinct processes: (1) declining share of agriculture in GDP, (2) declining share of agriculture in employment, (3) rural-urban migration, (4) growth of the services and manufacturing sectors, and (5) a demographic transition with reduction in the population growth rates. The final outcome of transformation is a state in which differences in labour productivity between the agricultural and non-agricultural sectors narrow considerably, whereas at early stages of development there is often a huge and even a widening gap in labour productivities between agriculture and non-agricultural sectors. A turning point is reached when the difference between the share of agriculture in employment and income begins to narrow. Analysts have considered agricultural productivity growth as crucial to the transformation process over the long haul. Analysis of structural transformation focuses on changing labour productivities among sectors over time and it is noted that today's developing countries in Asia are taking longer to reach the turning point than the historical experience of industrial countries.

Second, we have analyzed changes in land productivity with a focus on implications for India. Two policy issues seem relevant. Analysts have argued that through intensification, increased land productivity increases employment, and an inverse relationship between productivity and farm size is confirmed even for recent years. In Asia past intensification has occurred mainly through increased irrigation. Scope for further expansion is limited but there is considerable scope for increasing the efficiency of input use, which can lead to increased land productivity. Second, globally annual growth rates of per hectare yields have decelerated. Climate change increases the dual challenge of bridging the yield gap and raising the yield ceiling.

Third, we have conducted a meta-analysis of the substantial literature on total factor productivity (TFP) growth in agriculture. It measures the portion of growth of output, which is not explained by growth in the amount of inputs used in production, for it is a residual. As such, its level is determined by how efficiently and intensely inputs are used in production and how they are measured. A variety of approaches and methods have emerged to measure TFP growth, but most studies focus on the measurements of productivity growth through growth accounting of inputs and outputs. Only a few TFP studies systematically explore the causes underlying productivity growth. Furthermore, they do not measure changes in the quality of inputs.

Therefore, beyond reviewing formal studies and consulting with experts working to develop a fuller understanding of the underlying causes of performance that contribute to the efficiency and intensity of input use, we have also explored the impact of agricultural growth on resources.

Findings

Different behaviour of developing regions in structural transformation

Whereas there are similarities in the findings of our analysis and those of previous studies, there are also major differences. For example, all countries show a declining share of value added (VA) in agriculture in total value added and in the share of labour in agriculture over time as per capita income increases. Value added per worker in non-agriculture rises only in a single developing region, namely, East and South Asia, as it does in industrial countries.

Further analysis of per worker value-added in agriculture and non-agriculture over the 1980-2009 period reveals substantial differences in behavior of the current developing countries from the historical pattern of industrial countries, substantial differences among developing regions, and depending on the behavior of the regions in which they reside, among countries across different developing regions.

Inter-sectoral duality has increased sharply in China. It also increased in Indonesia until 1997. Value added per worker in non-agriculture increased in India, too, but less steeply than in China, and in Brazil, value added per worker in the non-agricultural sector declined throughout the 1980-2009 period.

Gap in the per worker value added between agriculture and non-agriculture narrowed in Latin America (and Brazil), however, owing to the declining per worker value added in non-agriculture. Value added per worker in the non-agricultural sector in industrial countries continued to increase as it did in Asia, suggesting an increase in inter-sectoral duality at the initial stages of growth and that it is taking longer for developing countries to reach a turning point. Furthermore, the declining value added per worker in the non-agricultural sector is not a good piece of news. In terms of structural transformation over the 1980-2009 period in the four focused countries, for the variable denoting difference between the share of agricultural labour in total labour and the share of value added in agriculture in total value added, India and Indonesia behave in a way that is consistent with the panel regression for 88 developing countries. However, China is an outlier, seemingly retaining more labour in agriculture than predicted by the regression, whereas Brazil is an outlier, in the opposite direction. It loses more labour from agriculture than predicted by the regression.

Inter-sectoral terms of trade

Inter-sectoral terms of trade have been rising rapidly in favour of agriculture in Asia, but moving against agriculture in Latin America, Africa and other developing regions. Within Asia, they have moved more in favour of agriculture in China, followed by India and Indonesia.

The slower rise in inter-sectoral terms of trade in favour of agriculture in India, when compared with China in the post-2000 period, may also be the result of slower growth in effective demand for food in India reflected in the undernourishment of 225 million people. Other evidence we reviewed suggests that the provision of subsidies to agriculture has been increasing in recent years in China as well as in India. Such subsidies raise the terms of trade and help to explain the narrower income gap between agriculture and non-agriculture relative to the productivity gap.

Unlike Asia, most of the production growth in Brazil has come from commercial agriculture. Although overall productivity has increased, new technologies and inputs allow efficiency gains on large farms, leading to a U-shape in growth in total factor productivity with respect to farm size.

Productivity growth and income distribution

Rapid increase in worker productivity in non-agriculture in Asia has reduced poverty but increased Gini coefficients. Inequality has increased to a greater extent in China than in India or Indonesia, though the initial Gini coefficients were relatively low and similar in Asia. The falling gap between per worker productivity in agriculture and non-agriculture in Brazil has contributed to a decline in the Gini coefficient. Brazil's market-based land reform has contributed little to change in either land or income distribution. In China, on the other hand, the introduction of the household responsibility system came upon an already equal access to land, brought about earlier, through a coercive land reform. The household responsibility system greatly enhanced agricultural productivity growth, and based on the foundation of equitable land access, resulted in broad-based growth. Rapid growth in per worker value added in agriculture and non-agriculture has resulted in a rapid decline in poverty in China as also in Indonesia, a record that has not been achieved in India. Its land distribution is nowhere as skewed as in Brazil, and its democratic system, attuned to better off farmers, has not provided conditions for clarifying access to agricultural land nor to the redistribution of land rights with an imperfect land market.

Differential performance in agricultural productivity growth

As in the case of labour productivity, land productivity, measured as yield growth, too, seems to have grown more rapidly in the other three countries over the entire 1961 to 2010 period than in India. Its ranking of yield growth improves when the 1980 to 2010 period is considered in some crops, e.g., rice, maize, cotton and in coarse grains, but with a few notable exceptions, e.g., wheat and sugar, yield levels still remain low compared with other countries. An implication of the differences in the compound growth rates is that India has fallen behind other countries in land productivity.

Causes of agricultural productivity differences

Fuglie and Evenson explain TFP growth differences in terms of investment in "technology capital", e.g., in China and Brazil relative to other developing countries. Unfortunately, there tend to be wild variations in the TFP growth estimates, even using the same data but different estimation methods of TFP, an issue that we examine in the body of the study. In their growth accounting framework, higher levels of complimentary inputs such as machinery, fertilizer and seeds in Brazil, China and Indonesia explain higher levels of increase in labour and land productivity. Brazil, China and Indonesia diversified agricultural production out of cereals to a greater extent into higher value crops did than India. Still other studies note that in some regions of the country the growth rates are explained by pushing the technology frontier outward, whereas in other less developed regions they are a result of meeting the yield gap through increased application of existing technologies. China presents an example of perpetual reforms. Once the benefits of the household responsibility system on productivity growth began to slacken, it seems to have adopted other policy reforms, explaining the pick-up of the TFP growth. Still others suggest a stronger synergistic relationship between the growths of the manufacturing and agricultural sectors in China, e.g., through the village enterprise growth leading to backward and forward linkages, than in India.

Our analysis shows that intensification, too, was greater in Brazil, China and Indonesia. China's share in global cereal production had almost doubled from 1961 to 2009, while the share in the global area under cereal crops had dropped in 2009. India's share in global cereal production did not change from 1961 to 2009, whereas its share in land area under cereals grew. Increased efficiency of land and water resources due to a combination of technologies, policies and institutional capital in China seem to explain these differences. Beyond continuous reforms in policies and institutions, our own review of evidence also attributes China's rapid productivity growth to substantial growth of investment in agricultural research and due to growth in investments in other sectors including infrastructure, energy and transport expansion, leading to greater market access and local institutional development. Not the least important is accountability for performance of the state and local authorities to the central government expenditure under a strongly unitary system of government and party structure. Indonesia also possessed such a structure until the end of the Suharto regime. Agriculture and water being state subjects in India's constitution, they pose special challenges in accountability for results, even when the central government provides funds with increasing decentralization.[1]

In Brazil, the Brazilian Agricultural Research Corporation/ Empresa Brasileira de Pesquisa Agropecuária (EMBRAPA), a national research organization, has played an outstanding role in the generation of new technology as did farmer-led innovation. Liberalization of the economy in the early 1990s led to increased competition, in turn leading to a substantial spurt in agricultural TFP growth, particularly since 1995. In Indonesia, in contrast, investment in agricultural research explained little of the growth of TFP. Internationally borrowed technology from Malaysia explains Indonesia's extraordinary palm oil sector development. In the case of rice, technology came largely from CGIAR, formerly the Consultative Group for International Agricultural Research. As in the case of Brazil, liberalization of the Indonesian markets also helped particularly with rapid growth in demand for palm oil from India and China. Indeed, Brazil, China and Indonesia show greater openness, i.e., share of agricultural trade in domestic availability and lower tariff rates in agriculture than does India.

Productivity differences by farm size and continued prevalence of "poor but efficient" farmers

Most studies that examine productivity differences by farm size look at partial measures using land productivity, and they suggest an

1 One hypothesis often cited to the authors in China was that the Chinese leadership relied on economic outcomes to assure its legitimacy. Democracies generate legitimacy through elections and face varied pressures from different constituencies to deliver results on the promises made during contesting elections, many of which tend to be non-economic.

inverse relationship between farm size and productivity. In an age of globalized capital and technology, the efficiency gains on large farms, reported in Latin America using a variety of new technologies, potentially have implications for whether and how Asia and sub-Saharan Africa will evolve in this direction going forward with significant policy implications.

At the same time, studies of Indonesia, by farm size much like the recent studies in Brazil, continue to show that small farmers such as those in the North or North-East of Brazil, tend to be efficient, even though the small producers have had little access to education, extension or inputs. These studies provide support to Schultz's "poor but efficient" hypothesis of agriculture, which was incubated and received early empirical support in India. Increasing small farm productivity calls for more access to services, but studies also suggest that agricultural productivity growth alone is unlikely to be sufficient to provide adequate incomes for poor households, typically with small farms concentrated in the poor regions. Some households supplement incomes with non-farm employment or remittances. Others leave the agricultural sector for the non-agricultural sector. With the sheer size of the agricultural labour forces in Asia, inter-sectoral labour transfers to productive employment in the non-agricultural sector are mammoth tasks, even with extraordinary economic performances in both sectors. With current growth performance, turning point for India is estimated to occur in about three decades.

Environmental sustainability of agricultural productivity growth

Studies of total agricultural factor productivity growth do not take into account the costs and benefits of agricultural intensification and diversification in terms of the use of resources, e.g., the conversion of forest lands into palm oil in Indonesia or of forest lands to agriculture in Brazil. Green Revolution studies have traditionally been cited for having reduced land clearing, which would have been needed without productivity growth. There is now a vast literature which notes the degradation of land and water resources, excessive exploitation of groundwater, pressure on surface irrigation systems and a large carbon footprint of land use changes. Land use changes and carbon footprint have been particularly large in Brazil and Indonesia in response to growing global demand. Increased agricultural factor productivity and land expansion have a more complex relationship.

Lessons and implications for India

"Small-scale but efficient rather than large-scale, mechanized and efficient"

Overall agricultural strategy

China's or Indonesia's smallholder strategy is clearly more relevant for India's resource endowments and current level and pattern of development than Brazil's large farm strategy. Brazil has been achieving a rapid technical change while shedding farm employment rapidly, whether it is retaining more than predicted levels of labour in agriculture, which our analysis showed, it has raised questions both about the reliability of the Chinese employment data and about what they mean. These are discussed in the body of this study. Yet, all three countries have performed better on key Millennium Development Goals (MDGs) than India, for farm households' primary education, health, water and sanitation. This has helped their agricultural productivity growth, given interactions between human capital, human health and productivity growth.

Overarching policy environment

China and Brazil have provided a more predictable, overarching enabling environments for agriculture, with stronger records of implementation. This has entailed continuous innovation in public sector management pertaining to agriculture and rural sectors. China has increased its water efficiency in agriculture and diversified out of water-intensive crops while increasing food imports. All three countries suggest that greater openness means more access to public and private sector technologies from CGIAR and from the private sector, whether in oil palm or in genetically modified (GM) crops. In India, institutions established at the time of the Green Revolution have been decaying, and their effectiveness has diminished, e.g., in agricultural research, education and extension. There seems to be no evidence of transformative change in the overarching policy environment in the agricultural sector towards a more dynamic but systemic, predictable, efficient operation of public research or delivery, or use of markets for the quality supply of inputs, such as seeds, fertilizers, finance, electric power, or output markets. Subsidies on inputs have distorted markets, inhibiting the development of the private sector in many areas.

Intensification and diversification

Agricultural intensification is the only way for India to increase land productivity and create productive employment as an engine of growth. Increasing land productivity has a variety of strategic policy implications, ranging from farms to national and international strategies related to land policy, trade, technology, investments in infrastructure and a regulatory framework. This is necessary to create an enabling environment for agriculture for the private sector that is consistent and predictable.

Bridging the huge yield gap relative to other countries and India's own productive potential sustainably is of the highest priority. India's most urgent challenge is to improve applied and adaptive research and investments in a range of areas to increase farmers' access to information and markets, while getting organized through research policy reforms to push the technological frontiers upwards and outwards. This means upping the basic and strategic public sector research and creating an enabling environment for private investment in research. This will require strengthening the research-related regulatory framework and creating trust among key stakeholders by ensuring transparency.

Diversification of cereals is needed in India not only to raise productivity but also to meet the changing dietary demands and needs of the portion of population that is currently seemingly not exerting effective demand for food. Despite recent progress on diversification, the country is behind other countries, with excessive reliance on a rice-wheat based agricultural development strategy. Diversification will also mean increased need to trade regionally and internationally in food and agriculture.

Pressure on natural resources

A big challenge in agriculture for India, which has exhausted its extensive margin, is one of reconciling growth with productive employment and reducing the environmental footprint of land, water and land use changes. Increasing water use efficiency is as high a priority as increasing land productivity. This means achieving an appropriate balance between the uses of modern inputs combined with environmentally friendly technologies that overcome the current over-exploitation of groundwater, salinization and soil degradation, while keeping productivity growth at the centre stage. Even though information technology and private sector investments are revolutionizing Indian agriculture in some respects, millions of poor farmers currently have little or no access to education, technology and basic agricultural services. Access to internet and cell phones is still lower in India than in China or Indonesia, reflecting a lower level of infrastructural development. The country needs more investment in physical infrastructure in rural areas. There is considerable scope to introduce knowledge-intensive innovations: crop rotations, minimum tillage, bio-fertilizers, agroforestry and integrated pest management. They call for more and different kinds of agricultural research and extension. Together, they will create employment and minimize the problems of input intensive mono-cropping, which adherence to a rice/wheat-centric agricultural strategy has inadvertently promoted.

Technology capital of public goods, including agricultural research, extension, education, transport and power

Brazil and China demonstrate the importance of technology capital of public sector research, extension and education through more and higher quality of expenditures. Public research expenditures have soared in China and agricultural extension is still intact. Brazil's EMBRAPA is a model of excellence in research. Unlike China, Brazil has experienced little growth in research expenditure. A corporate culture of research management focuses on incentives to researchers to demonstrate impacts of research to the public and yet, is free from day-to-day political interference in research management. EMBRAPA's acknowledged national status, outward orientation in research and autonomy help to maintain a scientific culture.

Public and private investment in Indian agriculture, while showing an increase in the recent years, has been falling over the long haul as a share of gross domestic product (GDP) and investment. Both need to increase substantially, as well as investment in rural infrastructure and power. The peak of investment in agriculture as a share of total investment each by the public and private sectors in agriculture was in the period 1977-8 to 1980-1. Agriculture's share in public investment bottomed out in the 2004-5 to 2008-9 period, and both public and private investment have been rising again as a share of the total investment. The Twelfth Plan proposed a considerable increase in public investment. Sustaining private sector interest in agricultural production, rural finance and supply chains will require fundamental policy and institutional reforms in public sector management to provide an enabling environment. This also means exploration of an appropriate role of the central and state governments in a rapidly decentralized country.

The tremendous growth in microcredit in recent years has been unplanned and plagued with numerous problems including non-repayment. While bringing microcredit into the fold of the Reserve Bank of India (RBI) is a good development, agricultural finance seems to have remained a neglected field in all the four countries. Specialized agencies in them face issues of targeting, subsidies, financial viability and effectiveness in serving the needs of the small farm sector. The gap remains large between the overall macro-financial sector and specialized small and microfinance institutions, self-help groups and cooperatives, which remain unequipped to address problems of agricultural finance as a whole. Better and more reliable credit facilities and crop insurance for the small farm sector would encourage purchase of modern inputs and other agricultural needs, e.g., investments to reduce post-harvest losses and for better storage.

Better flow of information to farmers

India's information technology (IT) revolution must be better harnessed to provide essential information to farmers on a scaled up basis on weather, technological options, and input and market conditions. A higher share of the population per 1000 in China and Indonesia has access to internet facilities.

Role of the central vs. state governments

A transformative change in agricultural policy calls for a re-examination of the centre-state roles. Much of the action on agricultural policy and investments is now at the state level. The central government needs to identify "public goods" areas where it has a clear comparative advantage in facilitating state activity, e.g., in establishing world class networks of national and state public institutions of agricultural research, education, extension; in liberalizing of inter- and intra-state domestic and external trade, with uniform tariffs, trade policies, and an active policy to develop a South Asia-wide regional trade zone; and creating an independent monitoring and evaluation system at the level of the National Institution for Transforming India (NITI Aayog) that supports the much needed multisectoral and multilevel approach and tie allocation of central resources to monitoring the performance in outcomes from the states to the resources allocated, promotes cross-state lessons and learning on an active basis, and generally increases accountability for results from the use of public revenues. Both China and Brazil have world class institutions of agricultural research, greater international collaborations and training, and more public accountability for results of their research systems; and each has made progress in monitoring public sector performance to increase accountability. India's introduction of the Performance Monitoring and Evaluation System (PMES) has been adopted by 80 government departments and 13 states and should be given real teeth.

Agricultural growth with and without poverty reduction

A combination of agricultural policy instruments is needed to address rural poverty through productivity growth. Brazil has opted to address its problem of poverty mainly through cash transfers. Its approach is not fiscally affordable for India where budget deficits are already high. Only 11 per cent of Brazil's population is in agriculture and only 43 per cent of its small incidence of poverty is rural, much of which is concentrated in the north-east and north, and so it is easier to target. Its per capita income and resource endowments are far higher. Even the National Rural Employment Scheme in India, while an important complement to productivity growth, cannot be a substitute, and without agricultural growth, will not be economically sustainable. Nevertheless, there are many useful lessons from Brazil, e.g., on monitoring and evaluation of targeted programmes and linking school feeding to local agricultural programmes. Without robust, broad-based agricultural growth, there will be three consequences: (1) higher inflation, (2) larger food imports, and (3) continued incidence of malnutrition and hunger. Higher inflation generates both economic and political problems.

In the short run, higher food imports without more exports increase the current account deficit, which was already at 4 per cent of GDP in 2012. In the long run, dependence on food imports will have to be coupled with a strategy to increase exports. That is China's strategy. Demand for food has grown rapidly, despite impressive agricultural performance. Increased imports are paid for mainly by higher manufacturing and agricultural exports of high value items. Without agricultural productivity growth among the food deficit households, hunger among the 224.6 million people, including child malnutrition, will persist.

Most importantly, growth without jobs will fail to achieve the government's declared goal of inclusive growth. It will fail to create effective demand, reduce poverty rapidly or raise nutrition levels. The experience of China suggests that even with rapid growth of the non-agricultural sector, more people may continue to be employed in agriculture, at least on a part-time basis, than has been the pattern historically in industrial countries and the one which Brazil is following. Because of a larger labour force, income differential may increase rather than decrease.

This analysis also raises questions for further intra-country and cross-country comparative research on agricultural transformation, including on the role of new and emerging technologies; appropriate balance of public and private sectors; behaviour of commodity, financial and labour markets; terms of trade; and more generally, the underlying non-price causes of productivity differences, including the political economy of policymaking and its implementation. An empirically based research agenda awaits the attention of policy wonks.

Section I: Background

This study, carried out to explore policy and investment options for accelerating agricultural productivity growth in India. The conference organizers asked us to address several questions:

1. How is structural transformation proceeding in large countries, such as Brazil, China, Indonesia and India?

2. What role has agriculture played in that process?

3. How does agricultural productivity growth performance compare among these countries and the regions in which they are located?

4. What factors explain the differences in their performance?

5. What policy and investment lessons do their experience offer for India?

A considerable literature has recently emerged on structural transformation and on productivity growth of agriculture in developing countries, using various methods, data and time periods. Yet, each of these strands of literature by itself cannot provide operational lessons for policies and priorities for a large and complex country such as India. We, therefore, proposed triangulation of evidence from a variety of sources in a comparative context to develop insights into determinants of factor productivity growth and their implications for policies, investments and institutions, which will promote rapid structural transformation in a long-term development context.

Defining concepts and their relationship to the three-pronged approach

Structural transformation

Past analysts have considered agricultural productivity growth as being fundamental to the processes of structural transformation of countries. They have identified several distinct processes: (1) declining share of agriculture in GDP, (2) declining share of agriculture in employment, (3) rural-urban migration, (4) growth of the service and manufacturing sectors, and (5) a demographic transition with reduction in the population growth rates (Kuznets 1955, 1966; Chenery and Syrquin 1975; Timmer 2009). The final outcome of structural transformation is a state in which differences in labour productivity between the agricultural and non-agricultural sectors disappear, whereas at early stages of development there is a huge and often even a widening gap in labour productivities between the agricultural and non-agricultural sectors (Lewis 1954; Johnston and Mellor 1961; Timmer and Akkus 2008). This is because as overall economic growth accelerates, agriculture's share in GDP declines rapidly, while a much larger share of population continues to derive its living from the agricultural sector. The result is widening income inequalities among the sectors and a large concentration of poverty in the agricultural sector. Not only does the share of labour in the non-agricultural activities increase as development proceeds, but the declining share of labour in agriculture has to be accompanied by increased labour productivity in agriculture to provide food, savings and investments for the development of the non-agricultural sector, without which inter-sectoral terms of trade can move in favour of agriculture, raising food prices, arresting the speed of transformation and, indeed, even socio-political stability (Kuznets 1955,1966; Lewis 1954; Johnston and Mellor 1961; Lele and Mellor 1981; Mellor and Lele 1973).

The turning point is reached when labour productivity in the two sectors begins to converge. For it to occur, agricultural productivity must increase and that in turn means not only labour productivity, but also land and total factor productivity. Timmer had noted that it is taking longer for today's developing countries to reach the turning point than was the case for industrial countries (Timmer and Akkus 2008). To achieve transformation calls for investment in agricultural research and innovation, education, transport and other supportive policies, institutions and investments as crucial elements of structural transformation. We have built our analysis on this body of literature, particularly on Timmer and Akkus's work on structural transformation, using data from a larger number of countries and covering a more recent post-2000 period of dynamic economic growth and accelerated pace of globalization. The transformation literature has largely focused on changes in labour productivity and implications for inter-sectoral labour transfers. (See Annex 1 for discussion of methodology, including the similarities and differences between our approach and that of Timmer and Akkus). We have taken a more eclectic analytical approach.

Land productivity

Land productivity is of interest in its own right. For countries which run out of extensive margin, i.e., for China and India, intensifying production on existing land is the only way to increase agricultural productivity, as well as create productive employment. Irrigation has been an important source of intensification through multiple cropping, and creating on- and off-farm employment. Considerable literature has emerged in Asia over the years that establishes an inverse relationship between farm size and productivity, using partial measures of land productivity (Sen 1962; Berry and Cline 1979; Cornia 1985; Dyer 2004; Feder 1985; Lipton 1993, 2009; Deolalikar 1981; Bhalla and Roy 1988; Benjamin 1995; Bhardwaj 1974; Carter 1984; Chen et al. 2011; Johnston and Le Roux 2007).

For countries that have not yet exhausted their extensive margin, e.g., Brazil and Indonesia, opening up new areas and increasing farm size have been attractive options. With a variety of new technologies in biological sciences, information and communication technologies, there is new evidence to suggest a U-shaped relationship between (growth in) farm size and productivity, entailing increased land as well as labour productivity with size. Adding to the complexity, the inverse relationship between size and efficiency varies by tenure systems associated with different types of technologies, market orientation, use of modern inputs and institutions.

In an age of globalization, rapidly growing demand for food and agricultural commodities and freer movement of capital and technology, land productivity and land use changes are no longer just microeconomic farm level issues. They have turned into political issues of regional and global significance. They involve trade and capital flows and "land grab", following food price increases. From the viewpoint of sustainable and equitable productivity growth, they present multiple policy options (Deininger and Byerlee 2011). Opening new areas has also generated a debate on the nature and extent of trade-offs between the food, environmental and other objectives of land use changes.

Total factor productivity

TFP growth measures the portion of output that is not explained by the amount of inputs used in production because it is a residual. As such, its level is determined by how efficiently and intensely all the inputs are used in production, and how they are measured. By linking the TFP growth rate to innovation, endogenous growth models shed light on the determinants of TFP growth. They suggest that research and development (R&D) expenditures, including government subsidies and abundance of skilled labour, reduce the marginal cost of conducting R&D and increase the rate of innovation development and, therefore, the TFP growth rate (Comin 2006). Increases in the size of markets increase the innovators' returns, leading to more innovation and higher TFP growth. In the case of agriculture, cross-country differences in TFP can also be due to differences in physical endowments, technologies used and in the efficiency with which they are used by actors. To explore the relative importance of these factors, it is necessary to have data on direct measures of technology and the spread and causes of innovations. A significant fraction of agricultural innovations is not patented. Understanding the determinants of the levels of technology and its adoption is key to explaining cross-country variation in agricultural TFP. There is an increasing number of theories linking the adoption of technologies to the role of institutions (Acemoglu et al. 2006), financial markets (Alfaro et al. 2006; Aghion et al. 2006), endowments (Caselli and Coleman 2006) and policies (Holmes and Schmitz 2001). The challenge is to test these theories in a developing country context, applying them to the data and assessing their empirical relevance. Many TFP studies have focused on measurement, and few have explored the causes underlying TFP growth. When they do so, they mostly explain proximate rather than underlying causes of TFP growth differences, such as policies and investments not just in agriculture but also related sectors such as education, infrastructure, power, etc. Therefore, triangulation of evidence through multiple approaches provides a richer set of insights into the questions that the study seeks to address, rather than a specific genre of literature.

Scope of the study

Analysis of structural transformation helps situate the role and importance of agricultural productivity growth in the context of overall economic growth over the long haul. First, we have conducted analysis of the structural transformation processes involving 109 developed and developing countries and covering a period starting from 1980 (when the Food and Agriculture Organization of the United Nations [FAO] began to publish labour data) to 2009. The quintessential question we sought to explore is whether our approach offers new insights into changes in labour productivity over time and effects on inter-sectoral labour transfers because it includes: (1) the more dynamic post-2000 period when global growth was driven by accelerated performance in all developing regions, (2) a larger number of countries than the 86 contained in Timmer and Akkus's work, and (3) the Chenery-Syrquin specification, which includes population as a variable (not included in the Timmer-Akkus analysis). Do patterns follow a uniform path as expected by previous analysts or vary across regions and countries, and do they offer new insights into the causes of those patterns?

Second, we have reviewed evidence on the partial measures of land productivity differences across the four countries to assess the extent to which there are yield gaps and the factors that may explain them.

Third, we have conduct a meta-analysis of the body of literature on total factor productivity in agriculture while maintaining the focus of the review on the four large countries to derive lessons.

Finally, we have complemented this work with some additional evidence and hypotheses on the underlying causes of productivity differences among countries. We identify areas where evidence offers scope for firm conclusions on policy implications and where further research is needed to address gaps in our knowledge.

Relevance of the enquiry

The questions which this study addresses are timely. Following the global food price rise from 2007 and the financial crisis that followed in 2008, the development community has been wrestling with the dual questions of threats to food security and growing inequality accompanying economic growth. Both of these issues are of immediate relevance to the agricultural priorities of developing countries. Several analysts of India have noted that its structural transformation has slowed (Hazell et al. 2011; Binswanger and D'Souza 2011). Already containing the world's second largest population, India will surpass China by 2023. By then India's population will reach 1.43 billion, compared with China's 1.42 billion (FAOSTAT 2011; UN 2012). By 2050 India's population will reach 1.69 billion, compared with China's 1.32 billion on a surface area that is a third of China's. Whether the so-called demographic dividend India is projected to reap remains a dividend or liability will depend on the extent to which it creates a healthy, educated and economically productive population.

Currently, close to 59 per cent of China's population is reported to be economically active in agriculture, compared to India's 53 per cent (FAOSTAT 2011). Differences in the current population levels, labour force participation and projected population growth rates reflect the past record of economic and social development, demographics, urbanization and agricultural productivity, and they will do so to a greater extent in the future. How much population will remain in agriculture will also affect the results. With an estimated 499 million of China's population and 273 million of India's population reported by FAO in agriculture in 2011, structural transformation of these two countries alone from predominately agricultural to non-agricultural sectors has profound implications for global labour markets by bringing millions of people into the non-agricultural labour force. In a more globalized world, the outcome will also be influenced by policies and developments in other countries. Not just the high and unstable food prices, but gainful, sustainable employment of people and policies towards them will be a major focus going forward throughout the world. India has achieved increasing rates of economic growth in each successive decade since 1973, unlike other large countries such as Brazil and Indonesia, which have experienced unstable macroeconomic growth. While agricultural growth rate in India declined in the post-2000 period until 2010 (Figure 1), due to good weather, production recovered in 2011 and 2012. Given year-to-year fluctuations, choice of base and end years makes a difference to estimates, needing a way of ironing out impacts of fluctuations on estimated growth rates.

Figure 1: Growth rates by sector (per cent per year) (Brazil, China, India, and Indonesia) (1990-2000 to 2001-10)

Source: *World Development Indicators (WDI) and Global Development Finance, World Bank.*

Recent studies have shown that India's overall growth has been less capital deepening than growth in East and South East Asian countries, whether deepening is considered in terms of physical or human capital (Bosworth and Collins 2008; & Bosworth et al. 2007). Its economic growth has slowed more than China's since the financial crisis. Its progress on several MDGs is lackluster relative to East and South-East Asian Countries (Annex 3: Statistics on structural features of the countries, Tables 1, 2, 3 and 4), although they all started at more or less similar initial conditions in the 1960s.

As much as 33 per cent of India's population lived below the poverty line of $1.25 a day in 2010. Well over two-thirds of it lives on less than $2 a day (Povcal Net and WDI, World Bank). The percentage share of undernourished population has declined in India, but it is less rapid than in East and South-East Asian countries. Besides, the number of poor and undernourished people in India has grown. It has the highest rates of infant mortality and child malnourishment, 44 per cent of the children under five are undernourished, higher even than those in sub-Saharan Africa. Again, the largest shares of global and South Asian infant deaths are in India. It also ranks high on micronutrient deficiencies that increase susceptibility to diseases. In East and South-East Asia, there has been a sharp drop in poverty, both in terms of relative and absolute numbers. Even in the areas where India has made progress on MDGs, such as literacy, access to primary education, sanitation and drop in infant mortality, it is lagging not just behind China but also Indonesia (Annex 3: Statistics on structural features of the countries; Table 1, 2, 3 and 4). Progress on MDG indicators will be critical for agricultural productivity growth, employment, income generation and food security of the poor[2] as literacy and human health influence labour productivity and the ability to adopt new innovations. A literate and skilled labour force is also essential for generating productive employment in the non-agricultural sector.

Literature on agricultural productivity has typically focused either on land productivity (i.e., yields per hectare as, for example, in World Development Report [WDR)] 2008, World Bank 2007) or total factor productivity (Evenson and Fuglie 2010; Fuglie 2011a, 2011b, 2010; Alston et al. 2010). Sustained agricultural productivity growth has been explained by investment in technology capital. The transformation process has consequences for changes in per capita income and intra- and inter-sectoral inequality, which many previous analysts have addressed (Clark 1940; Kuznets 1955, 1966; Chenery and Syrquin 1975; Chenery et al. 1974; Chenery and Taylor 1968), as well as the role of agriculture in that process

2 Large countries have less luxury of relying on international trade than small countries. A small percentage rise of total availability in imports can result in a rise in international prices. Nevertheless, India's agriculture has been more protected than that of other three countries both in terms of share of imports in total availability or agricultural tariff rates (Annex 3: Statistics on structural features of the countries, Table 5 & 6).

(Lewis 1954; Johnston and Mellor 1961; Ranis and Fei 1961; Mellor and Lele 1973; Timmer 2009; Hazell et al. 2011; Binswanger and D'Souza 2011; Badiane 2011).

Data used

Time series and cross-country data are available in the public domain from international organizations including FAO, World Bank, Asian Development Bank (ADB), etc. This makes analysis of structural transformation more feasible today than in the days of Kuznets and Chenery. Yet, there are huge differences in the concepts used by different international organizations, related to seemingly similar issues such as labour employed in agriculture. They raise major issues with regard to data accuracy and what they signify, as we discuss later. It is, however, important to stress that the data reported by international organizations come from governments of developing countries. Data quality and capacity to generate high quality data vary greatly among countries. Improving data quality requires working with governments and other stakeholders. Notwithstanding data problems, analysis such as this helps to identify data weaknesses and improve information and data.

Brazil, Indonesia, China and India are of interest for reasons of their scale, significant roles in the world food and agricultural markets, and contribution to global economic growth. Yet, they are different in their resource endowments and agroecological systems, diversity of political systems, size of internal markets, and institutional choices and capacities. Together, they had a third of the world's population in 1960, and now contain 43 per cent. They represent a quarter of the global GDP on purchasing power parity terms, with China alone representing 16 per cent. Together, they represent 32 per cent of the global area harvested for cereals and produce 36.7 per cent of the global cereal production. In recent years they have some of the fastest growing economies and are members of the G20 (i.e., Group of Twenty: Argentina, Australia, Brazil, Canada, China, France, Germany, India, Indonesia, Italy, Japan, South Korea, Mexico, Russia, Saudi Arabia, South Africa, Turkey, the United Kingdom and the United States, along with the European Union [EU]). Consistent with the regions in which they are located, their initial "structural" conditions are different in terms of dualism, and political and administrative institutions. India has been the only democracy since gaining political independence. Brazil and Indonesia became democratic in the 1990s, and China has increasingly decentralized its system and begun to tolerate dissent within limits, albeit under a single party rule.

Land short China and India have been trading with land abundant Brazil and Indonesia in soybeans, palm oil, livestock, sugar and ethanol (Figure 2; also see Annex 3: Statistics on structural features of the countries, Table 6).

Figure 2: Palm oil import by India & China and export by Indonesia (tonnes) (1961-2010)

Source: FAOSTAT.

Past international comparative analysis

Past analysts provide a useful set of hypotheses to test in the new context. In his pioneering exploration of the character and causes of long-term changes in the secular level and trends of inter-sectoral income inequalities, Kuznets noted growing income inequalities between the agricultural and non-agricultural sectors at early stages of industrialization in the now industrialized countries, i.e., the US, UK and Germany (Kuzets 1955,1966). However, he noted that once the early turbulent phases of industrialization and urbanization had passed, a variety of forces converged to bolster the economic position of the lower income groups within the urban population as the major offset to the widening of income inequality associated with the shift from agriculture to the non-agricultural sector. Kuznets attributed this outcome to a combination of factors: public policy (progressive taxation), changing patterns of savings and investment (even between the old rich and the new entrepreneurial class), and the nature of technical change. He also noted, largely based on inductive analysis, how the eventual intra-sectoral income distribution, e.g., within agriculture and within the urban sector, will depend on the "initial" income distribution. Countries with large populations in agriculture are likely to have more equal distribution of income within agriculture to start with than those without, and this will affect subsequent patterns of growth, a particularly useful insight from the perspective of the performance of Latin America, compared with Asia presented later.

Chenery and Syrquin (1975) made a major contribution to defining the characterization of transformation and the factors explaining differing patterns. W. Arthur Lewis and the economists that followed him concluded that in a closed economy, industrialization is dependent upon agricultural improvement (Lewis 1954; & Johnston and Mellor 1961). Lewis argued that it is not profitable to produce a growing volume of manufactures unless agricultural production is growing simultaneously to meet the growing urban food demand. “This is also why industrial and agrarian revolutions always go together, and why an economy in which agriculture is stagnant does not show industrial development. We must either postulate that the subsistence sector is increasing its output, or else conclude that the expansion of the capitalist sector will be brought to an end through adverse terms of trade eating into profits” (Lewis 1954, 433). In an extension of his closed model, He foresaw contemporary debates, noting that, in situations of free flow of factors of production, labour should typically be expected to migrate from labour surplus to labour short countries. However, vested interests, he argued, particularly the resistance of organized labour, will likely prevent international labour migration, and therefore, capital is more likely to move to labour surplus economies. To this must now be added the rising food demand in land short countries, leading to an impetus for land acquisition in land surplus countries or the need to trade, the slow growth of demand in the mature industrial countries, and the need for developing countries to explore developing country markets.

Johnston and Mellor described agriculture’s contribution to a successful transformation through a combination of factors, including food, labour, savings and investment, and demand for goods and services in the process of urbanization and industrialization, in short, the multiplier effects of agricultural growth. By showing labour and food as separate but interacting markets, through a formal model, Lele and Mellor demonstrated the effects of the nature of distributive bias of technical change in the agricultural sector on labour supply and inter-sectorial terms of trade, and thus, on the pace and pattern of growth of employment in the non-agricultural sector (Lele and Mellor 1981). A labour-intensive strategy in agriculture will increase employment, generate rural demand and growth linkages, leading to multiplier effects of agricultural growth, but will contribute less to the growth of the marketed surplus of food due to higher income elasticities of demand for food among labouring classes. Hence, a labour-intensive technical change in agriculture will not keep non-agricultural wages and prices down. The reverse would be true when there is a distributive bias in agricultural technology, i.e., less employment creation in agriculture, leading to greater growth of marketed food supply helping to keep wages and prices lower than they would otherwise be in the non-agricultural sector.[3] These findings are pertinent to the transformation processes of the agricultural and rural sectors.

Section II: Analysis of structural transformation

Our analysis of data for 109 countries over the 1980-2009 period for developed and developing countries involved several types of analysis.

- Regressions for the entire sample of 109 developed and developing countries.
- Regressions for only 88 developing countries.
- Regressions for developing countries within each region to understand neighborhood patterns.
- The performance of the four large countries in each of the above three contexts: (1) developed and developing countries, (2) developing countries only, and (3) country performance in the context of regional performance.

Our specification used a combination of Chenery-Taylor/ Chenery-Syrquin and Timmer and Akkus models that allow for many different types of behaviour. Using the quadratic form allows

3 In cross-country analysis Christiansen et al. (2011) recently empirically confirmed the arguments of Lewis. Johnston and Mellor think that agriculture is significantly more effective in reducing poverty, up to 3.2 times better at reducing $1-day headcount poverty in low-income and resource-rich countries, but non-agriculture has the edge in dealing with the better off poor (reflected in the $2-day measure). The larger participation of poorer households in growth from agriculture more than compensates for the slower growth of the sector.

accelerating or decelerating increase or decrease in an initial increase followed by a decrease, or a decrease followed by an increase. The Chenery-Syrquin specification allows for initial stagnation - a low level trap - followed by accelerating increase and then decelerating increase and stagnation and other very non-linear patterns. The form also allows the share of agriculture to settle somewhere above zero. Chenery-Taylor and Chenery-Syrquin models did not use inter-sectoral terms of trade as an explanatory variable, as did Timmer-Akkus model. On the other hand, Timmer-Akkus did not use population, as did Chenery-Syrquin models. We used both the variables, terms of trade and population. Chenery–Syrquin had used five year dummies while Timmer-Akkus used annual dummies. We have conducted analysis using two alternative methods, year dummies and decadal dummies. Year dummies capture short-term changes in policies, institutions etc. Decadal dummies capture long-term changes in institutions, technology, infrastructure, etc., which are unlikely to be captured in year dummies. We have also introduced dummies for three regions, Asia, Latin America and Caribbean (LAC) and sub-Saharan Africa (SSA) to understand the characteristics of the specific regions in explaining outcomes, e.g., the structural inequality in Latin America, land pressure and intensive agriculture in Asia, and land surplus extensive agriculture in Africa (Annex 1 discusses the similarities and differences between ours and Timmer and Akkus's analysis).

This specification is:

$$X = a + b. \text{Ln } Y + c. (\text{Ln } Y)\ \hat{}2 + d. \text{Ln Pop} + e. (\text{Ln Pop})\ \hat{}2 + f. \text{TOT}$$

where TOT, the terms of trade, is the deflator for value-added in agriculture divided by the deflator for non-agriculture. Y is per capita income and Pop is population. X, the dependent variable in different equations represents share of value added in agriculture in GDP, share of employment in agriculture to total employment, value added in agriculture in 2000 US dollars and value added per worker in agriculture, and the difference between agriculture's share in value-added and agriculture's share in employment.

We first ran the regressions for 109 (developed and developing) countries. Furthermore, given the large difference between developed and developing countries, even at the start of the period of analysis in 1980, we also conducted an analysis of 88 developing countries and disaggregated it further by regions to understand their specific regional behaviour. Results of regressions for the 109 countries using annual dummies are in Table 1, and those for 88 developing countries in Table 2. There is relatively little difference between estimates based on the use of decadal and annual dummies, except in a few key areas discussed later.

Table 1: Regression result for the 109 developed and developing countries using regional dummies and annual dummies

	Agriculture share in				
	VA	Employment	VA in Agriculture	VA/L	Agriculture share in VA minus Agriculture share in employment
Constant	1.95*	1.83*	3.15*	5.6*	0.16*
Ln Y	-0.39*	-0.27*	0.416*	-0.037	-0.125*
(Ln Y)^2	0.02*	0.01*	-0.0046	0.053*	0.01*
Ln P	-0.009*	-0.01*	0.97*	0.03*	0.004*
(Ln P)^2	-0.001*	0.003*	0.009*	-0.02*	-0.004*
TOT	0.05*	-0.008	-0.32*	-0.35*	0.05*
d1 Asian countries	.002	.084*	.093*	-.338*	-.08*
d2 LAC countries	-.005	-.014	-.082*	-.206*	.01

d3 SSA countries	-.051*	.162*	-.414*	-.992*	-.21*
R2	0.84	0.81	0.97	0.92	0.52

* Significant at 1 per cent; ** significant at 5 per cent.

Table 2: Regression result for the 88 developing countries using regional dummies and annual dummies

	Agriculture share in				
	VA	Employment	VA in Agriculture	VA/L	Agriculture share in VA minus Agriculture share in employment
Constant	1.95*	2.29*	1.9*	2.08*	-0.34*
Ln Y	-0.39*	-0.415*	0.79*	1.04*	0.0213
(Ln Y)^2	0.02*	0.021*	-0.034*	-0.03*	-0.0015
Ln P	-0.01*	-0.01*	0.95*	0.01	0.0001
(Ln P)^2	-0.001*	0.003*	-0.003**	-0.02*	-0.003*
TOT	0.06*	-0.01	-0.3*	-0.28*	0.07*
d1 Asian countries	-.001	0.1*	0.08*	-0.36*	-0.1*
d2 LAC countries	-.004	-0.03*	0.04	-0.05	0.03**
d3 SSA countries	-.05*	0.16*	-0.34*	-0.93*	-0.22*
R2	0.79	0.73	0.97	0.84	0.4

* Significant at 1 per cent; **significant at 5 per cent.

Key conclusions

As previous studies of structural transformation have noted, the share of value added and share of employment in agriculture declines with per capita income (Figures 3 and 4) while the share of value added in agriculture falls at a declining rate. (The squared income term is positive whereas the linear term is negative). Similarly, the share of agriculture in employment falls at a decelerating rate. (The squared income term is positive whereas the linear term is negative).

Figure 3: Declining share of agriculture value added with respect to per capita income (109 developed and developing countries and 88 developing countries) (1980-2009)

Figure 4: Declining share of agricultural employment with respect to per capita income (109 developed and developing countries and 88 developing countries) (1980-2009)

Total value added in agriculture and value added per worker (a measure of labour productivity) increases with per capita income (Figures 5 and 6). However, if only the 88 developing countries are considered, rather than 109 countries including developed countries, the r2's[4] are slightly lower. Dispersion from the mean is greater in these trends because of greater variability among developing countries. Whereas the total value added in agriculture and per worker value added increase at increasing rates, if all the 109 countries are considered, the total value added and per worker value added in agriculture increase at a declining rate for the 88 developing countries.

4 The linear term is negative but not significant at the 1 per cent level and the squared income term, which is positive, dominates the behaviour at very low levels of income.

Figure 5: Total agriculture value added with respect to per capita income (109 developed and developing countries and 88 developing countries) (1980-2009)

Figure 6: Per worker agriculture value added with respect to per capita income (109 developed and developing countries and 88 developing countries) (1980-2009)

Turning points

The gap between the value added in agriculture and share of employment in agriculture reflects the differences between per worker incomes in the two sectors and is important for the process of convergence in incomes between them. In the equations presented above, when regressions are fitted to 109 countries, difference between the share of value added in agriculture and share of employment in agriculture, i.e., the so-called gap, narrows over time with an r2 of 0.52 with all the variables in the equation being significant at 1 per cent level. When all 109 countries are included in the regression, the gap first becomes more negative as income increases, enhancing the duality between the agriculture and non-agricultural sectors. Later, it tapers off.

Here we see a very sharp difference, however, when the regression is fitted only to 88 developing countries. In this regression equation there is no convergence in the gap between agriculture's share in the value added and share in employment with respect to income (Figure 7). The r2 is very low and the turning point is not reached until per capita income reaches a very high level (Figure 7). Besides, in the regression result for 88 countries in Table 2, only the population square and TOT variables are significant coefficients. Coefficients for per capita income, income square and population are not significant. We will return to these issues when we examine turning point results for different regions of the world.

Figure 7: Difference between the share of value added in agriculture and share of employment in agriculture (109 developed and developing countries and 88 developing countries) (1980-2009)

Figures 3 to 8 are constructed by using regional dummies with annual dummies. In Figure 8 we have followed the 109 countries' equation because the coefficient of income and income squared terms are not significant for the 88 developing countries (only significant for 109 countries), and there is no convergence in the gap between agriculture's share in the value added and share in employment with respect to income in the 88 countries' regression equation. The r2 is low and the turning point is not reached until per capita income reaches a very high level.

Figure 8: Difference between the share of value added in agriculture and share of employment in agriculture (Asia-19 countries, LAC-24 countries and SSA-38 countries) (1980-2009)

Incomes at which turning points are reached

Next, using country dummies, we estimated average per capita income at which turning points are reached in the four countries, assuming that they will follow the same average pattern demonstrated by the 109 developed and developing countries, or the 88 developing countries. Furthermore, we make this analysis for groups of countries in a region, e.g., 19 Asian and the remaining non-Asian countries (as did Timmer and Akkus). In addition we made this analysis for the 38 developing countries in sub-Saharan Africa and 24 developing countries in Latin America. In each case we make this analysis using decadal dummies, as well as using annual dummies (the latter to compare our results with those of Timmer and Akkus). Detailed results are presented in Annex 1.

The per capita income at which the turning point is reached turns out to be much higher if both developed and developing countries are included than if only the developing countries are included (Table 3). This result is explained by the fact that there are basically two clusters of data. One is for the developing countries, which have much lower per capita income and larger share of agriculture in value added and in employment with the agricultural employment share being greater than the value added in agriculture. The second cluster is of data for the developed countries, which is to the south east of the data cluster for the developing countries, as the developed countries, have much higher per capita income and a lower share of agriculture in value added and employment. This means that when the developed countries, are included in the sample, the regression equation is more to the right in terms of the x-axis and so the turning point occurs at a higher level of income. The time dummies are negative so that the gap meaning the difference between the share of agriculture in value-added and employment is larger, and the turning point will occur at a higher level of income. So, over time the turning point is becoming greater. These results are consistent with those obtained by Timmer and Akkus, as we explain in Annex 1.

Furthermore, if only the Asian countries are considered, the per capita income at which the turning point is reached is considerably lower than if all developing countries or developing and developed countries are considered. Again, these results are consistent with those obtained by Timmer–Akkus. But, as Binswanger and D'Souza (2011) note, the turning points are unstable (see Annex 1).

Table 3: Estimates of average per capita income at which turning points are reached

Our estimates Using decade dummies—[ydum1(1980-1989) and ydum2 (1990-1999)]					
Region	**Ln Y**	**(Ln Y)^2**	**R^2**	**Turning point of Ln GDP pc**	**Turning point of GDPpc (constant 2000 US$)**
109 countries (88 developing countries+21 developed countries)	-0.44	0.03	0.95	8.61	$5469
88 developing countries	-0.52	0.03	0.94	8.25	$3824
Asia (19 developing countries)	-0.78	0.05	0.94	7.43	$1681
SSA (38 developing countries)	-0.4	0.02	0.91	10.4	$32934
LAC (24 developing countries)	-0.12	0.01	0.92	8.36	$4272
Non-Asian countries (88 countries—69 developing+19 developed)	-0.41	0.02	0.95	9.21	$10046
4 countries (Brazil+ China+ India+ Indonesia)	-0.58	0.04	0.99	7.31	$1488

When we used annual dummies like Timmer and Akkus, we obtain extraordinarily high levels of income at which turning points are reached for non-Asian countries and for sub-Saharan Africa. This is perhaps due to collinearity among income and annual dummies, as explained in the Annex 1.

Number of years to reach a turning point

The number of years a country takes to reach the turning point is shown below[5] (Table 4). Years taken to reach the turning point depend on per capita income in 2010 and the growth rate of the per capita income (Tables 5 and 6).

Table 4: Number of years countries take to reach the turning point (Brazil, China, India and Indonesia)

Number of years to reach turning point

Decade dummies

Country	2004-08 growth rate	2009-10 growth rate
Brazil	Already there	
China	4	5
India	23	21
Indonesia	27	29

5 Following Timmer, using the regression equation for the gap presented at the beginning of this section and using the sample of 88 countries, we calculated the turning point. Differentiating the gap with respect to log of per capita income, setting the first derivative equal to zero and solving for log of per capita income, the turning point calculated is a per capita income of $3,824 in US 2000 dollars. Taking the per capita income in the four countries in 2010 in 2000 US dollars, we then calculated the number of years it would take each country to reach the turning point level of income. We use two different growth rates: the average annual growth in the period 2004-08 and for the period 2009-10.

Table 5: GDP per capita growth (annual per cent) (2004-2010) (Brazil, China, India and Indonesia)

Country	Indicator	2004	2005	2006	2007	2008	2004-08	2009	2010	2009-10
Brazil	GDP per capita growth (annual %)	4.42	1.99	2.87	5.06	4.21	3.71	-1.52	6.55	2.52
China	GDP per capita growth (annual %)	9.45	10.65	12.07	13.61	9.04	10.96	8.65	9.83	9.24
India	GDP per capita growth (annual %)	6.74	7.84	7.77	8.36	3.54	6.85	7.65	7.36	7.51
Indonesia	GDP per capita growth (annual %)	3.74	4.44	4.3	5.18	4.89	4.51	3.49	5.02	4.25

Table 6: GDP per capita (constant 2000 US$) in 2010 (Brazil, China, India and Indonesia)

Country	Indicator	2010
Brazil	GDP per capita (constant 2000 US$)	$4699.39993
China	GDP per capita (constant 2000 US$)	$2425.47218
India	GDP per capita (constant 2000 US$)	$822.763238
Indonesia	GDP per capita (constant 2000 US$)	$1143.82705

The turning point for SSA is not reached in the range for which we have data. Further, per capita income has a greater effect than population in all structural changes, with the notable exception of value added in agriculture.

These differences are potentially of relevance to what is happening to the labour markets within and across regions and globally, an issue to which we now turn.

Differences in behaviour among regions and countries

The lack of definite behaviour among all 88 developing countries with respect to the gap equation as regards income is explained by the different behaviour among regions. Value added per worker in agriculture falls relative to non-agriculture in Asia (Figure 9.2), but it increases in all other developing regions, developed and developing countries alike. Yet, this similarity hides important differences among regions. In five regions, (namely, East Asia, South Asia, industrial countries, LAC and SSA) value added per worker rises in agriculture; and value added per worker in non-agriculture also rises in East and South Asia as well, as in the industrial countries, i.e., labour productivity rises. But it falls in LAC and SSA.

Further analysis of per worker value added in agriculture and non-agriculture reveals substantial differences in the behaviour of the current developing countries from the historical pattern. They show substantial differences among developing regions, and depending on the behaviour of the regions in which they are located, among countries across different regions. Thus, for example, there are considerable differences between Brazil, on the one hand, and China, India and Indonesia, on the other. Inter-sectoral duality has increased sharply in China and it increased in Indonesia, too, until 1997 when the Asian financial crisis slowed its growth. Value added per worker in non-agriculture increased less steeply in India than in China, but it declined throughout the 1980-2009 period in Brazil (Figure 9.1). Countries display patterns similar to those in the regions in which they are located. Thus, fall in the value added per worker in agriculture relative to that in non-agriculture is sharp in East Asia relative to South Asia (Figure 9.2). This means inter-sectoral duality has been increasing in East Asia more rapidly than in South Asia.

The finding of China retaining more labour in agriculture than the regression predicts led to a number of hypotheses and questions when the results were presented in various seminars in China and at the World Bank. These are discussed later in this study. It is also noteworthy that the ADB's data on employment in agriculture differ significantly for all Asian countries, compared with those of FAO. However, those data are not available for the entire period we covered in this analysis and do not change the conclusions, although they do change the extent of inter-sectoral disparities (see below).

Figure 9.1: Ratio of value added per worker (non-agriculture/ agriculture) (Brazil, China, India, and Indonesia) (1980-2009)

Source: *WDI and Global Development Finance, World Bank and FAOSTAT 2011.*

Figure 9.2: Ratio of value added per worker (non-agriculture/ agriculture) by region (1980-2009)

Source: *WDI & Global Development Finance, World Bank and FAOSTAT 2011.*

Decline in duality between agriculture and non-agriculture in LAC is not only because productivity is increasing in agriculture but because it is falling in the non-agricultural sector. In LAC the ratio of value added between the two sectors decreases as value added per worker in non-agriculture falls by over a quarter, while it increases in agriculture by 87 per cent. These findings are consistent with studies of Brazil that suggest that its recent overall growth has been driven by growth in the agricultural sector. Agricultural exports are booming, but those in the manufacturing sector are lagging (Contini et al. 2010). However, the service sector is growing.

An increase in the gap in Asia, on the other hand, is accompanied by fast increases in per worker value added in both non-agriculture and agriculture, especially in East Asia. Value added per worker in non-agriculture relative to agriculture more than doubled there (Figure 9.2).

Relative value added per worker in the non-agricultural sector in South Asia increased only by about 60 per cent, while in agriculture it also increased by the same percentage, the similarity between the two numbers being accidental. These results are consistent with the evidence on agricultural land productivity and total factor productivity presented in the following sections.

Although the outcome is the same in SSA as in Latin America, the situation in SSA is more worrisome than in LAC in terms of overall performance. There was a sharper fall in non-agricultural value added per worker, i.e., by 30 per cent and only a small rise in value added per worker in agriculture, i.e., of only 20 per cent. Land productivity and agricultural TFP growth has also been slower in SSA than in South Asia, but it is a subject of exploration of another paper.

Some hypotheses of causes of behavioral differences among regions and countries

Role of distributive bias of agricultural technology, factor efficiency and factor productivity

We argued in Section I that the nature of technology, i.e., the factor bias in agriculture determines labour share and income distribution within agriculture and labour transfers to the non-agricultural sector. Regression results do not throw light on within sector distribution, but nevertheless shed interesting light on these issues. China and Brazil each behave differently than predicted by the regression analysis of 109 countries (see Annex 2 for details of the econometric/regression analysis). Regressions suggest that China's agriculture is losing labour more slowly than the regression equation predicts. Its share of agricultural employment in total employment started out at the highest level (73.8 per cent) among the four countries in 1980, and declined to only 60 per cent, with the labour share in agriculture remaining the highest among the four countries using FAO data (FAOSTAT 2011) (Figure 9.3). FAO data refer to those employed in agriculture as well as those seeking employment. ADB data, on the other hand, only included those employed and is less. The difference would reflect unemployment and it seems to be increasing from the data. (See Figures 10a, 10b and 10c below). Brazil's agriculture, on the other hand, is shedding labour much more rapidly than predicted (Figure 9.3).

Figure 9.3: Agricultural employment share residuals (Brazil, China, India and Indonesia) (1980-2009)

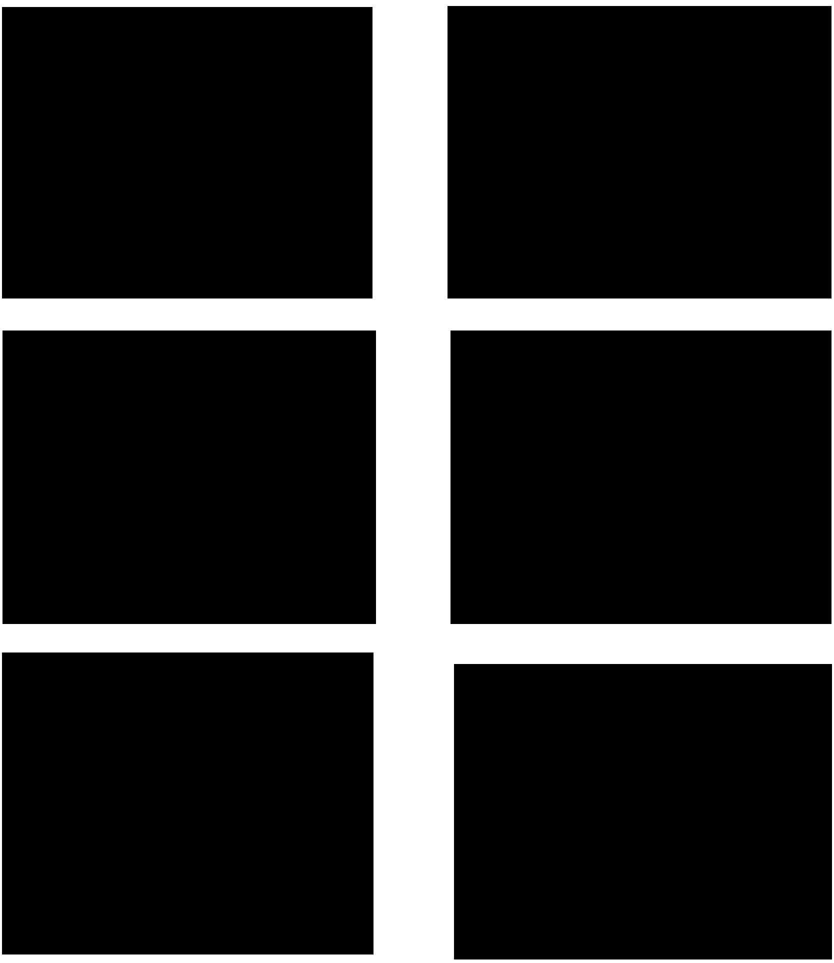
Source: *FAOSTAT*.

Brazil's share of labour in agriculture was the lowest in 1980 and declined most rapidly. The analysis of transformation using sectoral shares does not get into the impact of acute dualism in agriculture on technology choices and scale economies or poverty reduction through TFP growth, issues discussed in the following sections.

Decline in labour shares in Indonesia and India was consistent with that predicted by the model using FAO data. These results depend on what the labour data signify.

The definition of employment of an economically active population, used by ADB, shows a lower initial share of labour in agriculture and its faster decline (Figures 10a, 10b & 10c). We will return to this issue of the behaviour of employment in agriculture, some possible reasons for differences in reporting and their implications for outcome and policy drivers that might explain the outcomes.

Figures 10a, 10b & 10c: Total labour force in agriculture (million) and percentage of agricultural labour in total labour force (1994-2011) by ADB and FAOSTAT (China, India and Indonesia)



Source: FAOSTAT and ADB's Key Indicators for Asia and the Pacific 2012--http://www.adb.org/publications/key-indicators-asia-and-pacific-2012. Note: For China--data are not available for the year 2011, and for India data are available only for the years 1994, 2000, 2005, and 2009 from ADB.

Role of inter-sectoral terms of trade

Relative terms of trade moved sharply against agriculture in Brazil over time, as in most other regions, whereas agricultural terms of trade improved relative to non-agriculture in China and the improvement has been particularly significant since 2000 (Figure 11). Christiansen noted that subsidization has dramatically increased in China (Christiansen 2011). Moreover these differences in inter-sectoral terms of trade reflect broader regional trends (Figure 12).

Figure 11: Terms of trade (Deflator for Agriculture/Deflator for Non-Agriculture [Industry + Service], in US$) (Brazil, China, India, and Indonesia) (1980-2009)

Source: *WDI and Global Development Finance, World Bank.*

Figure 12: Terms of trade (Deflator for Agriculture/Deflator for Non-Agriculture [Industry + Service], in US$) by region (1980-2009)

Source: *WDI and Global Development Finance, World Bank.*

The behaviour of terms of trade of agriculture relative to non-agriculture often reflects a combination of public policy, particularly in the form of price supports and market interventions in the agricultural sector, and movement in relative outputs prompted by technological change and supply response to relative prices.

Over time, relative terms of trade have moved against agriculture in all regions other than Asia (Figure 12) but for different reasons. In industrialized countries the shift seems to have been a result of some reduction in agricultural price support although overall they remain high; in Brazil, as in Latin America, it is due to a reduction in credit subsidies and opening up agricultural trade to global competition; and, in SSA, it is due to a combination of structural adjustment leading to alignment of overvalued exchange rates and liberalization of economic policies and markets. Inter-sectoral terms of trade, on the other hand, have moved far more in favour of agriculture in Asia, particularly since 2000. Whereas the trends are clear, the direction of causality between terms of trade and labour shares in agriculture seems less clear. Timmer (2009, 27) argued in an earlier analysis that the "Asian countries were able to use agricultural terms of trade as a policy instrument for keeping labour employed in agriculture, a pattern not seen in the rest of the countries in the sample," perhaps because of the importance of rice in Asian agriculture and, hence, in determining terms of trade. Asian countries provided more price incentives to their agricultural sectors during 1960-2000 period, as a way to prevent the movement of labour out of agriculture from being "too fast". Certainly the pattern of movements in the agricultural terms of trade for the two sets of countries was strikingly different until 2000 (the end of Timmer's period of analysis) with Asian countries seeing a long-run relative decline at half the pace of the non-Asian countries' terms of trade. During the 2000–2009 period (which this analysis covers), the relative terms of trade have moved even more sharply in favour of agriculture in Asia, and more so in East Asia than in South Asia. These favourable terms of trade effects have occurred even though East Asia pursued a relatively more open food trade policy than South Asia. Shares of net imports in total availability were higher, levels of protection as measured by agricultural tariffs were lower and had declined well below World Trade Organization's (WTO) required levels.[6] Subsidization (and protection), however, has dramatically increased, resulting in a nominal protection rate of 17 per cent of gross farm receipts (Christriaensen 2011). The relative terms of trade increase in favour of agriculture in China, and East Asia suggests that, as non-agricultural output per worker increased faster than agricultural output per worker, its effective demand for agriculture from non-

6 Brazilians attribute their agricultural success at least in part to the growth of markets in East Asia (Contini et al. 2010).

agriculture must have outpaced growth of output.[7] As a part of the stimulus, Asian governments have also enhanced their safety nets and transfer programmes in the rural sector since the financial crisis. The movement of inter-sectoral terms of trade has tended to counter the movement of output per worker and so has tended to leave inter-sectoral nominal incomes less unequal than they would otherwise be.

There is, however, a difference even within Asia in the behaviour of East and South Asia with regard to the terms of trade. South Asia experienced slower growth in both sectors and, therefore, has not seen as big terms of trade effect as East Asia, as we will demonstrate subsequently, although by some measures agriculture lost labour in East Asia whereas employment increased in agriculture in South Asia. The moderate movement in TOT in South Asia in agriculture has occurred despite slower agricultural growth and lesser dependence on food imports, and may be explained by slower growth in effective demand for food, as reflected in the large incidence of hunger. However, the Chinese data on labour in agriculture and migration have been questioned by some writers. Our interviews in China and comments on the earlier draft of this study suggest that Chinese data may over-report labour engaged in agriculture, as workers claim to remain in rural areas for lack of permits to migrate to the urban sector while actually living in urban areas and engaged in part-time farming and circulator migration.[8] Others have suggested that the hukou system, as well as the land tenure system, have kept farmers tied to the lands much longer (Christiaensen 2011).

Some studies of agricultural TFP growth in China reported in Section IV suggest considerable loss of labour from agriculture, leading to rising agricultural wages. The extent of urban

7 A large share of growth in soybeans in Brazil is due to growth of imports by China. Furthermore, International Food Policy Research Institute (IFPRI) reports increased use of grain for domestic ethanol production in China (2011 Global Food Policy Report, IFPRI 2012).

8 Personal communication with Gregory Ingram, and Joyce Man of the Lincoln Institute of Land Policy.

migration is a highly region-specific phenomenon, as will be discussed later.[9] It is worth stressing that within-country differences in these trends in all four countries are substantial, beyond these broad national trends. These are explored later.

The total value added in agriculture has increased rapidly in China and then in Brazil, as compared with the predicted values. Brazil had a lower share of value added in agriculture than predicted in the beginning of the 1980s but now has a much larger share than predicted. Residuals are positive in China. Indonesia also had a smaller share for much of the period but has now caught up with the average for all countries (Figure 13).

Figure 13: Agricultural value added share residuals (Brazil, China, India, and Indonesia) (1980-2009)

Source: *WDI and Global Development Finance, World Bank.*

9 Rada and Fuglie (2011) made the same observation about FAO labour data in the case of Indonesia as discussed later in this study. Hazell et al. (2011), on the other hand, argued that in the case of South Asia FAO labour data may understate employment in agriculture since it measures only the direct employment in farming. How these findings translate into conclusions about employment in agriculture and agriculture's growth linkages clearly is an area needing more empirical work. Not only does it affect measurement of total factor productivity, as discussed here, but also implications for policy and priorities.

In per capita terms there is a sharp difference between Brazil and Asian countries. Despite an impressive growth in the total value added in agriculture in China (Figure 14), the per capita value added has increased little because of the large amount of labour in agriculture and its continued relatively high share in agriculture (Figure 9.3). This is in contrast with Brazil, which has seen a rapid increase in per capita value added in agriculture.

Figure 14: Agricultural value added per worker (constant 2000 US$) (Brazil, China, India, and Indonesia) (1980-2009)

Source: *WDI and Global Development Finance, World Bank and FAOSTAT 2011.*

India's share of value added in agriculture has been consistently close to that predicted for its per capita GDP and population. Agriculture's share in employment has fallen more slowly here than in China and is also smaller than predicted, so that the residuals are becoming progressively large and positive.

Figure 15: Agriculture value added share minus agricultural employment share residuals (Brazil, China, India, and Indonesia) (1980-2009)

Source: *WDI and Global Development Finance, World Bank and FAOSTAT 2011.*

Taking into account the five processes of structural transformation listed at the outset of this study, India is clearly behind China and Indonesia in the process of transformation. It has the highest share of agricultural value added in GDP among the three countries, a higher share of labour force in agriculture than Indonesia but lower than China, the lowest valued added per worker, and lower total value added in agriculture than China, though higher than Indonesia.

It also has the highest birth and death rates among the three Asian countries. In view of the fact that China's agricultural employment figures, as reported by FAO (and provided by China to FAO) are questioned by some thinkers as over-reporting for various reasons, its share of employment in agriculture may be lower, per worker value added higher, etc. Other evidence supports this contention, which places China at an even higher stage of structural transformation than India.

Value added per worker for China has steadily fallen lower than the predicted value, and the residuals have become larger and negative (per worker value added is smaller than predicted), while for Brazil, they have become positive, namely, per worker value added is larger than predicted. For India and Indonesia the residuals of value added per worker were positive in the initial years but have recently become negative.

In Brazil value added in agriculture increased even in the face of the decline in TOT, reflecting a rapid increase in efficiency of agriculture. The average story in Brazil masks the acute inequality in land distribution and the differential distribution of growth, however, discussed later.

China's TOT increased substantially in favour of agriculture, but increased weakly in India and have remained constant in the case of Indonesia.

Indian TOT would have moved more in favour of agriculture, much like China's, had growth been more inclusive and had effective demand for food increased more rapidly. India's MDG indicators have been well behind China's or Indonesia's, even in those goals where they have shown improvements. The incidence of undernutrition and child malnutrition is high, notwithstanding an increase in per capita income. Deaton and Dreze (2009 and 2010) noted the "Indian Enigma" as also the downward "drift" in the relation between calorie intake and per capita expenditure, it being sufficiently pronounced to drive down average calorie consumption, especially in rural India, in spite of some increase in real per capita expenditure. They offer a number of possible reasons for it, including changes in relative prices, demographic patterns, food habits and calorie requirements. They also acknowledge the possibility that the decline in average calorie consumption might actually be driven by rising poverty, hidden in the National Sample Survey (NSS) data by faulty price indexes. Another possible explanation offered by N. C. Saxena is that the higher income elasticities of demand for food for the labouring class, assumed in the two sector models discussed earlier, and the demand projections (Rosegrant et al. 2001; Bhalla et al. 1999) have not materialized because of alternate demands on household incomes, such as schooling of children, transport and mobile phones (personal communication with Saxena), or that agriculture has not created enough employment to generate sufficient increase in per capita income to move TOTs more in favour of agriculture, a phenomenon which has been changing in recent years, particularly with the establishment of the National Rural Employment Scheme. There is currently a debate on the effect of Mahatma Gandhi National Rural Employment Guarantee Act (NREGA) on wages and demand for food. Both Chand et al. (2011) and this study note upward trend in agricultural ToTs relative to non-agriculture in India from 2009 to 2011.

Some overarching issues raised by analysis of structural transformation

Role of factor markets

In the now industrialized countries, the gap in labour productivities narrowed, not just because rural and urban labour markets were integrated but because all factor markets tend to be more integrated, enabling a combination of increased efficiency and more rapid technical change. Property rights with respect to land are well established, and an active land market results in land consolidation, leading to increased agricultural efficiency, particularly during periods of recession. Convergence in productivity is faster among states in the US, for example, during recessions because technical innovation is embodied in capital equipment so that investment, capital markets and cost-reducing measures during periods of low demand are important (Fuglie et al. 2012). Land markets are important when, during a recession, inefficient enterprises that do not successfully cut costs go out of business in agriculture. This implies that labour would be shed and land consolidation increase efficiency in agriculture. The Latin American region is closer to developed countries in terms of overall development, i.e., per capita income, degree of urbanization, farm size and scale of economies in agriculture in the modern agricultural sector. In both industrialized countries and Latin America, the share of labour in agriculture and the extent of labour movement required to narrow earnings gaps were relatively small, both in absolute and relative terms. The land market is more developed and has contributed to scale economies and decline in labour share, although there is also considerable low end poverty in agriculture as in the north-east and north of Brazil. However, large farms dominate in the south-west (where average farm size is six times the national) and to a lesser extent south where technical change has been shifting the production frontier outward (Gasquez et al. 2012). In the north and north-east, production growth has occurred through improved extension, agricultural diversification out of traditional crops and livestock.

According to the 2006 Agricultural Census, family farms accounted for 84 per cent of the farm establishments in Brazil but only 24 per cent of the area of all farms and 38 per cent of the value of agricultural production. The 1995-96 Censuses indicated that poverty rates were 36 percentage points higher for family farms relative to non-family farms in north-east Brazil where 50 per cent of the family farms are located.[10] In the other macro regions nationwide, this gap ranged from 15 to 26 percentage points. When

10 According to the legal definition, family farms must (1) have less than four fiscal units (modulos fiscais) of total land; (2) primarily utilize household labour; (3) have family income derived principally from own farm; and, (4) manage their own farm establishment. Fiscal units in Brazil vary from as small as 5 ha in the south to as large as 110 ha in the centre-west.

one compares farms of the same size, non-family farms uniformly have higher land productivity, a result of a more intensive use of inputs and access to capital through own or credit markets. Those farms have also higher incomes due to the importance of non-farm income, compared with the poor family farms in the north-east where farming income dominates (Helfand and Moreira 2012). This phenomenon of economies of scale due to new technology has been noted by Deininger and Byerlee in the case of Argentina (Deininger and Byerlee 2011).

In Asia while labour markets are well developed, land and capital markets are not. The example of East Asian countries shows that even the historically unprecedented rapid growth in non-agricultural employment in the urban sector may be insufficient to absorb more labour in the non-agricultural sector for factor productivities to equalize for a long time. During periods of recession (as in the case of the Asian Crisis or the recent global financial crisis), labour has tended to return to agriculture in Indonesia and China. Furthermore, non-transparent land sales are already leading to widespread social conflicts in China and India, and on a smaller scale in Indonesia. This suggests that a wide variety of economy-wide policies are needed to increase productivity of land and people making a living in that sector.

Movement in Gini coefficients

In an effort to “triangulate” the results of the transformation analysis from other independent sources of evidence, the authors examined evidence from movements in the Gini coefficients, changes in inequality in rural and urban areas each and relative movement in income between the urban and rural areas. Brazil had the most acute disparity in income distribution with a Gini coefficient of .574 in 1981. It increased to .625 by the end of the 1980s, i.e., income distribution worsened. Owing to public policies such as various forms of cash transfers, a la Bolsa Familia, the Gini had declined to .539 in 2009 despite the fact that agriculture appears not to have generated much employment for the poor (Table 7).

Table 7: Gini co-efficient (Brazil, China, India and Indonesia)

Year	1981	1989	1993	1997	2004	2009*
Brazil	0.574	0.625	0.595	0.593	0.564	0.539
Year	1978	1988	1998	2006		
China	0.304	0.346	0.403	0.462		
Year	1983	1987/88	1993/94	1999/2000	2005*	
India	0.325	0.329	0.325	0.32	0.368	
Year	1969/70	1978	1987	1996	2009*	
Indonesia	0.35	0.38	0.32	0.36	0.368	

Source: *Ferreira et al. 2006; Pal & Ghosh 2007; Chen et al. 2010; Asra 2000; and GDI and Global Development Finance, World Bank. * is from WDI 2011.*

Gini coefficients for China, India or Indonesia were much lower and closer together at the end of the 1970s with China having the most equal distribution of income, 0.304. Equivalent coefficients for India and Indonesia were .32 and .35, respectively. Unlike Brazil whose Gini coefficient has declined from a high level, those of China, India and Indonesia have increased. China's has increased the most to .46, and their land reform programmes designed to break the power of traditional village elite, recruit new village leaders from among the peasants and distribute wealth (especially land) from the elite to the poor were, in retrospect, important, although at the time were violent aspects of the Communist Revolution. Market-based reforms in Brazil, in contrast, have made only a small dent on the overall land distribution or even on poverty. Introduction of the household responsibility system in 1979 is credited with productivity growth since the 1980s. It reallocated collective agricultural land to individual rural households, giving them relative autonomy over land use decisions and crop selection. The impact of the institutional reform had eroded in a decade and productivity slowed until China adopted a host of agricultural policies, including particularly investment in research, infrastructure and power, which explain its extraordinary agricultural growth performance. How land distribution will take place, as the market for leasing land evolves, remains to be seen.

Changes in the national levels reflect more the changing disparity between the rural and urban sectors than the changing inequality within each of the sectors (Chen et al. 2010). For instance, for China the contribution of rural inequality to overall inequality, according to Chen et al. (2010), has been decreasing and that of urban inequality increasing. Inequality between urban and rural areas contributes about 60 per cent of the overall inequality (Chen et al. 2010). In the case of Indonesia, there has been a little change in relative per worker productivity and the Gini is relatively constant for rural, urban and total populations.

In Brazil per worker output in non-agriculture was almost eight times the level in agriculture, and this ratio has declined three times, which may have contributed to the decline in the Gini that has been observed rather than the reduction of inequality within agriculture beyond the greater use of distributive safety nets such as Bolsa Familia (Higgins 2011).

In India, too, there has been little change in the rural or urban Gini (Pal and Ghosh 2007; Ghosh 2010). The urban Gini is higher than the rural one. Per worker output with increasing gap in favour of non-agriculture seems to be the cause behind the increase in inequality in recent years.

Going forward, India’s rural population by 2020 is projected by the UN (UN 2012) to be 916.9 million, compared with China’s 635.3 million and Indonesia’s 136.2 million - a far larger population increase due to higher population growth rate, in turn, due to lesser progress on MDGs, with the result that the pressure on resources will be greater going forward. The policy implications are explored in Section III.

Section III: Land productivity

Why should we care about agricultural land productivity?

As in the case of labour productivity, behaviour of land productivity is of interest in any study of agricultural productivity for at least ten reasons.

1. India, China and the island of Java have already reached the end of their extensive margin. Increasing land productivity is the only way for them to increase their domestic production. Indonesian expansion of agriculture in the outer islands to tree crops to meet global demand has been an issue of global debates, as has the expansion of agriculture in the Amazon and the cerrados in Brazil (Lele et al. 2000). Brazil and Indonesia have had the largest loss of tropical forests and been largest emitters of forest carbon. Brazil's rate of forest loss has declined in the post-2000 year. China and India have gained forest cover, especially China.

2. Land productivity can be increased either by (1) increasing yields per ha per crop, (2) multiple cropping on the same land, (3) shifting from low to high value activities, (4) increasing the efficiency of organization of existing activities to increase sustainability of the land and water resources. Studies of TFP reviewed in the section that follows suggest that these factors have been at play in TFP growth in various countries; but with a focus on agriculture not all costs and benefits have been measured through full accounting, e.g., growth of trees on farmlands that FAO and others have reported. Their costs and benefits, e.g., in terms of improvement in soil quality, watersheds, fuel wood and carbon

sequestration are not measured in TFP studies, in part, because data and measurement pose challenges.

3. Whereas the inverse relationship between farm size and productivity has been well established in the literature, as discussed in Section II, this consensus is beginning to break down with new technology, i.e., hybrids, information technology, precision farming, tractors, access to finance with possibilities of vertical integration from production, marketing, processing, etc. Even in poorer areas large farms are able to overcome institutional failures more effectively than small farms (Helfand and Moreira 2012). This phenomenon is renewing an age-old debate about the merit of small vs large farming. In SSA where foreign direct investment in land has increased, the debate is particularly animated (Deininger and Byerlee 2011). In Brazil the government has declared its determination to strengthen the enforcement of existing land laws.

4. Whereas large farms can raise land productivity and tend to have a strong political constituency, creating sufficient on- and off-farm employment and income for small and marginal farmers remains the primary policy challenge throughout the developing world. Expanding safety nets has been a socio-politically expedient way to cushion those who have not benefited from development efforts and have been affected by the food and financial crises. The administrative efficiency, effectiveness of targeting, fiscal sustainability and implications of safety nets for long-term growth, however, remain challenges in both the developed and developing world.

5. Most of the past increase in production in Asia has come from the expansion of irrigation, which allowed multiple cropping, increased productivity and employment, but now is leading to new environmental pressures. Yields per hectare have been three to five times as high on irrigated lands, as those in rain-fed farming, depending on the areas and crops. They have created substantial

on- and off-farm employment (Kerr 1996), but the scope for further expansion of irrigation is limited. China has been far more effective in exploiting its hydrological potential than India (Chellaney 2011). Future growth in both countries must come from increasing irrigation efficiency, and water and soil conservation. Groundwater exploitation has reached unsustainable levels and salinity has become a major issue. These system-level challenges are far more complex to tackle biophysically and socio-politically than the traditional Green Revolution approaches of dependence on high-yielding varieties. Many involve transboundary issues, both internally and regionally. They call for the kind of nested organizational and institutional arrangements at multiple levels, which Ostrom promotes but which are more difficult to establish in countries with weak democratic systems of governance, such as the one that exists in India, than they are in a more authoritarian unitary system of government in China-although the example of Gujarat has shown that it is possible to undertake effective integrated water resource management if there is a political will (Shah and Lele 2011).

6. Incorporating environmental costs, such as water charges, pesticide run-offs or deforestation, not only change the cost-benefit of crop production but often entail high economic and socio-political costs. Besides, once introduced, subsidies are difficult to withdraw.

7. Not only do production conditions tend to be more favourable in irrigated (and better watered) areas, but those areas typically receive priority in the placement of physical and social infrastructure. Together the presence of infrastructure, access to markets and timely availability of inputs tend to have a strong positive relationship with factor productivity (Lele 1971; Binswanger 1978; Binswanger et al. 1993; Subbarao 1985).

8. Poverty tends to be greater in rain-fed areas than in irrigated areas and, hence, in a policy context becomes a regional development issue.

9. Yield gap, i.e., actual yields per hectare relative to the yield potential, can be an important measure of agricultural performance, as well as a potential guide to future public policy and investment decisions of private actors.

10. Globally, cereal yields are plateauing except for maize. Productivity of producers who are operating at the technological frontier can only be increased by more investment in basic and strategic research. Producers operating at well below the technological frontier require applied and adaptive research, farmer access to information and knowledge, and effectively delivered services to ensure farmers' access to inputs, credit and markets to achieve technical change.

11. Careful intra- and inter-country comparisons of yield performance and underlying causes of differential performance can help derive lessons on whether to import technology, add value through value chains, or trade within and across the national and regional borders.

12. By influencing profitability, a combination of technological possibilities, investments and policies are causing huge regional and global shifts in cropping patterns and land use changes with global impacts on climate change, biodiversity and poverty, and leading to global attention to the macro issues of land ownership, acquisition and productivity.

Agricultural lands and their uses

India contained 18 per cent of the global population, 13.5 per cent of global cereal area harvested and a little less than 10 per cent of the global cereal production in 2010. Among the four countries of our focus, India and China have had comparable areas under cereals, although vastly different in shares of agricultural areas, because much of China's agricultural lands are grasslands. At about 92 million hectares in 1961, India's cereal acreage had increased to 104 million hectares in 1980, before declining slightly to 97 million hectares in 2009. By comparison, China had 91 million hectares in 1961, and it had only slightly diminished to 89 million hectares in 2009.[11] In Brazil the area increased until 1987 to 23.5 million hectares from 11.2 million hectares in 1961, but had fallen to 20 million hectares in 2009. Indonesia's area under cereals has nearly doubled since 1961, from 9.3 million hectares to 17.4 million hectare (FAOSTAT 2011).

Rice, wheat and maize dominate in China with only a small role for other cereals; in Indonesia nearly three-quarters of the area is under rice with the remaining quarter under maize. Of the total area under cereals, India had a more diversified portfolio. Rice, wheat and maize occupied only 60 per cent of the area in 1961, with numerous other cereals playing a role. The share of these other cereals has diminished in importance from 40 per cent to 20 per cent, but crops such as barley, millets and sorghum are still important for the poor (FAOSTAT 2011). Rice has dominated the traditional policy and political economy focus in Indonesia; rice, wheat and maize in China; rice and wheat in India; and sugar, rice, beans, soybeans and livestock in Brazil.

11 As shares of total agricultural areas, India's area had increased from about 50 per cent to 60 per cent of the total agricultural area declining to 54 per cent by 2009. For China, on the other hand, it declined from 26.4 per cent in 1961 to only 17 per cent of the total agricultural area in 2009 (FAOSTAT 2011).

According to FAOSTAT- Agricultural area: this category is the sum of areas under (a) arable land - land under temporary agricultural crops (multiple-cropped areas are counted only once), temporary meadows for mowing or pasture, land under market and kitchen gardens and land temporarily fallow (less than five years). The abandoned land resulting from shifting cultivation is not included in this category. Data for "arable land" are not meant to indicate the amount of land that is potentially cultivable; (b) permanent crops - land cultivated with long-term crops, which do not have to be replanted for several years (such as cocoa and coffee); land under trees and shrubs producing flowers such as roses and jasmine; and nurseries (except those for forest trees that should be classified under "forest"); and (c) permanent meadows and pastures - land used permanently (five years or more) to grow herbaceous forage crops, either cultivated or growing wild (wild prairie or grazing land). Data are expressed in 1000 hectares. Source: FAO Statistics Division.

Role of irrigation

At about 26 million hectares in 1961, India's total area under irrigation was almost half the irrigated area of China's 45.2 million hectares but has increased to 66.7 million hectares and now exceeds China's 64.5 million (FAOSTAT 2011). The major problem with India's area under irrigation is that much of it does not get water, though shown under irrigation. This affects cropping intensity. These issues are discussed in Lele et al. (2013). Although the fastest growth in irrigation has occurred in Brazil, it is from a small base of half a million hectares in 1961 to 4.5 million in 2009. Indonesia had 3.9 million hectares in 1961 and increased to 6.7 million hectares in 2009. Together, they have each only about 10 per cent or less of the irrigated areas in China and India. Surface irrigation management, excessive groundwater exploitation and measures to improve water use efficiency in agriculture are issues that are not captured in the studies of TFP growth, but which influence land productivity.

Measures of partial productivity growth trends

Yield levels and differences in yield growth across Brazil, China, India, and Indonesia: 1961-2011

With a few exceptions, yield levels per hectare were the lowest in India in 1961 and remain so until today. The exceptions were wheat, sugarcane, fruits and vegetables where India ranked the highest and second highest, respectively, and maize where Indian yields were the third highest among the four countries.

The fastest cereal yield growth over the 1961-2010 period was in China, followed by Indonesia. China has surpassed India in wheat yields, with India ranking second, and Brazil had almost caught up to Indian yields, whereas they were almost 40 per cent lower in 1961. In sugar, India continued to have the second highest yields. Although India experienced some growth in coarse grain yields, the gap between its yield level and that of the other three countries had widened substantially by the end of the period. Growth in the yield of oil crops in Indonesia far exceeded growth in other countries, and the gap between Indonesia and other countries increased. Pulse yields, too, were the highest in China, followed by India and Brazil. The gap in per ha pulse yield levels between China and Indonesia, on the one hand, and India, on the other, had increased.

Cassava was one of the few exceptions. India's yields increased substantially and surpassed those of all other countries, followed by Indonesia. In maize, China surpassed others in yield growth, followed by Indonesia, Brazil and India. While India's maize yields also increased, the gap with others has increased. The same is true for rice. Only Brazil's yields were lower and have now caught up with India's, leading to huge gaps vis-à-vis China and Indonesia.

Again, India's soya yields are the lowest and the gap is widening. Its sugarcane yields have been growing, but the growth seems to have been dropping off relative to China and Brazil. Fruit yields have been growing, but yield levels are lower than Brazil's for the whole period, 1961-2010. Vegetable yield, too is lower than China's or Brazil's.

In fruits and vegetables and in maize, also, yields in India grew relatively slowly. In Brazil, except for soybeans and sugarcane, yields grew faster in the post-1981 years than in the period 1961-1980. Our ranking of countries by yield levels in 1961 and 2010 and in yield growth in two the periods (1961-2010 and 1980-2010) is given in Table 8.

India ranked the lowest in yield levels in 1961 in most crops grown, with the exception of wheat where it ranked first and sugarcane, where it ranked second. In fruits and vegetables, yield data would seem to be suspect due to the heterogeneity of the products and low level of attention to collection of statistics about them in most countries until recently.

India's yield growth for the entire 1961-2010 period was the slowest, except in cereals where its ranking had improved from number four to number three, and wheat where it ranked second to China, losing its first rank in yield level in 1961.

Yield growth in the 1981-2010 period was better, suggesting a momentum from the Green Revolution, rather than when the entire 1961-2010 period is considered. Yields were still the lowest with a few exceptions, e.g., cassava where India ranked first in yield growth, its ranking improved to second in yield growth in rice and to third in wheat, maize and coarse grains, fruits and vegetables.

As a result, yield levels continued to remain the lowest in the case of most crops except in cassava where its ranking improved to one, sugarcane where its ranking improved to number two, and sorghum, fruits and vegetables where it improved to number three.

Table 8: Yield (hg/ha), yield growth rate (per cent per year) and rankings of Brazil, China, India, and Indonesia (1960-2010)

Countries	Item	Yield (hg/ha) (1961)	Rank in 1961	Yield (hg/ha) (2010)	Rank in 2010	Yield growth rate (%) (1961-2010)	Rank (1961-2010)	Yield growth rate (%) (1980-2010)	Rank (1980-2010)
Brazil	Cereals, total	13463	2	40554	3	2.35	4	3.17	1
China	Cereals, total	12110	3	55206	1	2.86	1	1.72	3
India	Cereals, total	9473	4	25366	4	2.41	3	2.17	2
Indonesia	Cereals, total	15417	1	48757	2	2.47	2	1.31	4
Brazil	Rice, paddy	16989	3	41736	3	2.30	1	3.68	1
China	Rice, paddy	20787	1	65482	1	2.11	3	1.15	3
India	Rice, paddy	15419	4	32644	4	1.91	4	1.71	2
Indonesia	Rice, paddy	17623	2	50144	2	2.25	2	0.95	4
Brazil	Wheat	5330	3	27730	3	2.66	3	2.66	1
China	Wheat	5591	2	47485	1	3.93	1	2.38	2
India	Wheat	8507	1	28299	2	2.74	2	1.92	3
Indonesia	Wheat	N.A.	_	N.A.	_	N.A.	_	N.A.	_
Brazil	Maize	13123	1	43747	3	2.49	3	3.15	2
China	Maize	11848	2	54598	1	3.01	2	1.71	4
India	Maize	9567	3	19582	4	1.81	4	2.18	3
Indonesia	Maize	9273	4	44324	2	3.30	1	3.40	1
Brazil	Coarse grains, total	13050	1	42346	3	2.41	3	3.03	2
China	Coarse grains, total	10318	2	51787	1	3.35	1	2.14	4
India	Coarse grain, total	5129	4	12373	4	1.96	4	2.24	3
Indonesia	Coarse grains, total	9273	3	44324	2	3.30	2	3.40	1
Brazil	Oil crops primary + (total)	1782	2	5408	3	2.66	3	2.89	2
China	Oil crops primary + (total)	1347	3	5890	2	2.79	2	2.17	3
India	Oil crops primary + (total)	1321	4	2748	4	1.70	4	1.71	4

Indonesia	Oil crops primary + (total)	4849	1	28304	1	3.83	1	5.25	1
Brazil	Oil seeds, nes	N.A.	_	N.A.	_	N.A.	_	N.A.	_
China	Oil seeds, nes	N.A.	_	N.A.	_	N.A.	_	N.A.	_
India	Oil seeds, nes	2096	_	2650	_	1.03	_	0.35	_
Indonesia	Oil seeds, nes	N.A.	_	N.A.	_	N.A.	_	N.A.	_
Brazil	Pulses, total	6681	3	9217	3	0.60	3	2.83	1
China	Pulses, total	8760	2	15834	1	1.26	1	0.91	3
India	Pulses, total	5401	4	6539	4	0.74	2	0.99	2
Indonesia	Pulses, total	11074	1	11266	2	-0.12	4	-0.83	4
Brazil	Sorghum	25000	1	23315	2	-0.38	3	0.69	3
China	Sorghum	9267	2	31722	1	2.86	1	1.20	1
India	Sorghum	4400	3	9100	3	1.36	2	0.91	2
Indonesia	Sorghum	N.A.	_	N.A.	_	N.A.	_	N.A.	_
Brazil	Soybeans	11269	1	29416	1	2.13	1	1.99	1
China	Soybeans	6260	3	17711	2	1.88	3	1.35	4
India	Soybeans	4545	4	10651	4	1.89	2	1.64	2
Indonesia	Soybeans	6821	2	13724	3	1.66	4	1.48	3
Brazil	Sugarcane	434477	3	791956	1	1.33	1	1.04	1
China	Sugarcane	424333	4	657459	3	1.15	2	0.82	2
India	Sugarcane	455868	2	661310	2	1.06	3	0.68	3
Indonesia	Sugarcane	1366400	1	630952	4	-1.95	4	-1.35	4
Brazil	Cassava	130732	1	137337	4	-0.03	4	0.70	3
China	Cassava	124005	2	168217	3	0.73	3	0.36	4
India	Cassava	71861	4	347555	1	2.44	1	2.42	1
Indonesia	Cassava	75707	3	202169	2	1.88	2	1.98	2
Brazil	Fruit excl. melons, Total	123961	1	160917	2	0.38	4	0.58	4
China	Fruit excl. melons, total	52275	4	107160	4	1.53	2	3.34	2
India	Fruit excl. melons, total	86320	2	123231	3	0.71	3	0.69	3
Indonesia	Fruit excl. melons, total	58544	3	224317	1	2.46	1	3.38	1
Brazil	Vegetables & melons, total	37792	3	222316	2	3.81	1	2.86	2
China	Vegetables & melons, total	102590	1	224763	1	1.41	4	1.33	4

India	Vegetables & melons, total	66449	2	138528	3	1.59	3	1.71	3
Indonesia	Vegetables & melons, total	36098	4	87789	4	2.30	2	3.39	1

Source: *FAOSTAT 2011; NA-Data is not available; and Not applicable.*

Production

With a few exceptions, in comparison of overall national production, India has done as well as the other three countries during the 1961-2010 period, e.g., cassava, where India's acreages are small relative to Brazil's and livestock where India's production growth has been impressive, but ranked third behind China and Indonesia in 1980-2010 (Figure 16 and Tables 9 and 10).

Figure 16 and Table 9: Growth rate of production, yield and area harvested for cereals (per cent per year) in Brazil, China, India, and Indonesia (1961-2010)

Countries	Item	Production growth rate (per cent)	Yield growth rate (per cent)	Area harvested growth rate (per cent)
Brazil	Cereals, total	3	2.35	0.65
China	Cereals, total	2.63	2.86	-0.23
India	Cereals, total	2.45	2.41	0.05
Indonesia	Cereals, total	3.58	2.47	1.12

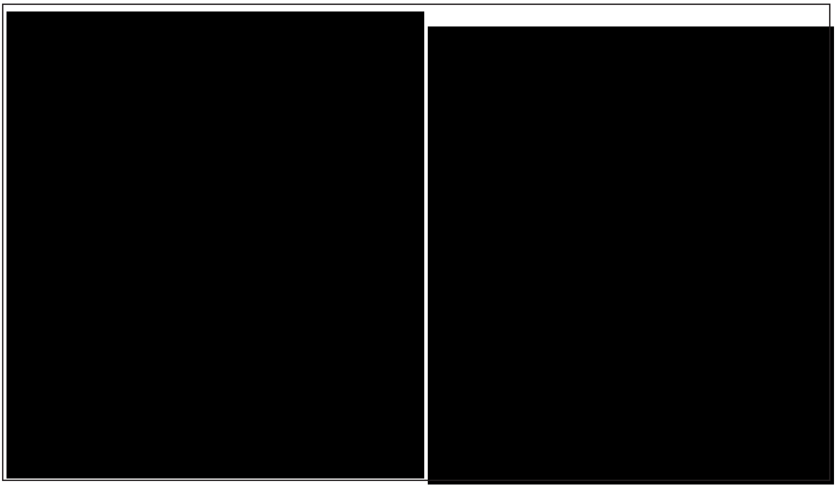
(Source: *FAOSTAT 2011*).

Changing global shares

The performance of yield levels and growth (Figures 17.1 and 17.2) was reflected in changing shares of global cereal production. China and India each had roughly similar areas under cereals and roughly similar annual shares of global production in 1961 (China's share was 12.5 per cent and India's, 10 per cent). By 2010 from the same land area and comparable areas under irrigation in both periods, China's share in global cereal production increased from 12.5 per cent to 20.4 per cent in 2010, whereas India's share had remained at about 10 per cent. In both countries almost all the cereal production growth came from growth in land productivity.[12]

12 There was a slight decline in the area under cereals in China (0.23 per cent per year), but a slight increase of 0.05 per cent per year growth rate in India.

Figures 17.1 & 17.2: Cereal yield level (hg/ha) and yield growths (1961=100) in Brazil, China, India, and Indonesia (1961-2010



Source: *FAOSTAT 2011*.

In the 1960-61 to 2010-11 period, per capita food grain production and total cereal production in India kept up with the burgeoning population. Increases in per capita total food grains and total cereal production, however, were modest, 0.014 tonnes per capita for total food grains and 0.028 tonnes per capita for total cereals. With the use of moving averages and different base and end year periods, one can obtain different estimates of production (see next). Growth has been insufficient to address the large incidence of poverty and hunger. Per capita coarse grain production, the staple food of the poor, declined at the rate of 1.28 per cent annually (Figure 18).

Figure 18: Food production per capita in India (tonnes per capita) (1960-61 to 2010-11)

Source: *FAOSTAT 2011*.

Table 10: Growth rate of production for total livestock primary (eggs primary + total meat + total milk) (per cent per year) in Brazil, China, India and Indonesia (1961-2010 and 1980-2010)

Countries	Item	Production growth rate (per cent) (1961-2010)	Production growth rate (per cent) (1980-2010)
Brazil	Total livestock primary (eggs + meat + milk)	4.05	4.06
China	Total livestock primary (eggs + meat + milk)	6.73	6.97
India	Total livestock primary (eggs + meat + milk)	4	4.07

Indonesia	Total livestock primary (eggs + meat + milk)	5.12	4.56

Source: *FAOSTAT 2011*.

Global debates on yield plateaus, slowing yield growth and yield gaps

There is evidence of yield plateaus for several major crops around the world, e.g., in Korea and China for rice, wheat in northwest Europe and India, maize in China and even for irrigated maize in the US (World Bank 2007; Cassman 2011). A recent study of Rice in the Global Economy also concluded that yield growth for rice has slowed from a peak of 3.3 per cent in 1976-85 (vs population growth of 1.7 per cent) to 0.7 per cent in 1998-2007 (vs population growth of 1.2 per cent) (IRRI 2011). The supply-demand model for rice in the global study indicates that yield growth of 1.4 per cent per year will be needed to compensate for expected area decline in rice and keep its prices at affordable levels ($300/t of milled rice) to around 2020. Global consumption of rice will be likely to stabilize by 2020. At the same time, an FAO report (2009) concluded that, as we have seen in the previous section, the potential to raise crop yields (even with existing technology) is considerable, provided appropriate socio-economic incentives are in place. We demonstrated that, in the short and medium term for India, there are ample 'bridgeable' gaps in yield difference between agro-ecologically attainable and actual yields that could be filled. Without the necessary incentives, however, the rates of yield increase of <1.5 per cent are not fast enough to meet expected demand on existing farmland (FAOSTAT 2011).

A more in-depth comparative study will be needed to establish the technological frontiers crop by crop and their implications for strategic sustained investment in "technology capital", i.e., research, education, human capital, and institutional and physical infrastructure that constitute this capital, the details of which are discussed in the section on TFP growth. India has been rapidly falling behind in technology capital, relative to China and Brazil, and in some cases, e.g., in tree crops, also behind Indonesia.

Possible underlying causes of yield gaps

Findings of the TFP studies discussed in the section that follows report the proximate causes. They are useful but not sufficient to provide insights into specific policy implications. The authors' observations based on consultations with a number of scientists, experts in the national agricultural systems of the four countries, CGIAR Centres and the United States Department of Agriculture (USDA) led to the collection of evidence on the possible underlying causes of yield gaps for India. Comparable data across countries are not available for many of these variables. Factors listed below should receive more attention in policy research, both at the national and cross-country levels by international organizations, CGIAR Centres and through South-South collaboration by the national governments of developing countries.

Investment in Indian agriculture

The most important underlying cause of low growth performance of Indian agriculture seems to be the behaviour of public and private investment. As a percentage share of agriculture and allied sector (public + private), the Gross Capital Formation (GCF) investment shows a strong declining trend since 1951 from a high of 23 per cent in the mid-1950s to a low of 7 per cent through much of the 1990s. Some writers may suggest that this may not be as harmful as it appears on the surface, because it was a declining share of a growing pie. Economy-wide, GCF as a share of GDP had increased from 24.2 per cent in 1990 to an impressive 36.5 per cent in 2009, and GCF was as low as 12.5 per cent in 1960 and 18.4 per cent in 1980. The GDP, too, was growing rapidly, particularly since 2000.

Yet, the share of public sector GCF in agriculture and allied sectors in total public sector GCF of the economy fluctuated considerably, too (Figure 19) and increased from 11.2 per cent to 15.6 per cent during the 1960-61 to 1980-81 period; the share of private sector GCF in agriculture and allied sectors in total private sector GCF of the economy increased from 14.3 per cent to 21.9 per cent during the 1960-61 to 1976-77 period.

Figure 19: Share of agriculture and allied sector in total GCF (per cent) in India (1950-51 to 2008-09)

Source: *Central Statistics Office (CSO), Ministry of Statistics and Programme Implementation. Government of India 2011*.

In the period of the Green Revolution (from 1967/8 to 1977/8), cereal production increased by 138 per cent, but it was also accompanied by an increase in the area under cereals reported earlier during this period (0.35 per cent per year). As the share of gross capital formation in agriculture and allied sectors declined from that exceptional Green Revolution period, so has cereal production growth slowed. If the growth rates are estimated from the trough year to trough year, or from peak year to peak year (Table 11) - in order to avoid bias in trends - they provide a more realistic picture of the deceleration growth, perhaps as yields have not been increasing rapidly enough and there has been little area expansion because of limited scope for it.

Table 11: Growth rate of total cereal production (rice + wheat + coarse cereals) in India

1964-65 to 1978-79 trough to trough	1964-65 to 1979-80 peak to peak	1979-80 to 2000-01 trough to trough	1979-80 to 2002-03 peak to peak
3.62	3.25	2.69	2.40

Source: Directorate of Economics and Statistics, Department of Agriculture and Cooperation, Ministry of Agriculture, GOI 2011.

Private investment in agriculture and need for regulatory reforms

Private investment share has begun to increase after reaching an all-time low in 1994-95, and public investment bottomed out only in 2007. Private investment in agriculture has increased even more rapidly than public investment in recent years. A more thorough empirical analysis of public and private investments is needed than could be achieved in this study. Nevertheless, the quality of public expenditure and regulatory environment accompanying private investment remain challenges in India. Thus, for example, some of the sharp increase in private investment would seem to include the growth of investment in tube wells by farm households. Yet, unchecked growth of groundwater exploitation has led to its sustainable levels, while area under surface irrigation has remained stagnant despite the rapid growth in irrigation investments (Shah and Lele 2011). The Planning Commission was aware of the history of an inadequate water investment strategy and quality of management in the water sector (Figure 26 on water management). Applicability of well-documented lessons of water management experience in

Gujarat through a multi-sectoral approach to other states (Shah et al. 2009) needs systematic exploration (Mukherji 2011). China appears to have had greater success in increasing water use efficiency in agriculture. That experience, too, needs a systematic exploration by collaboration between the two countries for potential lessons.

Agroclimatic conditions

More than half of Indian agriculture is dry land and rain-fed. Even though climate change risks in rain-fed agriculture are high and average yields tend to be lower, Kerr had shown that "…. the gap between the top 10% of farmers and the average farmers is almost as high [as in irrigated agriculture] as that between the average farm and the research station [suggesting] potentially high returns to helping the average farmer become more like the high performing farmer" (Kerr 1996, 70). Of course, much of the difference in yields may result from variations in soil conditions that cannot be overcome, but it is likely that variations in management are also important. This suggests scope for applied and adaptive research to close the yield gap under diverse conditions.

South Asia is expected to be particularly hard hit by climate change, together with sub-Saharan Africa and small island countries. Climate modeling is still at an early stage of development and depending on the models, assumptions with regard to the extent of mitigation effort and resources invested come to a wide range of outcomes. For example, with only 2 centigrade increases in temperature, India's yields could well decline by 30 to 40 per cent by 2050 from their current levels (Nelson et al. 2010; Cline 2011; Fischer 2009; Msangi and Rosegrant 2011). Extreme diversity on the ground with regard to soil, rainfall levels and variability, and most importantly, current and expected temperature changes, means that agriculture in different places would be affected differently and India needs to prepare for climate change on a war footing.

Coarse cereals such as pearl millet, finger millet and sorghum, traditionally crops of the poor, while declining in overall production occupy the bulk of the rain-fed areas and already have low yields. Maize yields are rising because of the introduction of single cross hybrids but are still lower than in other major maize-producing countries, and the situation calls for substantially more location-specific research, as well as comparative research with other countries having higher yields, to understand the reasons behind these differences. Some of the reasons cited by experts include the following.

Inadequate infrastructure development and supply of timely and quality inputs

Comparisons of infrastructure and attribution of productivity growth to market access require disaggregated data and analysis. There are enough differences between India and other countries, however, to warrant a study. China's surface area is 2.9 times that of India. India's national highway network increased from 31.7 thousand km in 1980-81 to 66.8 thousand km in 2007-08, and state highways increased from 94.4 thousand km in 1980-81 to 154.5 thousand km in 2007-08 (the latest year for which data were available). China had seven times the road network in 1980s, and the difference had increased by more than twentyfold to 38 (million km) by 2009. Expressways had increased from nil in 1980s to 65 thousand kms in 2009.

India's railways network was larger than China's in 1980-81 and increased from 61.2 thousand km in 1980-81 to 64 thousand km in 2009-10, with electrified railways increasing from 5.4 thousand km to 18.9 thousand km during this period. China's railway network of 53.3 thousand km in 1980s increased to 85.5 thousand km by 2009, and electrified railways from 1.7 thousand km in 1980s to 30.2 thousand km in 2009.

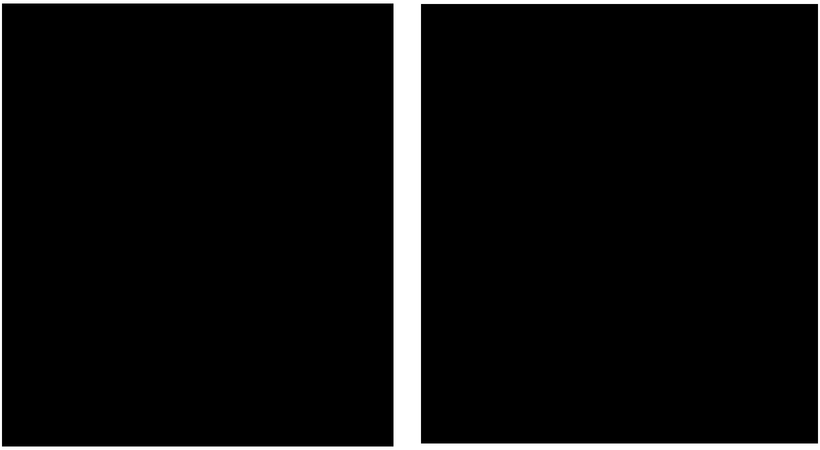
Figure 20: Changes in Road and Rail Networks in India and China (Thousand km) (1980-81 to 2010-11)

[redacted] [redacted]

Source: *Economy Survey 2011-2012, GOI and China Statistical Yearbook 2011*.

Despite the impressive performance of India's IT industry, comparisons with other countries suggest that India's use of internet connectivity and mobile phone use is lower (Figure 21). Besides, civil society organizations working in both countries suggest that the greater literacy in China and Indonesia allow transmission of extension in the form of text messages whereas in India, due to illiteracy of users, voice messaging is needed to develop content (conversation with Rajesh Tandon of the Society for Participatory Research in Asia [PRIA]).

Figure 21: Growth of internet and mobile cellular phone connectivity (per 1000 people) in Brazil, China, India, and Indonesia (1990-2010)



Source: *WDI and Global Development Finance, World Bank.*

Note: No bar means value is zero.

Eastern Uttar Pradesh and Bihar have huge potential for higher yields and under the new political regime in Bihar, policies are improving rapidly. The regions are still constrained, however, by inadequate infrastructure from decades of neglect of rural areas, leading to untimely delivery of poor quality seeds. These regions are also affected by multiple stresses and extreme weather events limiting yields. Hybrid rice is doing well in these states, as it provides significant yield advantage (1-2 t/ha) in the conditions of assured rainfall. Comparative data we analyzed by states on road density, electricity, etc., within India and China makes it clear that China and Indonesia have invested much more in rural roads and hydropower, and have higher levels of connectivity in terms of cell phones and access to internet.

Access to international agricultural technology

India benefitted the most from CGIAR during the Green Revolution and more recently from non-CG technologies such as Bt cotton, hybrid rice and hybrid maize. The private sector has been a major source of technology transfers in recent years and has the potential to grow substantially. Apart from the controversy surrounding GM technology in India, there is concern that it may be providing technology generated for the global market without sufficient investment in research in developing countries to address second generation problems with the technology, which is imported and disseminated. For private sector research to thrive will require a reliable policy environment.

India's public sector research overdue for real reforms

Despite many committees and commissions, there is a consensus among observers of the agricultural research scene, domestic and international alike, that the Indian research system has seen no real reforms in the way it functions. Paraphrasing many of those ideas, Suresh Babu stresses the need for a strategy to improve efficiency of resource use, increase dissemination of known technologies, enhance quality of human resources and commercialize technologies (Babu et al. 2013). Contrast with China and Brazil in public sector research now seems stark. Both have undertaken major reforms in incentives and moved ahead rapidly, China with great increase in research expenditure as well as in the development of its scientific cadre, laboratory investments and scientific research output, if recent assessments of China's scientific development and output are any indication (Conway et al. 2010). India is far behind China in its once premier human capital in agricultural research, which still performs at high levels in the CGIAR system, its publications and impacts. India's research expenditure and trained personnel seem to be falling behind China's. Recent increase in financial allocations will likely to be accompanied by fundamental changes in the organizational culture that rewards performance for research contributions to productivity growth. Agriculture, like water, being a state subject, seems to limit the ability of the central government to address these national issues confronting India.

Brazil's EMBRAPA, established in 1972 as a publicly funded national corporation, on the other hand, runs on corporate principles of hiring and performance assessment, combined with a high degree of public accountability for results and impacts (Alves 2011). Over the years it has developed an innovative and dynamic national agricultural research organization that is productive in technology generation and dissemination to commercial (including family) farms. It has been less successful in increasing incomes of family farmers who are not already in the commercial sector, e.g., in the north-east of Brazil, although productivity there has been increasing as discussed in the next section. By contrast, adaptive location-specific research in India has fallen behind, in no small part due to the poor state of agricultural research, quality of education and training, lack of incentive system for performance and inadequate involvement of stakeholders. To better understand these systems and their lessons, a programme of comparative research among the four countries should be developed.

Figure 22: Total spending on public agricultural R&D (1991-2008)

[redacted]

Source: *Agricultural Science and Technology Indicators (ASTI) as reported in Beintema and Stads 2011.*

Human capital, university research, education and training

India's once impressive agricultural university system (Lele and Goldsmith 1989) patterned after the US land grant system is in disarray. The state agricultural university system (which is the major source of education, training, research and extension) is facing multiple crises of governance, resources and ethics (Nene and Tamboli 2011). Post-secondary enrollment rate of students aged 18-23 years is only 18 per cent in India, compared with 41 per cent in US. The quality of Indian universities is not just poor but declining. Only around 130 out of 600 universities and 2,800 out of 30,000 colleges have received accreditation. More universities are created without paying attention to quality (Nene and Tamboli 2011). Tamboli, like many others, notes that all key stakeholders, including the Indian Council of Agricultural Research (ICAR), Vice-Chancellors (VCs), deans of universities and international organizations, are aware of the issues and challenges facing the higher education sector. The needed fundamental changes call for political will and commitment over a period of three to five years to take on the vested interests in the current system that are resistant to change.

Agricultural finance

All the four countries have agricultural finance systems in place. However, there are issues in each country regarding the efficacy of the agricultural credit system in servicing the needs of millions of small farmers. Despite a variety of policies and programmes, over 80 per cent of small and marginal farmers in Brazil, according to the 2006 survey, said that they do not have access to institutional finance. Most credit in China is provided by rural credit cooperatives rather than banks (Christiaensen 2011).

A comprehensive regulatory and supervisory framework that promotes competition and market environment for rural finance is needed, rather than subsidized credit that affects the financial viability of agricultural finance institutions. Despite the credit programme for small farmers in Indonesia being one of the world's largest programmes of its kind, there are doubts about its adequacy as well as financial sustainability. In India, there has been growth in credit to agriculture in recent years. Yet, V. Navin and Vijay Mahajan, the founder and chief executive officer (CEO) of Bhartiya Samruddhi Finance Ltd (BASIX), in a recent paper (2012) chronicle the problems of microfinance in India. Its extraordinarily rapid growth without training of staff, without qualitative changes in working processes in line with the quantitative growth and intense competition among self-help groups and microfinance institutions in states like Andhra Pradesh have reduced its effectiveness. Furthermore, while some states experienced rapid growth in microfinance, other states and areas lacked adequate financial services. Although greater clarity on the regulatory role of the Reserve Bank of India is now expected, with microfinance gaining legitimacy, along with closer monitoring of and the strengthened consumer protection norms for the sector towards responsible microfinance, a number of issues remain to be resolved. There are no empirical studies of the agricultural financial sector that address a variety of issues currently facing the sector, including adequacy of the current tools of microfinance and self-help groups to meet the agricultural financial needs of small farmers, issues of targeting, efficacy of different types of subsidies given on interest rates, credit administration, occasional massive debt remission and associated moral hazard problems, which plague the sector. Basically, the long-term impact of short-term, often politically driven, measures, particularly, on increasing agricultural productivity, are unknown. It is an area ripe for a well-conceived comparative study across countries.

International, regional and national "hands-on" partnerships in agricultural research:

Both Brazil and China have an overarching strategy and active international partnerships with countries of mutual research and teaching interest to continuously upgrade their research systems. Well described in Brazil's LABEX programme (i.e., to promote scientific and technological cooperation with other countries), EMBRAPA launched a program to set up virtual laboratories abroad, which aim to ensure EMBRAPA's physical presence outside of Brazil. The concept of virtual laboratory entails sharing laboratory space and infrastructure with partner institutions. While international technology is now an important source of growth, and India has an active private seed industry, there are concerns that the processes for approval of new innovations and biosafety of new technologies have lagged behind. While the necessary regulations are being put in place, building mutual trust among the diverse stakeholders, i.e., the government, private sector and civil society, seems to have a high priority to speed up the approval and transfer of technology processes in a transparent and efficient way, with clarity in the responsibilities and accountabilities for results from them.

International food trade

India has been a less open economy in food trade - the share of food imports in total production is lower compared with major countries, including Brazil, Indonesia (both major agricultural exporting countries) and China (Figure 23). Effective rates of protection have also been higher for agriculture in India, compared with other countries (Figure 24). India, like China, has become a major importer of edible oils (Figure 25).

Figure 23: Food imports as percentage share of domestic food supply in Brazil, China, India, and Indonesia (1961-2007)

Source: *FAOSTAT 2011*.

Note: Method of calculation: production + (imports - exports) + changes in stocks (decrease or increase) = supply for domestic utilization. There are various ways of defining supply and, in fact, various concepts are in use. The elements involved are production, imports, exports and changes in stocks (increase or decrease). There is no doubt that production, imports and stock changes (either decrease or increase in stocks) are genuine supply elements. Here food components are: 1. Cereals - excluding beer + (total), 2. Fruits - excluding wine + (total), 3. Oil crops + (total), 4. Pulses + (total), 5. Vegetables + (total), 6. Eggs + (total), 7. Fish, seafood + (total), 8. Meat + (total) and 9. Milk - excluding butter + (total).

Figure 24: Tariff rate (most favored nation), simple mean (primary products) (percentage) in Brazil, China, India, and Indonesia (1999-2009)

[redacted]

Source: *WDI and Global Development Finance, World Bank.*

Figure 25: Import quantity of fixed vegetable oils (tonnes) in Brazil, China, India, and Indonesia (1961-2009)

[redacted]

Source: *FAOSTAT 2011*.

Soil and water management

Several irrigated areas in India face problems of decline in soil quality and salinity from mono-cropping and absence of crop rotations.

Figure 26: Irrigation investment & irrigated area in India

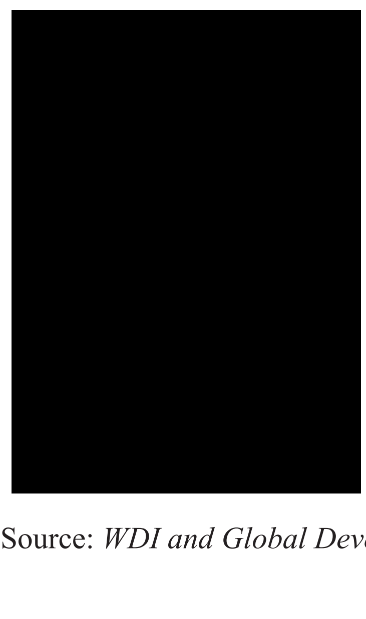
Source: *International Water Management Institute (IWMI) 2009.*

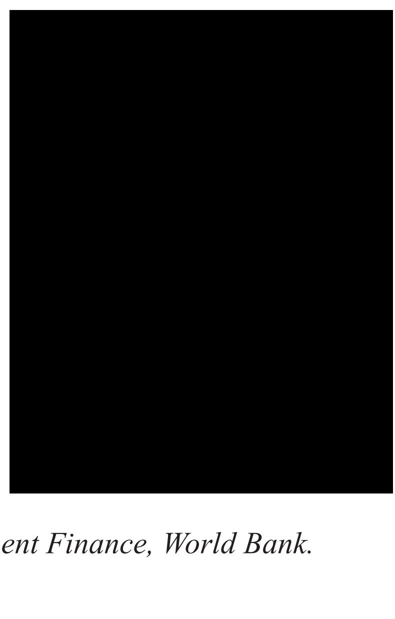
Rain-fed areas face issues of excessive groundwater exploitation. Increasing water use efficiency and effective management of watersheds at multiple scales will be the challenges of the future. China has more significant programmes and policies to improve soil and water management than India. Its unitary system of government enables it to conduct multi-level and multi-sectoral planning akin to landscape management. In agriculture, water withdrawal as a percentage of total national water withdrawal has declined from 92 per cent in 1990 to 91.5 per cent in 2000 in India and in China, from 83 per cent to 68.8 per cent, respectively (AQUASTAT, FAO 2011). India's increasingly decentralized system of government, a multi-party control of local, state and central governments and other forms of social fragmentation present challenges in developing resource management strategies which entail short- and long-term costs and benefits, private and social benefits and costs.

Energy use

There is a synergetic relationship between the use of water and energy in agriculture, which has become increasingly energy dependent. Both the supply and timeliness have been issues in India (Shah and Lele 2011). It is not possible to obtain data for energy use in agriculture in any of the four countries, but the rate of growth of energy production (oil equivalent) and net availability are a good proxy for their access to agricultural producers. Energy use per capita has been the lowest in India and highest in China, and again, the gap with other countries, particularly China and Indonesia, in per capita use is growing. Yet, China's energy efficiency in relation to the rise in income has increased sharply, as measured in elasticity of energy use with respect to GDP growth, which is consistent with the record of East Asia as a whole. Per capita energy use has declined sharply in relation to increase in per capita income, and this decline is the greatest in China and East Asia, among all regions of the world (Figure 27).

Figure 27: Energy use per $1000 GDP (constant 2005 PPP) (kg of oil equivalent) in Brazil, China, India, and Indonesia and by region (1980-2009)





Source: *WDI and Global Development Finance, World Bank.*

Section 4: Deconstructing agricultural factor productivity growth

Comparative evidence on productivity growth discussed in this section should be viewed from the perspectives of two key insights arising out of the analysis of 109 countries in the earlier section. First, structural transformation occurs through growth linkages emanating from the effects of productivity growth on cheaper food and through labour transfers from the expenditure patterns of small and increasingly commercially oriented farmers. These have been demonstrated over many years, and more recently, through formal modeling in several countries. Through productivity growth, farmers' expenditures facilitate value addition, savings and investments and growth of enterprise to meet the growing rural demand by processing farm commodities. In addition, they demand manufacturing goods and services, which also results in higher non-agricultural employment. An important result of our analysis in the previous section was that the 88 developing countries in our sample do not show the same patterns in the narrowing trend in the gap between the share of value added in agriculture and share of employment in agriculture with respect to changes in per capita income, as expected based on historical patterns. Different regions behave differently.

Evidence of total agricultural factor productivity growth

A complete accounting of growth in the form of total factor productivity, i.e., a measure of increase in output and all inputs can now help provide a better understanding of the future prospects for growth and steps needed to achieve it. Evenson and Fuglie (2010) and Fuglie (2011a and 2011b) produced, perhaps, the most comprehensive and comparable measures of TFP growth in agriculture for the world during the 1961- 2010 period, using FAO data based on output growth in global agriculture and disaggregated into resource-led and TFP components (Fuglie 2011a and 2011b). Their work follows the work of Avila and Evenson (2010) for an earlier period (1961-2001). We will show, through a review of existing evidence, that TFP growth rates vary depending on the data used, periods covered and methods used, and there is scope to improve their measurement in several ways. Nevertheless, their overall conclusions are worth summarizing to place the Indian agricultural growth performance in a global perspective and in view of other country-specific evidence, which follows these global comparative estimates. Despite wide variations in TFP growth rates across countries, they conclude that there is a tendency for convergence in several respects:

- Annual TFP growth rates have been increasing over time and are converging among major global regions.
- Agricultural productivity is now rising faster in developing countries as a group than in developed countries as a group.[13]

Productivity growth has been gradually replacing resource-led growth (i.e., growth in land, labour and physical capital) around the world. An increasing share of growth is explained by technical change. This would be a positive development for Asian countries, provided it helps to generate rapid employment and intensive growth in the non-agricultural sector, unlike the case of Brazil and Latin America we noted earlier. The accelerating rate of TFP growth in many developing countries is strongly correlated with their national capacities to develop and disseminate new agricultural technologies. Fuglie and Evenson concluded that "Technology capital" is the essential price of admission to a "growth club" (Evenson and Fuglie 2010). They measure technology capital as consisting of innovation-invention capacity and an index of technology mastery, the former in terms of the number of agricultural scientists in relation to cropland and industrial R&D, as a percentage of GDP, and the latter in terms of agricultural extension workers/cropland and average schooling of male workers (Figures 28 and 29). Measuring TFP growth in this way in 87 countries for two periods (1970-5 and 1990-5), they

13 Although they do not explore the larger issue, TFP growth evidence is consistent with the broad conclusion that overall economic growth is more rapid in developing countries as a whole, although not in all countries has agricultural growth been accompanied by rapid growth in value added or value added per worker in the non-agricultural sector, e.g., in Brazil.

show distinct differences in TFP growth among countries. China and Brazil show a substantial increase in TFP, followed by Indonesia, with India being a distant fourth in the recent period (Figure 30).

Figure 28: "Technology capital" as strongly correlated with agricultural TFP growth

[redacted]

Source: *Evenson & Fuglie 2010.*

Note: Bar height shows average TFP growth of countries with increasing technology capacities.

Figure 29: Slowing agricultural productivity growth

[redacted]

Source: *World Bank 2007.*

Note: Figure refers to developing countries only.

Figure 30: Agricultural TFP indexes growths (Brazil, China, India, and Indonesia) (1961-2009)

Source: *Fuglie Worksheet 2011c.*

Globally, the annual average growth rates were above 2 per cent in Brazil, China, North Africa (Morocco and Tunisia) and South Africa. They were between 1 per cent to 2 per cent in North America, India, Latin America (except Brazil), Japan and Australia. They were less than 1 per cent in SSA.

Among our four countries, per Fuglie's estimates, Indonesia's growth rate was higher until 1995 and has now fallen behind China's and Brazil's. This is consistent with a separate independent study of TFP growth of Indonesia using country data for it by Rada and Fuglie (2011), as reported below. India's TFP growth was slightly higher than China's until about 1982, i.e., the period of the Green Revolution. China seems to have taken off until about mid-1987, then tapered off until 1991, and thereafter took off again in a significant way, surging ahead of others. It shows that countries can decide to invest in productivity growth and make it happen. Brazil's TFP growth was slower than India's until 1991, but then China and Brazil surpassed India and even surpassed Indonesia, starting in 1994. India's TFP growth, while rising, is now showing an increasing gap with TFP growth in China, Brazil and Indonesia in that order (Figure 30). Fuglie's results are consistent with the evidence we provided earlier on slower yield growth in India relative to other countries, and other independent estimates on TFP growth estimates, presented later in this section.

A large body of evidence we reviewed on TFP in agriculture suggests that over the 1961 to 2010 period agricultural productivity increased more rapidly in China, Brazil and Indonesia than in India, whether measured in terms of value added per worker, land productivity or TFP.[14] India ranks in the second half of 58 countries whose increase in TFP was estimated separately by Fuglie and IFPRI, except for Fuglie's estimates for 1981-90, where India's rank was twenty-third (Table 12).

Table 12: TFP growth (per cent per year) by Fuglie and IFPRI (Nin-Pratt) and rank among 58 countries (India) (1981-2009)

Period	Fuglie	Rank (among 58 countries)	IFPRI	Rank (among 58 countries)
1981-90	1.367986	23	-0.24	43
1991-00	1.165128	42	0.33	42
2001-09	1.679155	31	-0.54	50

Source: *Fuglie Worksheet 2011 and Global Food Policy Report 2011, IFPRI.*

14 Although this was not a systematic exercise on measurement, there seems to be a greater body of scholarship on issues related to agricultural productivity growth in China and Brazil relative to India and Indonesia both by domestic and international scholars. Some of it is collaborative. It is a reflection of the extent of policy research conducted on the countries.

Note: 1. Fuglie used the Tornqvist-Theil Index -- Growth Accounting Method and 2. Nin-Pratt used the Malmquist Index -- Data Envelopment Analysis (DEA) Approach.

TFP growth measurement by countries

Beyond the work of Evenson and Fuglie (2010), and Avila and Evenson (2010), substantial literature on agricultural TFP growth has emerged, using different methodologies, data and time periods.

In addition to country studies, which are by far the most abundant for China and Brazil, there are also a number of comparative studies on China with India.[15] They overwhelmingly support the conclusions that China's agricultural productivity has increased more rapidly than India's and that its agricultural performance overall has been better, and (to a lesser extent) in Brazil, followed by Indonesia, then India. However, there are differences in estimates among studies and within countries across regions as discussed below.

Box 1: Methodologies used to measure total factor productivity

Approach	Estimation	Method	Main options	Measure
Non - frontier	Parametric	Production function	Cobb-Douglas, Translog, Constant Elasticity of Substitution (CES)	Productivity growth
	Non-parametric	Growth accounting	Discrete approximations, based on the various functional forms of production functions, such as, Cobb-Douglas, Translog, etc.	Productivity change
Frontier	Non-parametric	Data envelopment analysis (DEA)	Malmquist index based on distance functions	Productivity and efficiency change

15 It could be argued that the extent of analysis itself is an indication of the technology capital since it increases understanding of the location-specific analysis of sources and causes of growth or stagnation.

None of the TFP studies we reviewed measures or addresses any aspect of environmental impacts of land or resource use changes, either within or outside agriculture. China has gained by far the largest forest cover, a net increment of nearly 40 million hectares.

Total factor productivity growth in China

In their paper on National and Regional Growth Patterns, 1993-2005, Tong et al. (2011) illustrated the challenge in summarizing findings for China. They reported 13 studies of TFP growth for the recent period, using their stringent criterion, i.e., those that overlap their studied period and those that report annual TFP growth for every year for at least some part of that period. In addition, they report an extraordinarily large number of studies using a variety of methods, issues, periods and data sets.[16] They use two different approaches to the measurement of productivity growth: (1) stochastic and parametric, and (2) non-parametric and

16 McMillan et al. (1989) for 1978-1984 with focus on the effects of price increases and institutional reform introduced by the Household Responsibility System (HRS). Fan's (1991) frontier production function to separate agricultural growth into input growth, technical change, institutional reform, and efficiency change. Lin's (1992) fixed effects model is on provincial data to evaluate the effects of decollectivization, price adjustments and other factors on productivity growth. In a follow-up paper, Lin (1993) studied the efficiency of different systems and showed that household farms outperformed cooperative farms, which gave support for institutional reform in China. Lin (1995) examined rice production and tested the induced institutional innovation theory. Huang and Rozelle (1995), using 1952-1990 data, found environmental stress to be an important factor in reducing TFP growth after the mid-1980s. With 1990 data , it was found that environmental stress was an important factor in reducing TFP growth after the mid-1980s. (Spitzer's (1997) non-parametric index number approach to decompose Chinese TFP demonstrates the positive effect of technical change and negative effect of efficiency change during the period from 1985 to 1994. Zhang and Carter's (1997) Cobb-Douglas production function separates the contribution of inputs, weather and efficiency to the growth of grain production from 1980 to 1990. Zhang and Fan's (2001) generalized maximum entropy approach estimated a multi-output production technology for 25 provinces during 1979-1996. Jin et al. (2010) used a stochastic production frontier function approach to estimate the rate of change in TFP for 23 of China's main farm commodities. In addition, they reported studies of the role of market institutions and transaction costs on productivity. Rozelle et al. (1997) studied market integration after the implementation of liberalized economic policies in food markets. Rozelle et al. (1999) studied labour migration framework to model the effects of migration and remittances on agricultural productivity growth in China. De Brauw et al. (2000) examined how market liberalization influenced the behaviour of producers. Agricultural productivity growth based on

non-stochastic with the objective of identifying sensitivity to the choice of technique. Consistent with conclusions based on Fuglie's

data are from FAO in a multi-country context, including China. Coelli and Rao (2005), using a data envelopment analysis (DEA) approach to Malmquist indexes of TFP growth for many countries based on data from FAO for the period 1980-2000, found that agricultural TFP in China grew at an average yearly rate of 1.06 per cent during that period. Bravo-Ortega and Lederman (2004) also use FAO data to calculate agricultural TFP growth for China (among other countries) during the 1961-2000 period. They estimate a translog production function and calculate TFP as a residual. While they found that Chinese agricultural TFP grew 1.67 per cent per year in the period, they did not report annual figures of TFP growth after 1994. Ludena et al. (2007) constructed TFP indexes for Chinese agriculture based on a DEA directional distance function. Using data from FAO, they calculated an average agricultural TFP growth of 3.05 per cent per year for the period 1990-2000, consistent with Bravo-Ortega and Lederman (2004). Because these studies do not report yearly TFP growth estimates, they are not directly comparable with this analysis. A number of studies have calculated and decomposed agricultural TFP growth in China within a time frame overlapping (at least partially) that considered are here. Using provincial data, Lambert and Parker (1998) constructed a Divisia index for the period 1979-1995, finding an increase in TFP of 5.8 per cent per year in the period 1993-1995. Jin et al. (2002) also used an accounting approach and constructed a Tornqvist index. They concluded that new technologies were the main driver of agricultural productivity growth during 1980-1995. However, in contrast with Lambert and Parker (1998), they found that TFP declined by 3.2 per cent annually in the period 1994-1995. Mead (2003) re-examined data on Chinese agricultural productivity growth using an alternative calculation of the country's labour force. This estimate is employed in a TFP calculation based on a constant-returns-to-scale Cobb-Douglas production function. The study found a strong correlation between policies and productivity growth during 1984-1999. In contrast, Dekle and Vandenbroucke (2006), calculating productivity growth in China as a residual based on a constant-returns-to-scale Cobb-Douglas approximation to the technology, found strong TFP growth in the period 1994-2003 (6.6 per cent per year).Using national data, Wu et al. (2001) constructed Malmquist indexes for 1980-1995. They found that TFP grew at an annual rate of 2.3 per cent in 1994-1995. This is in line with Colby et al. (2000), Fan and Zhang (2002), Hsu et al. (2003), Lezin and Wei (2005), and Bosworth and Collins (2008), who found rather strong growth in agricultural TFP during different parts of the 1994-2005 period. Colby et al. (2000) used a Tornquist index to analyze the sources of output growth in grains and in four major crops in China (rice, wheat, corn and soybeans). They found that agricultural TFP grew on average at an annual rate of 0.8 per cent. Fan and Zhang (2002) adjusted previous measures of growth in outputs and inputs and calculated a Tornquist-Theil index of TFP at the national and provincial levels for the period 1952-1997. In particular, they found an increase in TFP during the period 1978-1997. Lezin and Wei (2005) also estimated a Cobb-Douglas production function for the province of Zhejiang had found positive TFP growth in the period 1994-1997. Hsu et al. (2003) calculated output-orientated Malmquist productivity indexes using a non-parametric data envelopment analysis approach covering 1984-1999. They estimated that TFP growth averaged 1 per cent per year. Bosworth and Collins (2008) calculated productivity growth in China as a residual based on a constant-returns-to-scale Cobb-Douglas approximation to the technology. They calculated average national productivity of China and India and compared their performances in the period 1978-2004. They estimated China's agricultural TFP growth at 1.7 per cent per year in the 1993-2004 period estimates, although based on different data sources, their estimates indicate that agricultural productivity growth in China was higher immediately after the introduction of the Household Responsibility System from 1978 to the mid-1980s. TFP growth slowed after that period until the end of the 1990s, a trend researchers argue was due to the exhaustion of the impact of the introduction of the household responsibility system. Other factors also played a role, including the procurement price system, environmental stress and lack of agricultural investments and innovations. The trend reversed after 1999 with annual productivity growth rates rising between 2000 and 2005, the end of the period of their analysis. They conclude that, on average, TFP growth in Chinese agriculture during 1993-2005 was a robust 3.97 per cent annually, compared with 1.73 per cent in US agriculture during the same period.

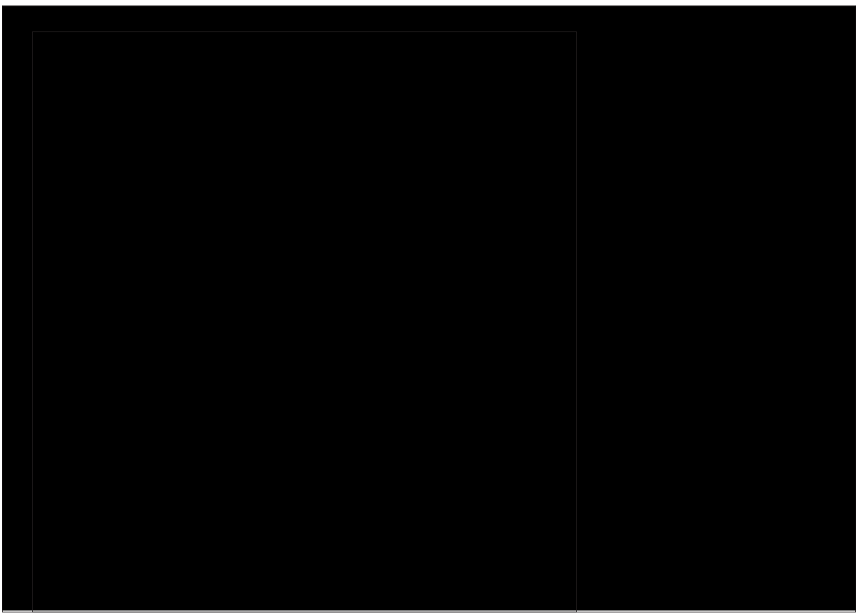
Regionally, the east (with an average annual TFP growth rate of 5.7 per cent) outperformed the central (2.9 per cent) and west (0.9 per cent) during this period. It is interesting to note that TFP growth rates in the west improved rapidly after 2000, while those of the east decreased slightly. By 2004-2005, TFP growth rates in all three regions converged to about 3 per cent per year. [17]

In a recent study using provincial data to assess provincial TFP growth in China, Wang et al. (2013) also reported extraordinary growth rates of TFP in Chinese provinces. In the top ten provinces, TFP growth ranges from 2.8 per cent to well over 4 per cent annually over the 1985-2007 period (Wang et al. 2013). Six of the top ten provinces in TFP growth on the east coast of China, which according to Wang et al. (2013), experienced declining labour's share in agriculture concurrently with increased productivity (Map 1). These

17 The Central region can be divided into a North Central and a South Central region, given differences in agronomic characteristics. Doing so, in later years the North Central region marginally outperformed the South Central region. On an average, annual TFP growth rates are 3.3 per cent for the North Central and 2.5 per cent for the South Central region.

estimates compare well with Fuglie's nationwide (2010) estimate of TFP growth in Chinese agriculture of approximately 3.5 per cent from 1990 to 2006. They also suggest that the growth and labour transfers out of agriculture is a regional story in China, as indeed it is in all our four countries. TFP growth cannot be well understood only by looking at national aggregates, although other evidence for China suggests convergence in productivity growth among regions.

Map 1: Agricultural TFP growth in China



Source: *Wang et al. 2013.*

Nin-Pratt et al. (2009), using a multi-country context and FAO data, calculated both a Tornquist-Theil index and a Malmquist index of TFP growth for China. They found increases in Chinese agricultural productivity in the post-reform period up until 2003 - growth averaged 5 per cent per year when calculated with a Malmquist index and 3 per cent with a Tornqvist-Theil index. They also found that both efficiency and technical change were important drivers of productivity growth and that returns to agricultural R&D had been high.

In a separate comparative study of China and India, Nin-Pratt et al. (2009) also noted a far stronger performance of China relative to India, as do other studies, including IFPRI studies. They attributed this superior performance to more fundamental institutional and policy reforms in agriculture as well as to the transformation of industry in China that helped agricultural TFP growth while absorbing labour and reducing employment in agriculture. They further noted that the incentives for capital investment and technical change led to increased output per worker in agriculture at high rates (Nin-Pratt et al. 2009).

Following the introduction of the household responsibility system in 1979, at the beginning of the 1990s, China introduced a number of reforms. It abandoned its food rationing system, reducing the gap between controlled and market prices, and controlled prices were eliminated altogether in 1994. The Grain-Bag responsibility system, introduced in 1995, however, required leaders in each province to maintain an overall balance of grain supply and demand within each province and to regulate local markets, advocating self-sufficiency in grain production, leading to a potentially inefficient reallocation of resources towards grain production.

In 1998, a second (Household Responsibility System) wave replaced the one introduced in 1978, as land leases expired and were replaced by new ones. Starting in 2000, taxes of the farming sector were gradually eliminated. In 2001, China became a member of the WTO leading to greater openness to trade. Yet, Huang et al. (2011) reported extensive uses of taxes and subsidies, although well below WTO limits. A recent study by Christiansen (2011) and Fan confirmed our finding in the earlier section that subsidies to agriculture have increased since the triple crisis and may explain terms of trade moving more sharply in favour of agriculture (personal communication with Shenggen Fan).

China's stocks have also played a key role in domestic price stabilization. They have been variably estimated to be between 60 million to 240 million tons of grain, compared with around 60 million tons of India in 2011. The difficulty in measuring Chinese stocks is often attributed to their dispersal, e.g., provincial self-sufficiency encouraged by policy; but these large stocks may have also reduced global price volatility and the need to maintain global stocks. The only large stocks held globally beyond China and India are in the private sector by multinational companies. The post-2007 price rise and volatility have been attributed in part to declining global stocks and supplies, due to the export bans imposed by middle-income countries such as China and India. Small incremental purchase or sales by China or India tend to upset the relatively thin international markets for some commodities such as rice and, hence, their policies are increasingly of global relevance.

TFP growth in Brazil

Given the variety of TFP studies of Brazil (Contini et al. 2010; Moreira et al. 2007; Helfand and Levine 2004), we focus on the study of Gasquez et al. (2012) and TFP indexes for Brazilian agriculture that analyse structural changes in it over the 1970-2006 period, using agricultural censuses to compare Brazilian with US performance. The study of Gasquez et al. (2012) noted that the average farm size declined until 1970. The number of farms has been relatively stable since 1980, averaging between 60 and 70 hectares. Farm size entails differences among states. About 24,000 farms produced 51 per cent of the total production. Only 48,000 farms could have accounted for all the production of 2006 census year. There were 5.1 million farms by the census. Forty-six per cent were in the north-east and half of rural poverty is there.

Gasquez et al. (2012 and 2009) noted that in Brazil labour per farm declined sharply from 9.7 persons in 1920 to 3.2 persons in 2006 due to innovations in the production systems, introduction of new products and changes in labour policies. A rapid rise in the number of tractors also reflects the introduction of technology innovations. Crop area per tractor, however, fell from 3,893 ha in 1920 to 205 in 1970, and 73 in 2006, reflecting the introduction of appropriate technology. The tremendous productivity gain is reflected in their study in agricultural output, which increased by 243 per cent between 1970 and 2006, with an increase in input use of only 53 per cent. Whereas until 1995, Brazilian agriculture production was propelled mainly by increasing input use, after 1995 land and labour productivity gain was the result of schooling, increased use of machinery and equipment, adoption of new technologies, developed through agricultural research, and addition of new, more productive lands, which took place during the more than 30-year period. A primary source for technology innovations in rice, corn, coffee, sugarcane and livestock products has been EMBRAPA, the national agricultural research organization. Gasquez et al. (2012) estimated a 1 per cent rise in research spending by EMBRAPA to increase the total factor productivity index by 0.2 per cent (Gasquez et al. 2012 and 2009).

Like China, there is a significant difference in TFP growth among the Brazilian states (Map 2). In the southeast, Espírito Santo and Minas Gerais recorded productivity growth above the national average, and in the centre-west, Mato Grosso's TFP growth was above the average for Brazil. Para and Tocantins, Paraiba and Rio Grande do Norte, Rio Grande do Sul and Paraná recorded productivity growth below the average. Among the changes in the composition of inputs, the most notable is the cost of labour which declined from 51 per cent in 1970 to 16.1 per cent in 2006. The share of tractors in expenses increased from 7 per cent in 1970 to 17.8 per cent in 2006. Electrical energy, fertilizers, soil conditioners and diesel oil also had higher shares in total expenses. The largest structural change occurred between 1975 and 1980, which contributed to the debt crisis, and the smallest between 1995 and 2006, a period when

Brazil's macroeconomic policies brought inflation and domestic and external imbalances under control, and subsidies were replaced by efficiency-enhancing expenditures.

Map 2: Brazil-state level variation in TFP growth rate (average per cent per year over period)

Source: *Authors' own creation based on the data from Gasquez et al. (2012).*

Two important transformations in Brazil have been diversification and investment in programmes. Reduction in traditional activities, such as bovine, milk, cocoa, coffee, cashew fruit, manioc, corn and rice cultivation, has been accompanied by an increase in the growth of new products, especially fruits such as banana, grape, mango and papaya in the states of Rio Grande do Norte, Bahia and Pernambuco. Diversification to major products of high added value, such as livestock and fruit, combined with irrigation and programmes like Pronaf National Programmeme for the strengthening of family agriculture (Programmea Nacional de Fortalecimento da Agricultura Familiar), provide a minimum of financial resources that allows new products to be introduced in agriculture. Gasquez et al. (2012, 2009) estimated the average annual growth rate for agricultural total factor productivity in Brazil between 1995 and 2006 at 2.13 per cent a year, far lower than those found in other studies. They also estimated average TFP growth rate for the period 1975-2008, 3.66 per cent per year. The results of Gasquez et al. (2012, 2009) are based on Brazilian Agricultural Census data. They used annual data provided by Instituto Brasileiro de Geografia e Estatística/ Brazil's Institute of Geography and Statistics (IBGE) with a different composition of commodities and underestimation of production data provided in the 2006 Agricultural Census. They concluded that even if agricultural TFP grew at an annual rate of 2.13 per cent, it is still above the annual rate of 1.89 per cent recorded for the United States in the same period 1995-2006 (Economic Research Service, 2010). This conclusion is consistent with Fuglie's.

In the case of Brazil, as indeed in other parts of the world, access to institutions and goods that are often provided by the public sector (such as market access via infrastructure creation and rural electrification) was among the most important determinants of differences in efficiency. Other important determinants included the use of inputs such as irrigation and fertilizers, and differences in the composition of output. Furthermore, the relationship between farm size and technical efficiency is more complex than what has been normally believed. Rather than an inverse relationship where productivity falls as farm size rises, Helfand and Levine (2004) have found it to be u-shaped. For farms up to about 1000–2000 ha, efficiency falls as farm size rises, but beyond this size it starts to rise again. The most important reasons why the inverse relationship broke down relate to preferential access by large farms to access to institutions and goods that are often provided by the public sector, such as market access via infrastructure creation and rural electrification. They were among the most important determinants of differences in efficiency. Other important determinants included the use of inputs such as irrigation and fertilizers, and differences in the composition of output.

These results identify the types of policies and production practices that could contribute to increased technical efficiency.

TFP growth in Indonesia

In their meticulous measurement of agricultural productivity growth in Indonesia, Rada et al. (2011) focused on the role of investment, price and research policies of the Indonesian government during 1985–2005. They noted that the country achieved remarkable success in raising food production during the 1970s and 1980s, but growth stagnated once Green Revolution technologies had run their course (Fuglie 2004). Input subsidies and trade regulations stabilized prices and supported food crops (Timmer 2004), but agricultural research on annual crops, particularly rice grown largely in Java, according to Rada and Fuglie (2011), did not result in much productivity growth.[18] Perennial export commodities including rubber, coffee and oil palm were the primary sources of TFP growth. They involved using export taxes, credit subsidies and land concessions (Fane and Warr 2009; Hill 2000).

Using provincial panel data set and a stochastic output distance frontier framework, they examined how government policies have affected agricultural productivity, which they decompose into its technical progress and efficiency components. They concluded that the government's primary contributions to technology growth have come through price and trade policies, rather than through effective public research. Most technology growth had occurred through

18 Here is the controversy over how to interpret TFP numbers. Indonesia has had pretty good success at raising and sustaining rice yields, but the input subsidies that are a part of that success have undermined total factor productivity. This is a political question, not agronomic. Most observers think rice yields would be little affected with sharply lower fertilizer and water inputs which would raise TFP.

informal technology diffusion from international sources; observers think rice yields would be little affected with sharply lower fertilizer and water inputs, which would raise TFP. e.g., CGIAR in the case of annual crops, much as Rosegrant and Evenson noted in the case of India discussed later, and from the international private sector in the case of perennial crops rather than through a formal public sector research or extension systems.[19] Notwithstanding these weaknesses in the technology capital, they estimate Indonesia's annual TFP growth over 1985-2005 to be 2.2 per cent after taking into account exceptionally high technical efficiency - 20 of the 22 provinces operated within a 90-100 per cent efficiency band of the best-practice frontier. So, the mean technical efficiency was 95.9 per cent, lending support to Schultz's hypothesis of "poor but efficient" farmers. With an efficiency loss of 0.2 per cent from the 2.4 per cent average annual technical growth rate, their overall TFP rate is higher than other estimates using other methods.[20] Moreover, their labour force statistics show slower agricultural labour growth than the FAO data, implying slower aggregate input accumulation growth and, therefore, more rapid total factor productivity growth. Public investment in agricultural and rural infrastructure was, however, important, including investment in irrigation (see Annex 3, Table 7 for expansion of irrigated area in Indonesia).

19 Technology change rates have been substantial, averaging 4.5 per cent in perennial crops, 3.5 per cent in livestock and 1.4 per cent in price/trade policies and development. Expenditures have had statistically significant output effects, and the price/trade impacts in particular have been substantial.

Taken as averages over the full 1985–2005 period, the average annual rates of change of these policies happen to have been small so that their annual output impacts have been small. Informal technical change appears to have dominated technical progress.

20 Fuglie's (2010) Tornqvist–Theil index approach yielded a mean growth rate of 1.8 per cent during 1961–2006. The value-added function of Mundlak et al. (2002) yielded a rate of 1.49 per cent during 1980–1998, Suhariyanto and Thirtle's (2001) low Indonesian TFP growth rate estimate of 0.17 per cent during 1965–1996, and Coelli and Rao's (2005) estimate of 0.98 per cent during 1980–2000. They argue, however, that these other estimates are not comparable with their estimates because their international Malmquist index approach expresses technical efficiencies in reference to the most efficient nation in the data set, rather than to Indonesia's own most efficient provinces.

Trade liberalization helped perennial crops by bringing in new technology from the private sector from Malaysia, helping their growth.

Investments in roads, particularly in the outer islands, improved efficiency, but investment in education does not explain productivity growth. On the contrary, literacy has had a large and negative effect in rural brain drain. Workers migrating from rural to urban areas and from agricultural to non-agricultural employment are likely to be younger and better educated, a phenomenon observed, for example, among West Javanese horticultural producers (World Bank 2007). Those remaining on the farm are also more likely females, who on account of household responsibilities, tend to work fewer and more intermittent hours than men do. According to FAO estimates, the share of female workers in the agricultural labour force rose from 27 per cent to 44 per cent between 1961 and 2005. Negative impact of literacy on the net efficiency of an Indonesian farm thus implies that its presumed positive effect on each potential worker's efficiency is substantial, more than outweighed by its average dilution effect on the rural labour force. One important rationale of high quality rural education, though, is to prepare young workers to be competitive in non-farm labour markets.

One limitation of the traditional TFP studies discussed in the case of Brazil also applies to Indonesia, in terms of the failure to integrate environmental costs and benefits into the TFP growth calculation, in part because of the difficulty of systematically measuring their impacts. Rada et al. (2011) did not explore the role of land concessions on outer islands in accelerated deforestation, loss of biodiversity and carbon emissions from conversion to palm oil, which have become a hot button issue in the context of Reducing Emissions from Deforestation and Forest Degradation in Developing Countries (REDD+) (Gautam et al. 2000; Lele et al. 2010). Opportunity cost of land in palm oil is by far one of the highest, given a combination of high demand for it from countries such as India and the import of technology from Malaysia, which makes it one of the most profitable land use changes.

TFP growth in India

Although there is a variation in the results of TFP studies for different periods for India, they support two conclusions: TFP growth has declined since the Green Revolution and India is falling behind, both in relation to its poverty and employment objectives, as compared with the other three countries (Brazil, China, and Indonesia).

Rosegrant and Evenson's (1995) findings regarding TFP may have been the portent of the challenges of Indian agriculture today. Covering three periods (1956-66 [pre-Green Revolution period]; 1967-77 [Green Revolution period]; and 1978-87 [post-Green Revolution period]), they noted that the period was characterized by rapid growth in investment in research and extension, and rapid growth in inventions in agricultural implements and inputs generated by private research and investment. A large part of the explained growth throughout the 1956-87 period is associated with the "foreign research" (we added quotes) and development, as measured by the stock of inventions, particularly during the pre-Green Revolution period. They concluded, "India has realized significant and important rates of TFP growth across all periods examined… linked to investments made in research, extension, markets, and irrigation. Imported investments (foreign R&D and HYVs [high-yielding varieties]) have played an important role in TFP growth" (Rosegrant and Evenson 1995, 21). However, they noted a secular decline in TFP, independent of the growth in the TFP-enhancing investments, possibly an impact of resource degradation in agriculture, calling for more research on the role of resources. By the third period, research impact was over three-fourths of that in the first period, while the extension impact was two-thirds that of the initial period, but they concluded, "… the economic returns to these investments remained very high in the final period" (Rosegrant and Evenson 1995, 17). Could these findings have led to a sense of complacency? Although there were some investments in initiatives, such as the Rice Wheat Initiative of the CGIAR, this important initiative did not receive the kind of support it should have either in India or elsewhere in South Asia. Several different versions of the Rice Wheat initiative are underway in the new reformulated CGIAR, and their linkages to each other are unclear.

The marginal impact of the expansion in irrigated area on TFP increased over time due mainly to rapid growth in the private tube well (groundwater) irrigation, compared with public canal irrigation. By mid-1980s the proportion of irrigated area under private tube well had already increased from one-third to over one-half, and studies confirm higher productivity of privately irrigated areas than areas dependent on canals (Dhawan 1989).

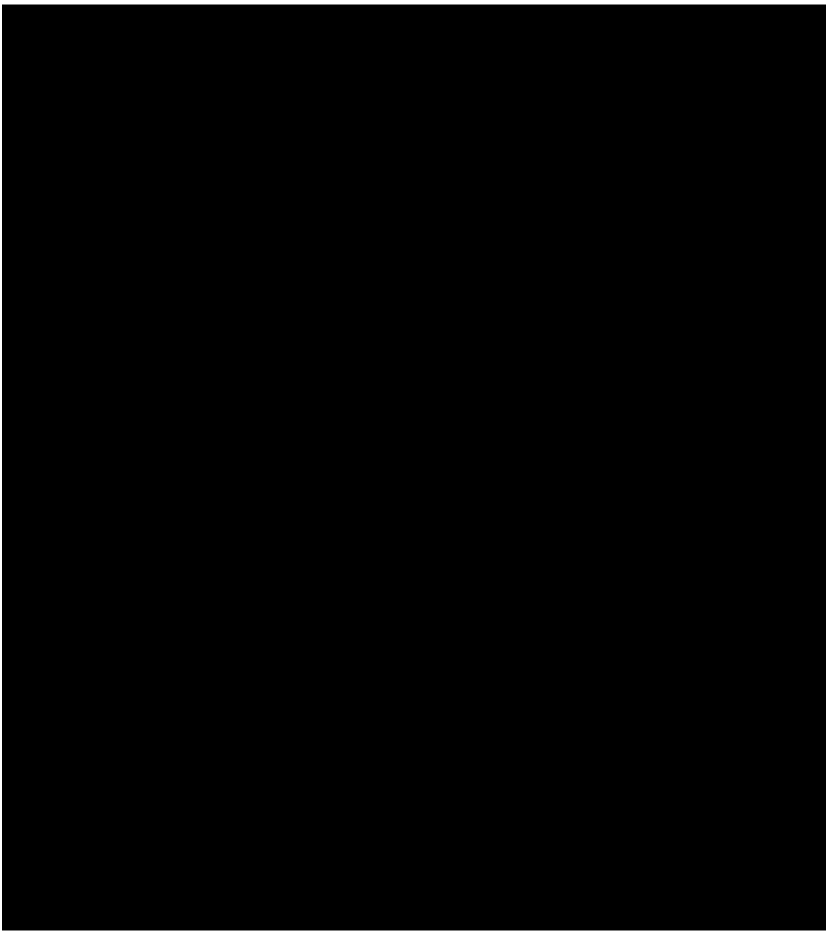
Comparing estimates of Dholakia and Dholakia (1993) and Fan et al. (2000), Saikia (2009) noted that the conclusion of Fan et al. (2000) that economic liberalization since the early 1990s may have helped improve TFP growth as shown in Table 13. Then he cited alternative estimates to show that agricultural growth in GDP was not accompanied by TFP growth from 1991 to 2000.

Table 13: Growth rate of TFP in agriculture (1950-51 to 1999-00)

[redacted]

For the most recent post-2000 period, Chand and his associates have produced two studies. They have presented TFP growth across crops and states (Chand 2008, Chand et al. 2011) (MAP 3).

Map 3: Distribution of TFP growth index (values by states in India: 1975-2005)



Source: *Authors' own creation based on the data from Chand et al. 2011.*

Chand et al. (2011) noted that India's (implicit) agricultural TFP growth had slowed, with considerable differences in TFP growth across crops and states. TFP growth of wheat was the highest and close to 2 per cent, (performance of wheat is consistently affirmed by various different kinds of studies reviewed for this study), but rice was far behind, and maize had been as low as 0.67 per cent. Hybrid sorghum productivity declined during 1995-2005. TFP growth in Bajra, on the other hand, had been impressive. Out of 18 crops, two-thirds exhibited decline in TFP. Madhya Pradesh, Gujarat, Andhra Pradesh, Rajasthan, Maharashtra and Chhattisgarh experienced agricultural growth rates of well over 4 per cent, but many other states like Uttarakhand, Himachal Pradesh, Punjab, Bihar, Jammu and Kashmir, Haryana and Orissa had between 2 to 4 per cent growth and Jharkhand, Karnataka, Assam. Kerala, Uttar Pradesh, Tamil Nadu and West Bengal had less than 2 per cent rate growth (Chand et al. 2011). In the most recent work covering the post-2005 period and including production data for 2010-2011 (Chand and Parapurathu 2012), however, Chand et al. (2011) noted a "recovery" in TFP and explained it in terms of an increase in agricultural terms of trade relative to the non-agricultural sector starting from 2005. Growth rates of GDP in agriculture and allied activities in 2008-09, 2009-10 and 2010-11 (advance estimates) were -0.1, 0.4 and 5.4 per cent, respectively. Rosegrant and Evenson had noted that TFP growth estimates vary from period to period due to changes in output, often caused by climatic factors, while input use remains reasonably steady. Based on his own all-India district-level estimates and a comprehensive review of literature, including the works of Thomas Walker and Peter Hazell, Kerr noted that the shifts in areas planted can explain differences in production (and productivity) as much as yield variability (Kerr 1996). A recent comprehensive study of productivity growth over the 1980-2008 period by Rada disaggregates TFP growth by regions and crops going beyond cereals. It includes livestock, horticulture and high value tree crops. It concludes that productivity growth has been most rapid in western and southern India, mostly through diversification to high value crops and livestock, and less rapid in the traditional Green Revolution belt of northern India. Productivity growth has been the least rapid in Eastern India, with the exception of West Bengal. Although improved incentives in the post-2000 period may explain productivity growth, in several states productivity growth has been accompanied by very little input growth leading to questions about the sustainability of growth that has been achieved (Rada 2013). Underlying causes of productivity growth discussed in this study and by Chand elsewhere are research, extension, energy supply, quality and timeliness of inputs, roads, education and market access, which call for further analysis, and in this regard, the dearth of research in India compared with China and Brazil is striking, notwithstanding the crucial importance of productivity growth for India's objectives of inclusive growth and political stability, perhaps reflecting the state of agriculture including social science research.

Value chains, agricultural transport, marketing, processing and storage

This study did not address issues of value chains.[21] Literature on agricultural productivity growth cannot easily accommodate the treatment of value chains. On the other hand, price incentives depend critically on the existence and efficiency of markets and, in turn, influence incentives to adopt new technology. Government price support was critical for the Green Revolution. While Indian grain markets were efficient in price formation during the 1960s and 1970s (Lele 1971), they were volatile with huge year-to-year and intra-year variations in prices (as would be expected of competitive markets that lack intervention), with little incentive to adopt new technology. With US advice, minimum prices and a procurement system

21 Reardon and Timmer are continuing to work on issues of value chains that suggest strong inter-sectoral growth linkages of agricultural industrialization and value added in agriculture. More work is forthcoming.

were then established in the key areas, which formed the cradle of the Green Revolution (Lele and Goldsmith 1989).

Promotion of foreign investment in the retail sector had become a political issue in India at the time of this writing. Arguments in favour of liberalization of foreign investment, made most notably by Reardon and Timmer, are that the supermarket revolution increases efficiency in agricultural markets, reduces transaction costs and losses, attracts increased private investment, improves price incentives and returns to farmers, and increases choice to consumers, stimulating more diversified food production (Reardon and Timmer 2005). The blockage of this policy by the opposition parties in India has been largely political, but the opposition also provides an opportunity to address important short-, medium- and long-run issues about the employment, environmental and health footprints of foreign retailing. When compared with the current inefficient and inequitable public sector management of the food grain stocks, foreign retailing seems attractive. An efficient modern system of transport, marketing and processing is urgently called for, with the need for investments in transport, energy and communications in which foreign investment can play a critical role. India's labour surplus agriculture must also stimulate activities in the rural and semi-urban sectors that create productive employment for the poor. Furthermore, the experience of industrialized countries suggests the need to avoid a large environmental footprint from the outset, including transport, packaging, processing and refrigeration.

Equally important is avoiding the kinds of excessive amounts of food additives driven by the lobbying of the food industry, with adverse health consequences for the consumers, such as sugar and salt that are actively being debated in the US. These were partially reversed through the revised food standards for the school feeding programmes introduced by the Obama administration, albeit with resistance from the food and beverage industry. Given the weak governance in countries such as India or Mexico, there is little capacity either to enforce the health standards or to resist the corruption associated with foreign direct investment or food additives. Policy research on value chains in India is ripe for a more multidimensional, comparative programme of research across the developing and developed world that attempts to reconcile objectives of efficiency, equity, human health and environmental sustainability.

Challenges of public sector management going forward

The public policy issues related to the level and efficiency of expenditure on agriculture range from the effectiveness of agricultural research, extension, education and teaching to water management. Energy, transport and communications are important for agricultural development. Data suggest that India is behind China and Indonesia in these areas. The very interesting state-level presentations of the workshop in November 2011 ("Policy Options and Investment Priorities for Accelerating Agricultural Productivity Growth", New Delhi) made it clear that the action in India in most of these areas is at the state level. The central government has essentially a public goods role, i.e., in developing best practices, establishing standards from within India and across the world, developing a system of incentives for the allocation of central government resources sharply focused on the race to the top, i.e., focused on ultimate impact on the poor rather than expenditure alone. Both the level and quality of public expenditure at the state levels and below need addressing, as well as the central government's criteria for allocation of resources among states and sectors. It calls for a transformative change in the way planned resources are allocated, their uses are monitored and evaluated, and lessons learned from experience are translated into strategies going forward, a sort of Total Quality Management (TQM) of public sector expenditure in the provision of essential national public goods. These are functions without which agriculture will not achieve the much needed accelerated and inclusive growth.

China's record suggests that even with a rapid increase in value added in agriculture and industry, reaching a turning point in agriculture (equalizing labour productivities in agriculture and industry) would be a few decades away. Accelerated growth researchers at the World Bank have attempted to relate economic growth with knowledge by constructing a Knowledge Economy Index (KEI) for 80 structural and qualitative variables that are first combined into four categories: Economic Incentive Regime; Innovation; Education; and Information and Communication technologies. The overall KEI (an average of the scores on these indices is strongly correlated with economic growth. Among our four countries, Brazil ranks at the top, followed by China, Indonesia and India, showing the same rankings in each of the four indices following the same pattern. Not surprisingly, the only exception in their ranking in this study is that India does better than Indonesia in the Innovation category. Also Brazil and China show a significantly higher index for recent years in the twenty-first century compared with 1995, whereas India does not show a similar improvement. When the researchers looked at the relation between per capita income and the KEI, they find that China had a higher income than predicted on the basis of the KEI index. India's per capita income lies on the regression equation, i.e., conforms to the trend but does not exceed it. When per worker growth in GDP was related to KEI, both China and India show a higher growth than predicted by the regression. It confirms our overall conclusion that India's effort to achieve productivity growth in agriculture needs a redoubling of effort on a wide variety of fronts.

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Annex 1:

Methodology

Structural Transformation Analysis

To examine and understand the structural transformation patterns for developed and developing countries/regions we drew on data for 109 countries (88 developing countries + 21 developed countries) over the 1980-2009 period. From the year 1980, FAO began to publish data on labour employed in agriculture[22] and we conducted several types of analysis:

- Regressions for the entire sample of 109 developed and developing countries (regression result is in the Annex).
- Regressions for only 88 developing countries (regression result is in the Annex).
- Regressions for developing countries (Asia, SSA and LAC) within each region to understand neighbourhood patterns (regression result is in the Annex).
- Performance of four large countries (BIIC) in each of the above three contexts- (1) developed and developing countries, (2) developing countries only, and (3) country performance in the context of their regional performance (regression result is in the Annex).

Our specification used the Chenery-Taylor and Chenery-Syrquin models that allows for many different types of behaviour, namely, a quadratic form that allows for accelerating or decelerating increase or decrease in an initial increase, followed by a decrease,

22 Economically active population in agriculture- economically active population in agriculture (agricultural labour force) is that part of the economically active population engaged in or seeking work in agriculture, hunting, fishing or forestry. Sources: FAO Statistics Division.

or a decrease followed by an increase. The Chenery-Syrquin specification allows for initial stagnation-- a low level trap-- followed by accelerating increase and then decelerating increase and stagnation and other very non-linear patterns. The form also allows the share of agriculture to settle somewhere above zero.

This specification is

$$X = a + b. \ln Y + c. (\ln Y)^2 + d. \ln Pop + e. (\ln Pop)^2 + f. TOT$$

Where TOT, the terms of trade, is the deflator for value-added in agriculture divided by the deflator for non-agriculture. TOT was not used in Chenery-Syrquin analysis but was in Timmer and Akkus's analysis. The major difference between our analysis and that of Timmer and Akkus is the use of population variable. We introduced Ln (Pop) and (Ln Pop)^2 as independent variables which they did not have. Y is per capita income in 2000 US dollars and Pop is population. X, the dependent variable, in different equations represents-

1. Share of value added in agriculture in GDP.
2. Share of employment in agriculture to total employment.
3. Value added in agriculture in 2000 US dollars.
4. Value added per worker in agriculture, and
5. The difference between agriculture's share in value-added and in employment, which we denote as AgGAPshare.

We also introduced dummies for the three regions, Asia, Latin America and sub-Saharan Africa to reflect the stylized characteristics of specific regions in explaining outcomes (large farms in LAC, labour-intensive agriculture in Asia and extensive agriculture in SSA), and year dummies. Timmer and Akkus used country dummies and year dummies. The dependent variable (X) in their analysis for different equations was:

1. Share of value added in agriculture in GDP.
2. Share of employment in agriculture to total employment.
3. Difference between agriculture's share in value-added and in employment.
4. Ratio of Share of value added in agriculture in GDP/share of employment in agriculture to total employment.

Other differences are the time periods. During the bulk of the period 1980-2009 we covered (i.e., from 1990 to 2009), growth rates in developing countries had accelerated, whereas Timmer and Akkus's analysis covered the period 1965-2000. Growth in Latin America and sub-Saharan Africa was slow until 1990 and picked up thereafter. They also covered a different and smaller set of countries, i.e., 86 countries, compared with 109 countries in our case.

Estimating average per capita income at which the turning point is reached

We regressed AgGAP share on Ln (GDPpc), (Ln GDPpc)^2, Ln Pop, (Ln Pop)^2, TOT (Agr/Non-agr), year dummies/decade dummies and country dummies. Then by differentiating the gap with respect to per capita income, setting the first derivative equal to zero and solving for log of per capita income, we obtained the turning points. We estimated average income at which turning points are reached for various sets of countries/regions/patterns as presented below.

Table 1: Estimates of average per capita income at which turning points are reached (using country dummies)

Our estimates using decade dummies—[ydum1(1980-1989) and ydum2 (1990-1999)]					
Region	**Ln Y**	**(Ln Y)^2**	**R^2**	**Turning point of LnGDPpc**	**Turning point of GDPpc (constant 2000 US$)**
109 countries (88 developing countries+21 developed countries)	-0.44	0.03	0.95	8.61	$5469
88 developing countries	-0.52	0.03	0.94	8.25	$3824
Asia (19 developing countries)	-0.78	0.05	0.94	7.43	$1681
SSA (38 developing countries)	-0.4	0.02	0.91	10.4	$32934
LAC (24 developing countries)	-0.12	0.01	0.92	8.36	$4272
Non-Asian countries (88 countries—69 developing+19 developed)	-0.41	0.02	0.95	9.21	$10046
4 countries (Brazil+China+India+Indonesia)	-0.58	0.04	0.99	7.31	$1488

Estimates using annual dummies

Region	Ln Y	(Ln Y)^2	R^2	Turning point of LnGDPpc	Turning point of GDPpc (constant 2000 US$)
109 countries (88 developing countries+21 developed countries)	-0.37	0.02	0.95	9.71	$16552
88 developing countries	-0.44	0.02	0.94	9	$8143
Asia (19 developing countries)	-0.8	0.05	0.95	7.51	$1832
SSA (38 developing countries)	-0.29	0.01	0.92	14.33	$1672720

LAC (24 developing countries)	-0.12	0.01	0.93	8.94	$7638
Non-Asian countries (88 countries—69 developing+19 developed)	-0.31	0.01	0.96	11.79	$132408
4 countries (Brazil+China+India+Indonesia)	-0.57	0.03	0.99	9.96	$21236

Timmer and Akkus estimated the per capita income at which turning points are reached for Asian and non-Asian countries, using equations as follows:

AgGAP share is the dependent variable and Ln (GDPpc), (Ln GDPpc)^2, TOT (Agr/Non-agr), year dummies and country dummies are independent variables. As shown below, their estimates of Asian countries reaching the turning point at $1,663 (constant 2000 US$), and non-Asian countries reaching it at the per capita income of $11,329 (constant 2000 US$) [over six times higher] are similar to ours using decade dummies.

Table 2: Timmer and Akkus's estimates of average per capita income at which turning points are reached

Timmer and Akkus's estimates using annual dummies					
Region	Ln Y	(Ln Y)^2	R^2	Turning point of LnGDPpc	Turning point of GDPpc (constant 2000 US$)
Asian countries (13 countries)	-0.48	0.03	0.94	7.42	$1663
Non-Asian countries (73 countries)	-0.26	0.01	0.92	9.34	$11,329

Major differences between our and Timmer and Akkus's analytical framework are the population variable and our further breakdown of turning points for regions. With regional analysis with the inclusion of population variable, our specification provides a higher explanatory power both to ln per capita income and ln per capita income squared than Timmer and Akkus for the Asian and non-Asian countries.

Despite the differences in time periods covered and set of countries, our result and Timmer and Akkus's results are similar to each other for Asian and non-Asian countries, i.e., our estimates using decadal dummies are compared with their using annual dummies.

Table 3: Comparison between our estimates and Timmer and Akkus's estimates

Our estimates using decade dummies- [ydum1(1980-1989) and ydum2 (1990-1999)]					
Region	**Ln Y**	**(Ln Y)^2**	**R^2**	**Turning point of LnGDPpc**	**Turning point of GDPpc (constant 2000 US$)**
Asia (19 developing countries)	-0.78	0.05	0.94	7.43	$1681
Non-Asian countries (88 countries—69 developing+19 developed)	-0.41	0.02	0.95	9.21	$10046
Estimates using annual dummies compared with those of Timmer and Akkus					
Region	**Ln Y**	**(Ln Y)^2**	**R^2**	**Turning point of LnGDPpc**	**Turning point of GDPpc (constant 2000 US$)**
Our Asian countries (19 developing countries)	-0.8	0.05	0.95	7.51	$1832
Timmer and Akkus's Asian countries (13 countries)	-0.48	0.03	0.94	7.42	$1663
Our non-Asian countries (88 countries—69 developing+19 developed)	-0.31	0.01	0.96	11.79	$132,408
Timmer and Akkus's non-Asian countries (73 countries)	-0.26	0.01	0.92	9.34	$11,329

For Asian and non-Asian countries, our estimates of per capita income at the turning point using decade dummies are $1,681 (constant 2000 US$) and $10,046 (constant 2000 US$), respectively, compared with Timmer and Akkus's turning points for Asian countries of $1,663 (constant 2000 US$) and $11,329 (constant 2000 US$) for non-Asian countries. When we use annual dummies, our turning point for Asian sample again is close to Timmer and Akkus's estimates [$1832 (constant 2000 US$)]. For non-Asian countries our estimate of per capita income at which the turning point is reached is far higher, compared with that of Timmer and Akkus.

This seems to occur mostly because of the results of SSA countries, since the turning point for LAC in Table 1 above is close to where LAC countries seem to have reached their turning point.

With annual dummies the coefficients on log of income and log income squared are usually smaller than with decadal dummies, except for Asia. For it, the dummies are not significant and so there has been no shift in the speed of structural change. Hence, the turning points are close to one another. Because income is growing and the annual time dummies are also growing, including the annual dummies tends to reduce the influence of income (with perhaps problems of collinearity among these two variables), and thereby, the coefficients are smaller and turning points higher. This effect is absent when using decadal dummies. It is, therefore, more reasonable to use the decadal dummies.

Binswanger and D'Souza's (2011) on "Structural transformation of the Indian economy and its agriculture": They noted, "Timmer (2009) uses a sample of 86 countries to measure the pace of divergence and convergence across countries from 1965 to 2000. On average, countries reach the point when labour and output shares (and sectoral productivities) start to converge only at $9133 of per-capita income (in real 2000 US dollars). The estimates of turning points are not stable, and we need to analyze the Indian data to make judgments on how soon a turning point could arise….[23] Timmer also shows that over the past 35 years the turning point from divergence to convergence of productivity across the sectors has been reached at later and later stages in the economic transformation of high-growth performers. This suggests that industry and services have become less able to absorb the rapidly growing labour forces of developing economies" (p.2).

"During structural transformation, the speed with which labour is pulled out of agriculture depends on the labour intensity of industry. With a lag, services also start to increase their share in value added and in labour force. Structural change, by moving workers from lower to higher productive activities, accelerates economic growth. Productivity in agriculture will start increasing as technical change spreads to the agricultural sector and as labour leaves the sector and agricultural investment increases. In advanced countries, at the end point of this process, the shares of agriculture in output and employment will approximate each other, as will incomes across the sectors. Agriculture will become just like any other sector of the economy. Even though agriculture becomes a very small sector of the economy, in absolute terms it continues to grow throughout the transformation period and beyond.

During most of the structural economic transformation, labour productivity in agriculture and, therefore, agricultural incomes will typically fall farther and farther behind productivity and incomes in

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23 Timmer's estimate of a turning point is not stable across specifications and sub-samples. When the specification includes a variable for the agricultural to non-agricultural terms of trade, it is estimated at $5000. When using only the Asian sample of countries, he finds it for these countries at a per capita income of $1600. McMillan and Rodrick (2011) also investigate the question of the turning point. They use a sample of 38 developed and developing countries from 1990 to 2005, and regress the ratio of agricultural to non-agricultural labour productivity on the economy-wide labour productivity in purchasing power parity dollars (PPP) of 2000. They find a turning point towards convergence at $9000 PPP, which is between the 2005 economy-wide labour productivities of India ($7700 PPP) and China ($9518 PPP). They find, too, that Asia has been better at moving to conversion than Latin America and Africa.

other sectors, opening a widening inter-sector income differential. This income inequality will often cause major political problems. The reason for the widening gap is the long time it takes before the withdrawal of labour from agriculture translates into higher agricultural productivity, wages and incomes. Only towards the end of the structural transformation do the inter-sector productivity, wage and income differences start to fall, and productivity and incomes converge across all sectors. The turning point is reached when the share of agricultural labour in the economy starts declining at a faster rate than its share of output" (p. 2).

"It is not surprising that convergence in the Indian economy still has not started. Recall that Timmer (2009) showed convergence only starts at a per-capita income of between $1600 and $9000 (in 2000 US$), while per-capita income in 2006-2009 averaged only $719" (p. 7).

Other key findings

Turning points are sensitive to the choice of countries, choice of period and specification of the model. For example, developed and developing countries result in a higher per capita income at which the turning point is reached than if only developing countries- or only Asian countries- are considered. There are substantive reasons behind these results.

First, the per capita income levels at which the turning point is reached calculated from the regression with 109 countries (i.e., 88 developing countries and 21 developed countries) are greater than the per capita income level at which turning points are reached, based on only the 88 developing countries. This is because there are basically two clusters of data: one set for the developing countries, which have much lower per capita incomes and a larger share of agriculture in value added and in employment with the employment share being greater than the value added share. The second cluster is of data for developed countries, which is to the south-east of the data cluster for the developing countries. Developed countries have a much higher per capita income and a lower share of agriculture in value added and employment. This means that when developed countries are included, the fitted regression equation is more to the right in terms of the x-axis, and so the turning point occurs at a higher level of income.

Second, the estimated coefficients of time dummies are negative, meaning that the difference between the share of agriculture in value-added and employment tends to be larger at every level of income as time goes on and hence the turning point occurs at a higher level of income. Thus, over time the per capita income at which the turning point is reached is becoming greater.

Third, for the period we covered, only in Asia and in industrial countries has the value added per worker been increasing in both the agricultural and non–agricultural sectors, whereas it has been declining in the non-agricultural sectors in all other developing regions of the world. In this latter case, productivities in the two sectors can begin to converge without development occurring. We cannot compare this result with Timmer and Akkus's because they did not address the regional differences in the value added per worker in the non-agricultural sector. In any case for the period that we covered, per capita income in all developing regions was growing unlike in the 1960-1980 period, but labour productivity in the non-agricultural sector was not increasing in most developing regions, except for Asia.

The numbers of years to reach the turning point for BIIC

Now the major question is which pattern, i.e. 109 countries pattern/88 developing countries pattern etc., will be suitable to calculate this.

Since our focus was on calculating the number of years to reach the turning point for the four developing countries (Brazil, China, India and Indonesia), we chose the pattern of the 88 developing countries (the turning point value with annual dummies is $8143 (constant 2000 US$) and with decade dummies is $3824 (constant 2000 US$). We obtained the following result:

Estimates of number of years to reach turning point				
	Decade dummies		**Annual dummies**	
Country	**2004-08 growth Rate**	**2009-10 growth Rate**	**2004-08 growth Rate**	**2009-10 growth Rate**
Brazil	Already there		15	22
China	4	5	12	13
India	23	21	34	31
Indonesia	27	29	44	47

The years needed to reach turning point also depended on the rate of growth of GDP per capita. For the four countries (Brazil, China, India and Indonesia), average annual GDP per capita growth (%) (2004-08-5 years before crisis) and (2009 and 10-since 2009) are:

Country	**Indicator name**	**2004**	**2005**	**2006**	**2007**	**2008**	**2004-08**	**2009**	**2010**	**2009-10**
Brazil	GDP per capita growth (annual %)	4.4243	1.98735	2.865109	5.063117	4.205955	3.709166	-1.5204	6.552374	2.515985
China	GDP per capita growth (annual %)	9.448018	10.64734	12.07247	13.60512	9.03986	10.96256	8.648414	9.829191	9.238802
India	GDP per capita growth (annual %)	6.741572	7.834636	7.772471	8.354858	3.535265	6.84776	7.652264	7.357713	7.504989
Indonesia	GDP per capita growth (annual %)	3.736826	4.438672	4.300856	5.181577	4.890442	4.509675	3.49059	5.018275	4.254432

GDP per capita (constant 2000 US$) in 2010 is

Country	Indicator name	2010
Brazil	GDP per capita (constant 2000 US$)	$4699.39993
China	GDP per capita (constant 2000 US$)	$2425.47218
India	GDP per capita (constant 2000 US$)	$822.763238
Indonesia	GDP per capita (constant 2000 US$)	$1143.82705

Annex 2:

Regression Results (1980-2009)

1. Regression Results Using Regional dummies (Asia, LAC and SSA) and Year dummies

1.1: 109 Countries (88 Developing and 21 Developed)

1.1.1: Agricultural Value Added Share

Source	SS	df	MS		
Model	63.3445194	37	1.71201404	Number of obs =	3270
Residual	12.1601425	3232	.00376242	F(37, 3232) =	455.03
Total	75.5046619	3269	.023097174	Prob > F =	0.0000
				R-squared =	0.8389
				Adj R-squared =	0.8371
				Root MSE =	.06134

agric~dshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.392316	.0078675	-49.87	0.000	-.4077418	-.3768901
lngdppc2co~s	.0198624	.0005082	39.09	0.000	.018866	.0208588
lnpopinmil	-.0088637	.0008394	-10.56	0.000	-.0105096	-.0072178
lnpopinmil2	-.000703	.0002007	-3.50	0.000	-.0010965	-.0003094
totagrnona~s	.0479458	.0033131	14.47	0.000	.0414498	.0544419
d1asiancou~s	.0016132	.0043703	0.37	0.712	-.0069556	.010182
d2laccontr~s	-.0049303	.0038312	-1.29	0.198	-.0124421	.0025815
d3ssacount~s	-.0510234	.004303	-11.86	0.000	-.0594603	-.0425866
dyear2	.0014316	.0083098	0.17	0.863	-.0148614	.0177246
dyear3	.000024	.0083122	0.00	0.998	-.0162737	.0163217
dyear4	-.0022916	.0083132	-0.28	0.783	-.0185913	.0140081

dyear5	-.0003913	.0083153	-0.05	0.962	-.0166951	.0159124
dyear6	.000617	.0083157	0.07	0.941	-.0156875	.0169215
dyear7	.0012037	.0083149	0.14	0.885	-.0150994	.0175067
dyear8	.0021934	.0083144	0.26	0.792	-.0141087	.0184955
dyear9	.0045387	.0083162	0.55	0.585	-.0117668	.0208442
dyear10	.0027534	.0083192	0.33	0.741	-.013558	.0190648
dyear11	.0010595	.0083267	0.13	0.899	-.0152667	.0173857
dyear12	.0000511	.0083312	0.01	0.995	-.0162838	.016386
dyear13	-.0003537	.0083371	-0.04	0.966	-.0167002	.0159928
dyear14	-.0001626	.0083413	-0.02	0.984	-.0165175	.0161923
dyear15	-.0054917	.0083426	-0.66	0.510	-.021849	.0108656
dyear16	.001173	.0083461	0.14	0.888	-.0151911	.0175371
dyear17	.0057804	.0083568	0.69	0.489	-.0106048	.0221656
dyear18	.0044802	.0083638	0.54	0.592	-.0119187	.020879
dyear19	.0077345	.0083715	0.92	0.356	-.0086795	.0241485
dyear20	.0063176	.0083923	0.75	0.452	-.0101371	.0227723
dyear21	-.0007182	.0084151	-0.09	0.932	-.0172176	.0157812
dyear22	-.0023462	.0084183	-0.28	0.780	-.0188519	.0141594
dyear23	-.005284	.0084209	-0.63	0.530	-.0217949	.0112269
dyear24	-.0041188	.008418	-0.49	0.625	-.0206241	.0123864
dyear25	-.0047728	.0084274	-0.57	0.571	-.0212963	.0117506
dyear26	-.0061003	.008447	-0.72	0.470	-.0226623	.0104618
dyear27	-.0087311	.0084635	-1.03	0.302	-.0253256	.0078633
dyear28	-.0099771	.0084524	-1.18	0.238	-.0265497	.0065955
dyear29	-.0077487	.0084577	-0.92	0.360	-.0243317	.0088343
dyear30	-.0032575	.008434	-0.39	0.699	-.019794	.013279
_cons	1.947424	.0309736	62.87	0.000	1.886694	2.008154

1.1.2: Agricultural Employment Share

Source	SS	df	MS		
Model	210.025046	37	5.67635258	Number of obs =	3270
Residual	47.7771734	3232	.014782541	F(37, 3232) =	383.99
Total	257.802219	3269	.078862716	Prob > F =	0.0000
				R-squared =	0.8147
				Adj R-squared =	0.8126
				Root MSE =	.12158

agric~tshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.2674443	.0155948	-17.15	0.000	-.298021	-.2368676
lngdppc2co~s	.009767	.0010073	9.70	0.000	.0077921	.011742
lnpopinmil	-.0129942	.0016639	-7.81	0.000	-.0162567	-.0097318
lnpopinmil2	.0029001	.0003979	7.29	0.000	.0021199	.0036802
totagrnona~s	-.0084099	.0065672	-1.28	0.200	-.0212862	.0044664
d1asiancou~s	.0835673	.0086626	9.65	0.000	.0665825	.1005521
d2laccontr~s	-.0141691	.0075941	-1.87	0.062	-.0290588	.0007205
d3ssacount~s	.1618937	.0085293	18.98	0.000	.1451704	.178617
dyear2	-.0021266	.0164714	-0.13	0.897	-.0344221	.0301689
dyear3	-.0076709	.0164762	-0.47	0.642	-.0399757	.0246338
dyear4	-.013255	.0164782	-0.80	0.421	-.0455637	.0190537
dyear5	-.0155536	.0164823	-0.94	0.345	-.0478704	.0167632
dyear6	-.0195793	.0164831	-1.19	0.235	-.0518976	.012739
dyear7	-.023414	.0164816	-1.42	0.156	-.0557294	.0089014
dyear8	-.0260461	.0164806	-1.58	0.114	-.0583595	.0062674
dyear9	-.0279734	.0164841	-1.70	0.090	-.0602936	.0043469
dyear10	-.0321417	.01649	-1.95	0.051	-.0644737	.0001903
dyear11	-.038119	.016505	-2.31	0.021	-.0704804	-.0057576
dyear12	-.0426776	.0165138	-2.58	0.010	-.0750561	-.010299

dyear13	-.0485105	.0165255	-2.94	0.003	-.0809121	-.0161089
dyear14	-.053387	.016534	-3.23	0.001	-.0858051	-.0209688
dyear15	-.058094	.0165365	-3.51	0.000	-.090517	-.025671
dyear16	-.0598114	.0165433	-3.62	0.000	-.0922479	-.027375
dyear17	-.0613644	.0165647	-3.70	0.000	-.0938428	-.0288861
dyear18	-.0631263	.0165784	-3.81	0.000	-.0956316	-.030621
dyear19	-.0651426	.0165937	-3.93	0.000	-.0976779	-.0326073
dyear20	-.0687565	.0166349	-4.13	0.000	-.1013725	-.0361405
dyear21	-.071152	.0166801	-4.27	0.000	-.1038566	-.0384474
dyear22	-.0742076	.0166864	-4.45	0.000	-.1069247	-.0414905
dyear23	-.0775485	.0166917	-4.65	0.000	-.1102759	-.044821
dyear24	-.0802072	.016686	-4.81	0.000	-.1129234	-.0474911
dyear25	-.0808232	.0167044	-4.84	0.000	-.1135756	-.0480708
dyear26	-.0816116	.0167434	-4.87	0.000	-.1144403	-.0487828
dyear27	-.0818514	.0167762	-4.88	0.000	-.1147444	-.0489584
dyear28	-.081778	.0167541	-4.88	0.000	-.1146277	-.0489283
dyear29	-.0838245	.0167646	-5.00	0.000	-.1166948	-.0509542
dyear30	-.0882137	.0167176	-5.28	0.000	-.1209919	-.0554355
_cons	1.825367	.061395	29.73	0.000	1.70499	1.945744

1.1.3: Ln Agricultural Value Added (in millions) (constant 2000 US$)

Source	SS	df	MS		
Model	14436.0222	37	390.162762	Number of obs =	3270
Residual	421.275838	3232	.130345247	F(37, 3232) =	2993.30
				Prob > F =	0.0000
				R-squared =	0.9716
				Adj R-squared =	0.9713
Total	14857.298	3269	4.5449061	Root MSE =	.36103

lnagrvainm~s	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	.4156419	.0463076	8.98	0.000	.3248467	.5064372
lngdppc2co~s	-.0045895	.002991	-1.53	0.125	-.010454	.001275
lnpopinmil	.9660006	.0049409	195.51	0.000	.956313	.9756883
lnpopinmil2	-.0086876	.0011815	-7.35	0.000	-.0110041	-.0063711
totagrnona~s	-.3222264	.0195009	-16.52	0.000	-.3604618	-.2839911
d1asiancou~s	.0933007	.025723	3.63	0.000	.0428657	.1437358
d2laccontr~s	-.0818513	.02255	-3.63	0.000	-.1260651	-.0376375
d3ssacount~s	-.4138583	.0253271	-16.34	0.000	-.4635171	-.3641996
dyear2	-.0091484	.0489107	-0.19	0.852	-.1050476	.0867508
dyear3	-.0183832	.0489248	-0.38	0.707	-.1143099	.0775435
dyear4	-.0420872	.0489307	-0.86	0.390	-.1380256	.0538512
dyear5	-.0211622	.048943	-0.43	0.665	-.1171247	.0748004
dyear6	-.0198707	.0489453	-0.41	0.685	-.1158377	.0760963
dyear7	-.0111724	.0489409	-0.23	0.819	-.1071306	.0847859
dyear8	-.0112025	.048938	-0.23	0.819	-.1071551	.0847502
dyear9	-.0041105	.0489482	-0.08	0.933	-.1000832	.0918623
dyear10	-.0101955	.048966	-0.21	0.835	-.1062031	.0858121
dyear11	-.0277797	.0490105	-0.57	0.571	-.1238745	.0683152
dyear12	-.0447137	.0490365	-0.91	0.362	-.1408594	.0514321

dyear13 |	-.0632887	.0490714	-1.29	0.197	-.1595029	.0329255
dyear14 |	-.0755656	.0490965	-1.54	0.124	-.171829	.0206977
dyear15 |	-.0950877	.0491039	-1.94	0.053	-.1913656	.0011902
dyear16 |	-.0898109	.0491242	-1.83	0.068	-.1861286	.0065069
dyear17 |	-.0773314	.0491876	-1.57	0.116	-.1737734	.0191107
dyear18 |	-.0936295	.0492284	-1.90	0.057	-.1901516	.0028927
dyear19 |	-.1013769	.0492739	-2.06	0.040	-.1979883	-.0047656
dyear20 |	-.1174143	.0493961	-2.38	0.018	-.2142651	-.0205634
dyear21 |	-.1424778	.0495303	-2.88	0.004	-.2395918	-.0453639
dyear22 |	-.1515092	.0495492	-3.06	0.002	-.2486602	-.0543582
dyear23 |	-.1638519	.0495649	-3.31	0.001	-.2610338	-.0666701
dyear24 |	-.1589079	.0495479	-3.21	0.001	-.2560563	-.0617595
dyear25 |	-.1598373	.0496027	-3.22	0.001	-.2570932	-.0625814
dyear26 |	-.1944985	.0497184	-3.91	0.000	-.2919812	-.0970158
dyear27 |	-.2078091	.0498157	-4.17	0.000	-.3054826	-.1101356
dyear28 |	-.211717	.0497501	-4.26	0.000	-.3092619	-.1141721
dyear29 |	-.2104588	.0497813	-4.23	0.000	-.3080649	-.1128528
dyear30 |	-.1890771	.0496418	-3.81	0.000	-.2864096	-.0917445
_cons |	3.151659	.182308	17.29	0.000	2.794208	3.50911

1.1.4: Ln Agricultural Value Added per Worker (constant 2000 US$)

Source	SS	df	MS		
Model	7477.97241	37	202.107362	Number of obs =	3270
Residual	673.789243	3232	.208474395	F(37, 3232) =	969.46
Total	8151.76165	3269	2.49365606	Prob > F =	0.0000
				R-squared =	0.9173
				Adj R-squared =	0.9164
				Root MSE =	.45659

lnagrvapwo~r	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.0369497	.058564	-0.63	0.528	-.1517761	.0778767
lngdppc2co~s	.0526674	.0037827	13.92	0.000	.0452507	.060084
lnpopinmil	.0302297	.0062487	4.84	0.000	.0179779	.0424814
lnpopinmil2	-.020913	.0014942	-14.00	0.000	-.0238426	-.0179833
totagrnona~s	-.3503251	.0246623	-14.20	0.000	-.3986804	-.3019699
d1asiancou~s	-.3376272	.0325312	-10.38	0.000	-.4014111	-.2738433
d2laccontr~s	-.205695	.0285185	-7.21	0.000	-.2616111	-.1497789
d3ssacount~s	-.9916702	.0320305	-30.96	0.000	-1.054472	-.9288681
dyear2	-.0054604	.0618562	-0.09	0.930	-.1267417	.1158208
dyear3	-.0037233	.0618739	-0.06	0.952	-.1250395	.1175928
dyear4	-.0209134	.0618815	-0.34	0.735	-.1422442	.1004175
dyear5	-.0004349	.061897	-0.01	0.994	-.1217963	.1209264
dyear6	.0072065	.0618999	0.12	0.907	-.1141606	.1285735
dyear7	.0198697	.0618943	0.32	0.748	-.1014863	.1412257
dyear8	.0249524	.0618906	0.40	0.687	-.0963965	.1463013
dyear9	.031544	.0619036	0.51	0.610	-.0898303	.1529182
dyear10	.0329072	.0619261	0.53	0.595	-.0885111	.1543255
dyear11	.0256906	.0619824	0.41	0.679	-.0958382	.1472193
dyear12	.0231935	.0620152	0.37	0.708	-.0983997	.1447866

dyear13 |	.014122	.0620593	0.23	0.820	-.1075576	.1358017
dyear14 |	.0135188	.062091	0.22	0.828	-.108223	.1352606
dyear15 |	.0012632	.0621004	0.02	0.984	-.1204971	.1230234
dyear16 |	.0079514	.0621261	0.13	0.898	-.1138592	.1297619
dyear17 |	.0235966	.0622063	0.38	0.704	-.0983712	.1455644
dyear18 |	.009773	.062258	0.16	0.875	-.1122961	.131842
dyear19 |	.0060384	.0623155	0.10	0.923	-.1161435	.1282203
dyear20 |	-.0037912	.06247	-0.06	0.952	-.126276	.1186935
dyear21 |	-.0263477	.0626397	-0.42	0.674	-.1491653	.0964698
dyear22 |	-.0216333	.0626636	-0.35	0.730	-.1444978	.1012311
dyear23 |	-.022634	.0626835	-0.36	0.718	-.1455374	.1002694
dyear24 |	-.0106786	.0626619	-0.17	0.865	-.1335398	.1121825
dyear25 |	-.0104037	.0627313	-0.17	0.868	-.1334007	.1125934
dyear26 |	-.0454242	.0628775	-0.72	0.470	-.168708	.0778597
dyear27 |	-.0599903	.0630006	-0.95	0.341	-.1835155	.0635349
dyear28 |	-.0613371	.0629176	-0.97	0.330	-.1846996	.0620254
dyear29 |	-.0457429	.0629571	-0.73	0.468	-.1691828	.0776969
dyear30 |	.0039362	.0627807	0.06	0.950	-.1191578	.1270302
_cons |	5.602914	.2305603	24.30	0.000	5.150855	6.054973

1.1.5: Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	58.166141	36	1.61572614	Number of obs =	3270
Residual	53.2520694	3233	.01647141	F(36, 3233) =	98.09
				Prob > F =	0.0000
				R-squared =	0.5221
				Adj R-squared =	0.5167
Total	111.41821	3269	.03408327	Root MSE =	.12834

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.1248956	.0164615	-7.59	0.000	-.1571717	-.0926195
lngdppc2co~s	.0101367	.0010632	9.53	0.000	.0080521	.0122213
lnpopinmil	.0044411	.0017547	2.53	0.011	.0010006	.0078816
lnpopinmil2	-.0036047	.00042	-8.58	0.000	-.0044282	-.0027812
totagrnona~s	.05152	.0068291	7.54	0.000	.0381301	.0649098
d1asiancou~s	-.0814095	.0091431	-8.90	0.000	-.0993364	-.0634827
d2laccontr~s	.0104782	.0080103	1.31	0.191	-.0052276	.026184
d3ssacount~s	-.2111235	.0089925	-23.48	0.000	-.228755	-.1934919
dyear2	-.0313266	.0151154	-2.07	0.038	-.0609632	-.0016899
dyear3	-.0273496	.0150987	-1.81	0.070	-.0569535	.0022543
dyear4	-.0241333	.0150938	-1.60	0.110	-.0537276	.005461
dyear5	-.0200292	.0150854	-1.33	0.184	-.0496071	.0095487
dyear6	-.015014	.0150837	-1.00	0.320	-.0445885	.0145606
dyear7	-.010568	.0150853	-0.70	0.484	-.0401458	.0190097
dyear8	-.0069273	.0150868	-0.46	0.646	-.036508	.0226535
dyear9	-.002723	.0150814	-0.18	0.857	-.032293	.026847
dyear10	-.0004431	.015074	-0.03	0.977	-.0299986	.0291125
dyear11	.0036369	.0150633	0.24	0.809	-.0258976	.0331714
dyear12	.0070897	.01506	0.47	0.638	-.0224384	.0366178

dyear13 |	.0124024	.0150578	0.82	0.410	-.0171213	.0419261
dyear14 |	.0173948	.0150572	1.16	0.248	-.0121279	.0469175
dyear15 |	.0167533	.0150575	1.11	0.266	-.0127699	.0462766
dyear16 |	.0250734	.0150569	1.67	0.096	-.0044486	.0545955
dyear17 |	.0310649	.0150586	2.06	0.039	.0015396	.0605902
dyear18 |	.0314265	.0150609	2.09	0.037	.0018967	.0609563
dyear19 |	.0365944	.0150647	2.43	0.015	.0070571	.0661316
dyear20 |	.0385479	.0150795	2.56	0.011	.0089815	.0681143
dyear21 |	.0336727	.0151005	2.23	0.026	.0040652	.0632803
dyear22 |	.0350675	.0151035	2.32	0.020	.0054541	.0646809
dyear23 |	.0354439	.0151061	2.35	0.019	.0058254	.0650623
dyear24 |	.0392934	.0151028	2.60	0.009	.0096814	.0689053
dyear25 |	.039165	.0151121	2.59	0.010	.0095347	.0687954
dyear26 |	.0384497	.015134	2.54	0.011	.0087765	.0681228
dyear27 |	.0359187	.0151536	2.37	0.018	.0062071	.0656304
dyear29 |	.038921	.0151463	2.57	0.010	.0092238	.0686183
dyear30 |	.0480103	.0151194	3.18	0.002	.0183657	.0776548
_cons |	.1597912	.0641373	2.49	0.013	.0340374	.2855451

1.2. 88 Developing Countries

1.2.1. Agricultural Value Added Share

```
      Source |       SS       df       MS              Number of obs =    2640
-------------+------------------------------           F( 37,  2602) =  269.12
       Model |  44.9348303    37  1.21445487           Prob > F      =  0.0000
    Residual |   11.741929  2602  .004512655           R-squared     =  0.7928
-------------+------------------------------           Adj R-squared =  0.7899
       Total |  56.6767594  2639  .021476605           Root MSE      =  .06718


------------------------------------------------------------------------------
agric~dshare |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lngdppccon~s |  -.3941102   .0158858   -24.81   0.000    -.4252603   -.3629601
lngdppc2co~s |   .0198384    .001161    17.09   0.000     .0175618     .022115
  lnpopinmil |  -.0097761   .0009605   -10.18   0.000    -.0116596   -.0078926
 lnpopinmil2 |   -.000658   .0002403    -2.74   0.006    -.0011293   -.0001868
totagrnona~s |   .0565618   .0041335    13.68   0.000     .0484566     .064667
d1asiancou~s |  -.0007127   .0055512    -0.13   0.898     -.011598    .0101726
d2laccount~s |  -.0036644   .0052081    -0.70   0.482    -.0138769    .0065481
d3ssacount~s |  -.0525923   .0053819    -9.77   0.000    -.0631456    -.042039
      dyear2 |   .0021139   .0101283     0.21   0.835    -.0177464    .0219742
      dyear3 |  -.0003385   .0101296    -0.03   0.973    -.0202015    .0195245
      dyear4 |  -.0028658   .0101297    -0.28   0.777    -.0227289    .0169973
      dyear5 |  -.0011338   .0101311    -0.11   0.911    -.0209996    .0187321
      dyear6 |   .0000652   .0101301     0.01   0.995    -.0197986     .019929
      dyear7 |   .0010092   .0101291     0.10   0.921    -.0188526    .0208711
      dyear8 |   .0022699   .0101288     0.22   0.823    -.0175915    .0221313
      dyear9 |   .0056009   .0101302     0.55   0.580    -.0142631     .025465
     dyear10 |   .0039011    .010133     0.38   0.700    -.0159684    .0237707
     dyear11 |     .00201   .0101379     0.20   0.843    -.0178691    .0218891
```

dyear12	.0002418	.0101386	0.02	0.981	-.0196388	.0201224
dyear13	-.000544	.0101415	-0.05	0.957	-.0204303	.0193423
dyear14	-.0006295	.0101437	-0.06	0.951	-.0205201	.0192611
dyear15	-.0066953	.0101478	-0.66	0.509	-.026594	.0132034
dyear16	.002135	.0101514	0.21	0.833	-.0177706	.0220406
dyear17	.0082179	.0101622	0.81	0.419	-.0117088	.0281446
dyear18	.0066439	.0101659	0.65	0.513	-.0132902	.0265781
dyear19	.0108586	.0101722	1.07	0.286	-.0090879	.030805
dyear20	.0092403	.0101903	0.91	0.365	-.0107417	.0292222
dyear21	.0011486	.010218	0.11	0.911	-.0188876	.0211849
dyear22	-.0003766	.0102241	-0.04	0.971	-.0204247	.0196715
dyear23	-.004064	.0102207	-0.40	0.691	-.0241055	.0159775
dyear24	-.0023339	.0102188	-0.23	0.819	-.0223717	.017704
dyear25	-.0033144	.0102275	-0.32	0.746	-.0233692	.0167404
dyear26	-.0050685	.0102419	-0.49	0.621	-.0251515	.0150145
dyear27	-.00786	.0102638	-0.77	0.444	-.027986	.012266
dyear28	-.0089892	.0102609	-0.88	0.381	-.0291096	.0111312
dyear29	-.0065902	.0102636	-0.64	0.521	-.0267158	.0135354
dyear30	-.0020458	.0102276	-0.20	0.841	-.0221008	.0180093
_cons	1.951542	.0563792	34.61	0.000	1.840989	2.062094

1.2.2: Agricultural Employment Share

Source	SS	df	MS		
Model	121.370051	37	3.28027166	Number of obs =	2640
Residual	45.7887673	2602	.017597528	F(37, 2602) =	186.41
				Prob > F =	0.0000
				R-squared =	0.7261
				Adj R-squared =	0.7222
Total	167.158819	2639	.063341727	Root MSE =	.13266

agric~tshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.4153767	.0313703	-13.24	0.000	-.4768901	-.3538634
lngdppc2co~s	.0213338	.0022927	9.31	0.000	.0168381	.0258296
lnpopinmil	-.0098813	.0018968	-5.21	0.000	-.0136007	-.0061618
lnpopinmil2	.002738	.0004746	5.77	0.000	.0018074	.0036686
totagrnona~s	-.0103756	.0081625	-1.27	0.204	-.0263812	.0056301
d1asiancou~s	.0990289	.0109622	9.03	0.000	.0775333	.1205244
d2laccount~s	-.0290317	.0102847	-2.82	0.005	-.0491988	-.0088647
d3ssacount~s	.1638426	.0106279	15.42	0.000	.1430026	.1846826
dyear2	-.0016716	.0200007	-0.08	0.933	-.0408905	.0375474
dyear3	-.0073836	.0200034	-0.37	0.712	-.0466078	.0318406
dyear4	-.0136123	.0200035	-0.68	0.496	-.0528368	.0256121
dyear5	-.0165412	.0200063	-0.83	0.408	-.055771	.0226887
dyear6	-.0211427	.0200042	-1.06	0.291	-.0603685	.0180831
dyear7	-.0257829	.0200023	-1.29	0.198	-.0650048	.0134391
dyear8	-.0288422	.0200018	-1.44	0.149	-.0680633	.0103789
dyear9	-.0314014	.0200045	-1.57	0.117	-.0706278	.0078249
dyear10	-.0366823	.02001	-1.83	0.067	-.0759195	.002555
dyear11	-.0441003	.0200197	-2.20	0.028	-.0833564	-.0048443
dyear12	-.0492919	.0200212	-2.46	0.014	-.0885509	-.0100329

dyear13	-.0566145	.0200269	-2.83	0.005	-.0958848	-.0173443
dyear14	-.0624321	.0200312	-3.12	0.002	-.1017108	-.0231533
dyear15	-.0689073	.0200393	-3.44	0.001	-.1082019	-.0296126
dyear16	-.0710477	.0200464	-3.54	0.000	-.1103562	-.0317393
dyear17	-.0731887	.0200676	-3.65	0.000	-.1125388	-.0338386
dyear18	-.0755271	.0200751	-3.76	0.000	-.1148919	-.0361623
dyear19	-.078263	.0200875	-3.90	0.000	-.1176521	-.0388739
dyear20	-.0829381	.0201232	-4.12	0.000	-.1223972	-.043479
dyear21	-.0865815	.0201779	-4.29	0.000	-.1261478	-.0470151
dyear22	-.0900614	.0201898	-4.46	0.000	-.1296512	-.0504716
dyear23	-.0939295	.0201832	-4.65	0.000	-.1335062	-.0543527
dyear24	-.097462	.0201795	-4.83	0.000	-.1370315	-.0578925
dyear25	-.0987881	.0201966	-4.89	0.000	-.1383911	-.059185
dyear26	-.1001441	.020225	-4.95	0.000	-.1398028	-.0604853
dyear27	-.1013126	.0202683	-5.00	0.000	-.1410563	-.0615689
dyear28	-.1021594	.0202626	-5.04	0.000	-.1418919	-.0624269
dyear29	-.1046298	.0202679	-5.16	0.000	-.1443726	-.064887
dyear30	-.1081678	.0201968	-5.36	0.000	-.1477713	-.0685643
_cons	2.290192	.1113342	20.57	0.000	2.07188	2.508505

1.2.3: Ln Agricultural Value Added (in millions) (constant 2000 US$)

Source	SS	df	MS
Model	10772.0657	37	291.13691
Residual	327.843488	2602	.125996729
Total	11099.9091	2639	4.20610426

Number of obs =	2640
F(37, 2602) =	2310.67
Prob > F =	0.0000
R-squared =	0.9705
Adj R-squared =	0.9700
Root MSE =	.35496

lnagrvainm~s	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	.7850592	.0839408	9.35	0.000	.6204617	.9496568
lngdppc2co~s	-.0342292	.0061349	-5.58	0.000	-.0462588	-.0221995
lnpopinmil	.9527001	.0050755	187.70	0.000	.9427476	.9626525
lnpopinmil2	-.0025191	.0012699	-1.98	0.047	-.0050092	-.0000289
totagrnona~s	-.3044336	.0218412	-13.94	0.000	-.3472615	-.2616057
d1asiancou~s	.0771119	.0293328	2.63	0.009	.019594	.1346298
d2laccount~s	.0379196	.0275198	1.38	0.168	-.0160434	.0918826
d3ssacount~s	-.3401364	.0284382	-11.96	0.000	-.3959001	-.2843727
dyear2	-.0078493	.053518	-0.15	0.883	-.1127914	.0970927
dyear3	-.0237883	.0535251	-0.44	0.657	-.1287444	.0811679
dyear4	-.0408512	.0535254	-0.76	0.445	-.1458079	.0641056
dyear5	-.0254542	.0535328	-0.48	0.634	-.1304254	.0795171
dyear6	-.0170134	.0535273	-0.32	0.751	-.1219739	.0879471
dyear7	-.001617	.0535221	-0.03	0.976	-.1065673	.1033332
dyear8	.0024043	.0535209	0.04	0.964	-.1025436	.1073521
dyear9	.0135239	.053528	0.25	0.801	-.091438	.1184857
dyear10	.0016529	.0535429	0.03	0.975	-.1033381	.1066439
dyear11	-.0137775	.0535686	-0.26	0.797	-.118819	.0912639
dyear12	-.0261289	.0535726	-0.49	0.626	-.1311782	.0789204

dyear13	-.0399104	.053588	-0.74	0.456	-.1449898	.0651689
dyear14	-.0518683	.0535996	-0.97	0.333	-.1569704	.0532339
dyear15	-.0745145	.0536213	-1.39	0.165	-.1796591	.0306302
dyear16	-.061625	.0536401	-1.15	0.251	-.1668065	.0435565
dyear17	-.0466112	.0536969	-0.87	0.385	-.1519042	.0586818
dyear18	-.0619686	.0537169	-1.15	0.249	-.1673008	.0433637
dyear19	-.0614792	.0537502	-1.14	0.253	-.1668766	.0439182
dyear20	-.0790497	.0538457	-1.47	0.142	-.1846345	.0265351
dyear21	-.1074605	.0539921	-1.99	0.047	-.2133323	-.0015888
dyear22	-.1135821	.054024	-2.10	0.036	-.2195165	-.0076478
dyear23	-.1202211	.0540062	-2.23	0.026	-.2261206	-.0143216
dyear24	-.1045725	.0539963	-1.94	0.053	-.2104525	.0013075
dyear25	-.1132665	.0540421	-2.10	0.036	-.2192363	-.0072967
dyear26	-.1362352	.0541181	-2.52	0.012	-.2423541	-.0301164
dyear27	-.1444693	.054234	-2.66	0.008	-.2508155	-.0381231
dyear28	-.1478631	.0542188	-2.73	0.006	-.2541794	-.0415469
dyear29	-.1418027	.0542328	-2.61	0.009	-.2481465	-.0354589
dyear30	-.114613	.0540427	-2.12	0.034	-.220584	-.0086419
_cons	1.904762	.2979082	6.39	0.000	1.320601	2.488923

1.2.4: Ln Agricultural Value Added per Worker (constant 2000 US$)

Source	SS	df	MS
Model	2843.12618	37	76.8412481
Residual	554.260688	2602	.213013331
Total	3397.38687	2639	1.28737661

Number of obs =	2640
F(37, 2602) =	360.73
Prob > F =	0.0000
R-squared =	0.8369
Adj R-squared =	0.8345
Root MSE =	.46153

lnagrvapwo~r	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	1.039259	.1091433	9.52	0.000	.8252427	1.253275
lngdppc2co~s	-.0303436	.0079768	-3.80	0.000	-.0459851	-.0147021
lnpopinmil	.0119167	.0065994	1.81	0.071	-.0010239	.0248573
lnpopinmil2	-.0196424	.0016512	-11.90	0.000	-.0228802	-.0164046
totagrnona~s	-.2798613	.0283988	-9.85	0.000	-.3355479	-.2241747
d1asiancou~s	-.3558687	.0381396	-9.33	0.000	-.4306558	-.2810816
d2laccount~s	-.0549824	.0357824	-1.54	0.125	-.1251472	.0151825
d3ssacount~s	-.934184	.0369765	-25.26	0.000	-1.00669	-.8616777
dyear2	-.0062571	.0695862	-0.09	0.928	-.1427071	.1301929
dyear3	-.0127598	.0695956	-0.18	0.855	-.1492281	.1237085
dyear4	-.0236349	.069596	-0.34	0.734	-.1601039	.1128341
dyear5	-.0074724	.0696056	-0.11	0.915	-.1439603	.1290155
dyear6	.0078718	.0695984	0.11	0.910	-.1286021	.1443457
dyear7	.0273656	.0695916	0.39	0.694	-.1090949	.1638262
dyear8	.0365946	.06959	0.53	0.599	-.0998629	.173052
dyear9	.0473869	.0695993	0.68	0.496	-.0890887	.1838626
dyear10	.0447956	.0696187	0.64	0.520	-.0917179	.1813092
dyear11	.0425961	.0696521	0.61	0.541	-.0939831	.1791753
dyear12	.0423196	.0696573	0.61	0.544	-.0942698	.178909

dyear13 |	.0372041	.0696772	0.53	0.593	-.0994244	.1738325
dyear14 |	.0333591	.0696924	0.48	0.632	-.103299	.1700172
dyear15 |	.0200768	.0697206	0.29	0.773	-.1166366	.1567902
dyear16 |	.0379286	.069745	0.54	0.587	-.0988327	.1746899
dyear17 |	.0552797	.0698189	0.79	0.429	-.0816266	.1921859
dyear18 |	.0406856	.069845	0.58	0.560	-.0962717	.1776429
dyear19 |	.044378	.0698881	0.63	0.525	-.092664	.18142
dyear20 |	.0351579	.0700124	0.50	0.616	-.1021278	.1724435
dyear21 |	.0137201	.0702027	0.20	0.845	-.1239387	.1513788
dyear22 |	.0173759	.0702442	0.25	0.805	-.1203643	.1551161
dyear23 |	.0172472	.0702211	0.25	0.806	-.1204477	.154942
dyear24 |	.0368594	.0702082	0.53	0.600	-.1008102	.1745289
dyear25 |	.0286061	.0702677	0.41	0.684	-.1091802	.1663923
dyear26 |	.0040497	.0703665	0.06	0.954	-.1339304	.1420297
dyear27 |	-.0047799	.0705173	-0.07	0.946	-.1430555	.1334958
dyear28 |	-.0068891	.0704974	-0.10	0.922	-.1451259	.1313476
dyear29 |	.0055109	.0705157	0.08	0.938	-.1327617	.1437834
dyear30 |	.0430115	.0702685	0.61	0.541	-.0947764	.1807993
_cons |	2.083489	.3873524	5.38	0.000	1.323939	2.843039

1.2.5: Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	33.5944942	37	.907959303	Number of obs =	2640
Residual	50.7168273	2602	.019491479	F(37, 2602) =	46.58
Total	84.3113215	2639	.031948208	Prob > F =	0.0000
				R-squared =	0.3985
				Adj R-squared =	0.3899
				Root MSE =	.13961

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	.0212666	.0330153	0.64	0.520	-.0434724	.0860056
lngdppc2co~s	-.0014954	.0024129	-0.62	0.535	-.0062269	.0032361
lnpopinmil	.0001051	.0019963	0.05	0.958	-.0038093	.0040196
lnpopinmil2	-.0033961	.0004995	-6.80	0.000	-.0043755	-.0024166
totagrnona~s	.0669373	.0085905	7.79	0.000	.0500924	.0837823
d1asiancou~s	-.0997415	.0115371	-8.65	0.000	-.1223643	-.0771188
d2laccount~s	.0253673	.010824	2.34	0.019	.0041428	.0465919
d3ssacount~s	-.2164349	.0111852	-19.35	0.000	-.2383677	-.1945021
dyear2	.0037855	.0210495	0.18	0.857	-.03749	.045061
dyear3	.0070451	.0210523	0.33	0.738	-.0342359	.0483261
dyear4	.0107466	.0210525	0.51	0.610	-.0305347	.0520278
dyear5	.0154074	.0210554	0.73	0.464	-.0258796	.0566944
dyear6	.0212079	.0210532	1.01	0.314	-.0200748	.0624906
dyear7	.0267921	.0210512	1.27	0.203	-.0144866	.0680708
dyear8	.031112	.0210507	1.48	0.140	-.0101657	.0723898
dyear9	.0370024	.0210535	1.76	0.079	-.0042809	.0782857
dyear10	.0405834	.0210593	1.93	0.054	-.0007114	.0818781
dyear11	.0461103	.0210695	2.19	0.029	.0047957	.0874249
dyear12	.0495337	.021071	2.35	0.019	.008216	.0908514

dyear13	.0560706	.0210771	2.66	0.008	.0147411	.0974001
dyear14	.0618025	.0210816	2.93	0.003	.0204641	.103141
dyear15	.062212	.0210902	2.95	0.003	.0208568	.1035671
dyear16	.0731827	.0210975	3.47	0.001	.0318131	.1145524
dyear17	.0814066	.0211199	3.85	0.000	.0399931	.1228201
dyear18	.0821711	.0211278	3.89	0.000	.0407421	.1236
dyear19	.0891216	.0211409	4.22	0.000	.047667	.1305762
dyear20	.0921784	.0211784	4.35	0.000	.0506501	.1337067
dyear21	.0877301	.021236	4.13	0.000	.0460889	.1293713
dyear22	.0896848	.0212486	4.22	0.000	.048019	.1313506
dyear23	.0898654	.0212416	4.23	0.000	.0482134	.1315175
dyear24	.0951282	.0212377	4.48	0.000	.0534837	.1367726
dyear25	.0954737	.0212557	4.49	0.000	.053794	.1371534
dyear26	.0950756	.0212856	4.47	0.000	.0533372	.136814
dyear27	.0934526	.0213312	4.38	0.000	.0516249	.1352804
dyear28	.0931702	.0213252	4.37	0.000	.0513542	.1349862
dyear29	.0980396	.0213307	4.60	0.000	.0562128	.1398664
dyear30	.1061221	.0212559	4.99	0.000	.0644419	.1478023
_cons	-.3386506	.1171724	-2.89	0.004	-.5684111	-.10889

2. Regression Results Using Regional dummies (Asia, LAC and SSA) and Decadal dummies

2.1: 109 Countries (88 Developing and 21 Developed)

2.1.1. Agricultural Value Added Share

Source	SS	df	MS
Model	63.3171317	10	6.33171317
Residual	12.1875302	3259	.003739653
Total	75.5046619	3269	.023097174

Number of obs =	3270
F(10, 3259) =	1693.13
Prob > F =	0.0000
R-squared =	0.8386
Adj R-squared =	0.8381
Root MSE =	.06115

agric~dshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.3923352	.0078422	-50.03	0.000	-.4077114	-.3769591
lngdppc2co~s	.0198656	.0005065	39.22	0.000	.0188724	.0208588
lnpopinmil	-.0088441	.0008365	-10.57	0.000	-.0104842	-.0072041
lnpopinmil2	-.000703	.0002001	-3.51	0.000	-.0010954	-.0003107
totagrnona~s	.0476318	.0032793	14.53	0.000	.0412022	.0540614
d1asiancou~s	.0016283	.0043562	0.37	0.709	-.0069129	.0101695
d2laccount~s	-.0048596	.0038179	-1.27	0.203	-.0123454	.0026261
d3ssacount~s	-.0509363	.0042858	-11.88	0.000	-.0593394	-.0425332
yd~119801989	.0064306	.0028701	2.24	0.025	.0008033	.0120578
yd~219901999	.007427	.0026945	2.76	0.006	.002144	.01271
_cons	1.942288	.0302882	64.13	0.000	1.882902	2.001674

2.1.2: Agricultural Employment Share

Source	SS	df	MS
Model	209.787379	10	20.9787379
Residual	48.0148402	3259	.014732998
Total	257.802219	3269	.078862716

Number of obs	3270
F(10, 3259)	1423.93
Prob > F	0.0000
R-squared	0.8138
Adj R-squared	0.8132
Root MSE	.12138

agric~tshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.2673636	.0155656	-17.18	0.000	-.297883	-.2368441
lngdppc2co~s	.0097368	.0010054	9.68	0.000	.0077655	.0117081
lnpopinmil	-.0131841	.0016603	-7.94	0.000	-.0164394	-.0099288
lnpopinmil2	.0028987	.0003972	7.30	0.000	.0021199	.0036775
totagrnona~s	-.005819	.0065089	-0.89	0.371	-.0185809	.006943
d1asiancou~s	.0831536	.0086465	9.62	0.000	.0662005	.1001067
d2laccount~s	-.0149695	.007578	-1.98	0.048	-.0298278	-.0001113
d3ssacount~s	.1607298	.0085067	18.89	0.000	.1440509	.1774088
yd~119801989	.0623251	.0056966	10.94	0.000	.0511557	.0734945
yd~219901999	.0236741	.0053481	4.43	0.000	.0131881	.0341602
_cons	1.744989	.0601178	29.03	0.000	1.627116	1.862861

2.1.3: Ln Agricultural Value Added (in millions) (constant 2000 US$)

Source	SS	df	MS
Model	14434.4915	10	1443.44915
Residual	422.806533	3259	.129735052
Total	14857.298	3269	4.5449061

Number of obs =	3270
F(10, 3259) =	11126.13
Prob > F =	0.0000
R-squared =	0.9715
Adj R-squared =	0.9715
Root MSE =	.36019

lnagrvainm~s	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	.4152528	.0461902	8.99	0.000	.3246879	.5058176
lngdppc2co~s	-.0046238	.0029835	-1.55	0.121	-.0104735	.0012259
lnpopinmil	.9656005	.0049268	195.99	0.000	.9559406	.9752605
lnpopinmil2	-.0086852	.0011787	-7.37	0.000	-.0109962	-.0063741
totagrnona~s	-.3161839	.0193148	-16.37	0.000	-.3540543	-.2783135
d1asiancou~s	.092313	.025658	3.60	0.000	.0420056	.1426203
d2laccount~s	-.0835384	.0224874	-3.71	0.000	-.1276294	-.0394474
d3ssacount~s	-.4165759	.0252431	-16.50	0.000	-.4660699	-.3670818
yd~119801989	.1619263	.0169045	9.58	0.000	.1287817	.1950708
yd~219901999	.0991429	.0158703	6.25	0.000	.0680261	.1302597
_cons	2.974073	.1783965	16.67	0.000	2.624292	3.323853

2.1.4: Ln Agricultural Value Added per Worker (constant 2000 US$)

```
      Source |       SS       df       MS              Number of obs =    3270
-------------+------------------------------           F( 10,  3259) = 3611.76
       Model |  7477.08186    10  747.708186           Prob > F      =  0.0000
    Residual |  674.679789  3259  .207020494           R-squared     =  0.9172
-------------+------------------------------           Adj R-squared =  0.9170
       Total |  8151.76165  3269  2.49365606           Root MSE      =    .455

------------------------------------------------------------------------------
lnagrvapwo~r |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lngdppccon~s |  -.0368568   .0583483    -0.63   0.528    -.1512599    .0775462
lngdppc2co~s |   .0526536   .0037688    13.97   0.000     .0452641    .0600431
  lnpopinmil |   .0301856   .0062236     4.85   0.000      .017983    .0423881
 lnpopinmil2 |  -.0209063    .001489   -14.04   0.000    -.0238257   -.0179869
totagrnona~s |  -.3486933   .0243988   -14.29   0.000    -.3965318   -.3008548
d1asiancou~s |  -.3376468   .0324116   -10.42   0.000    -.4011959   -.2740977
d2laccount~s |  -.2058813   .0284065    -7.25   0.000    -.2615778   -.1501849
d3ssacount~s |  -.9919154   .0318876   -31.11   0.000    -1.054437   -.9293937
yd~119801989 |   .0380518   .0213541     1.78   0.075    -.0038169    .0799206
yd~219901999 |   .0418564   .0200477     2.09   0.037     .0025491    .0811637
       _cons |   5.571587   .2253535    24.72   0.000     5.129738    6.013436
------------------------------------------------------------------------------
```

2.1.5: Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	58.1214077	10	5.81214077	Number of obs =	3270
Residual	53.2968027	3259	.016353729	F(10, 3259) =	355.40
Total	111.41821	3269	.03408327	Prob > F =	0.0000
				R-squared =	0.5217
				Adj R-squared =	0.5202
				Root MSE =	.12788

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.1249717	.0163995	-7.62	0.000	-.157126	-.0928174
lngdppc2co~s	.0101288	.0010593	9.56	0.000	.0080519	.0122057
lnpopinmil	.00434	.0017492	2.48	0.013	.0009104	.0077697
lnpopinmil2	-.0036017	.0004185	-8.61	0.000	-.0044222	-.0027812
totagrnona~s	.0534508	.0068576	7.79	0.000	.0400052	.0668964
d1asiancou~s	-.0815253	.0091097	-8.95	0.000	-.0993865	-.0636641
d2laccount~s	.0101099	.007984	1.27	0.206	-.0055442	.0257641
d3ssacount~s	-.2116661	.0089624	-23.62	0.000	-.2292386	-.1940937
yd~119801989	-.0558946	.0060018	-9.31	0.000	-.0676623	-.0441269
yd~219901999	-.0162471	.0056346	-2.88	0.004	-.0272949	-.0051994
_cons	.1972996	.0633382	3.12	0.002	.0731128	.3214864

2.2: Developing Countries (Total 88 Countries)

2.2.1: Agricultural Value Added Share

```
      Source |       SS       df       MS              Number of obs =    2640
-------------+------------------------------           F( 10,  2629) = 1002.11
       Model |  44.8979332    10  4.48979332           Prob > F      =  0.0000
    Residual |  11.7788262  2629  .004480345           R-squared     =  0.7922
-------------+------------------------------           Adj R-squared =  0.7914
       Total |  56.6767594  2639  .021476605           Root MSE      =  .06694
```

agric~dshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.3943208	.0158111	-24.94	0.000	-.4253242	-.3633174
lngdppc2co~s	.0198589	.0011552	17.19	0.000	.0175937	.0221241
lnpopinmil	-.0097405	.0009562	-10.19	0.000	-.0116154	-.0078656
lnpopinmil2	-.0006594	.0002394	-2.75	0.006	-.0011289	-.0001899
totagrnona~s	.0561289	.0040981	13.70	0.000	.0480931	.0641647
d1asiancou~s	-.000709	.0055306	-0.13	0.898	-.0115537	.0101357
d2laccount~s	-.0036651	.0051889	-0.71	0.480	-.0138399	.0065097
d3ssacount~s	-.0525109	.005361	-9.80	0.000	-.0630231	-.0419988
yd~119801989	.005152	.0034421	1.50	0.135	-.0015974	.0119014
yd~219901999	.0071814	.0032805	2.19	0.029	.0007488	.0136141
_cons	1.948372	.0552846	35.24	0.000	1.839966	2.056778

2.2.2: Agricultural Employment Share

Source	SS	df	MS
Model	121.081676	10	12.1081676
Residual	46.0771429	2629	.01752649
Total	167.158819	2639	.063341727

Number of obs =	2640
F(10, 2629) =	690.85
Prob > F =	0.0000
R-squared =	0.7244
Adj R-squared =	0.7233
Root MSE =	.13239

agric~tshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.411112	.0312718	-13.15	0.000	-.4724318	-.3497921
lngdppc2co~s	.0209677	.0022848	9.18	0.000	.0164875	.0254478
lnpopinmil	-.0101695	.0018912	-5.38	0.000	-.0138778	-.0064612
lnpopinmil2	.002753	.0004736	5.81	0.000	.0018243	.0036816
totagrnona~s	-.0083714	.0081053	-1.03	0.302	-.0242648	.0075221
d1asiancou~s	.0986095	.0109386	9.01	0.000	.0771604	.1200586
d2laccount~s	-.0286807	.0102629	-2.79	0.005	-.0488048	-.0085566
d3ssacount~s	.1631238	.0106031	15.38	0.000	.1423325	.1839152
yd~119801989	.0791318	.0068079	11.62	0.000	.0657825	.0924811
yd~219901999	.031578	.0064883	4.87	0.000	.0188552	.0443007
_cons	2.179212	.1093443	19.93	0.000	1.964802	2.393622

2.2.3: Ln Agricultural Value Added (in millions) (constant 2000 US$)

```
      Source |       SS       df       MS              Number of obs =    2640
-------------+------------------------------           F( 10,  2629) = 8617.57
       Model |  10771.3042    10  1077.13042           Prob > F      =  0.0000
    Residual |  328.604924  2629  .124992364           R-squared     =  0.9704
-------------+------------------------------           Adj R-squared =  0.9703
       Total |  11099.9091  2639  4.20610426           Root MSE      =  .35354

------------------------------------------------------------------------------
lnagrvainm~s |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lngdppccon~s |   .7917119   .0835116     9.48   0.000     .6279567    .9554671
lngdppc2co~s |  -.0347692   .0061016    -5.70   0.000    -.0467335   -.0228048
  lnpopinmil |   .9523962   .0050503   188.58   0.000     .9424931    .9622992
 lnpopinmil2 |  -.0024849   .0012647    -1.96   0.050    -.0049649   -5.00e-06
totagrnona~s |  -.3009129   .0216454   -13.90   0.000    -.3433566   -.2584692
d1asiancou~s |   .0768728   .0292116     2.63   0.009     .0195927    .1341528
d2laccount~s |   .0385144   .0274071     1.41   0.160    -.0152273    .0922561
d3ssacount~s |  -.3404732   .0283158   -12.02   0.000    -.3959967   -.2849497
yd~119801989 |   .1132315   .0181805     6.23   0.000      .077582    .1488809
yd~219901999 |   .0719715   .0173272     4.15   0.000     .0379952    .1059477
       _cons |   1.757852   .2920052     6.02   0.000     1.185268    2.330435
------------------------------------------------------------------------------
```

2.2.4: Ln Agricultural Value Added per Worker (constant 2000 US$)

Source	SS	df	MS		
Model	2842.31801	10	284.231801	Number of obs =	2640
Residual	555.068852	2629	.211133074	F(10, 2629) =	1346.22
				Prob > F =	0.0000
				R-squared =	0.8366
				Adj R-squared =	0.8360
Total	3397.38687	2639	1.28737661	Root MSE =	.45949

lnagrvapwo~r	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	1.040346	.1085384	9.59	0.000	.8275169	1.253176
lngdppc2co~s	-.0304083	.0079301	-3.83	0.000	-.0459581	-.0148585
lnpopinmil	.0119772	.0065638	1.82	0.068	-.0008936	.024848
lnpopinmil2	-.0196273	.0016437	-11.94	0.000	-.0228504	-.0164042
totagrnona~s	-.2788978	.0281321	-9.91	0.000	-.334061	-.2237346
d1asiancou~s	-.3555866	.0379657	-9.37	0.000	-.4300323	-.2811409
d2laccount~s	-.0548443	.0356205	-1.54	0.124	-.1246914	.0150027
d3ssacount~s	-.9336364	.0368015	-25.37	0.000	-1.005799	-.8614736
yd~119801989	-.0042323	.0236288	-0.18	0.858	-.0505652	.0421006
yd~219901999	.0233379	.0225198	1.04	0.300	-.0208204	.0674962
_cons	2.093094	.3795132	5.52	0.000	1.348919	2.837269

2.2.5: Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS
Model	33.2003192	10	3.32003192
Residual	51.1110023	2629	.019441233
Total	84.3113215	2639	.031948208

Number of obs	=	2640
F(10, 2629)	=	170.77
Prob > F	=	0.0000
R-squared	=	0.3938
Adj R-squared	=	0.3915
Root MSE	=	.13943

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	.0167912	.0329357	0.51	0.610	-.0477914	.0813738
lngdppc2co~s	-.0011087	.0024064	-0.46	0.645	-.0058273	.0036098
lnpopinmil	.000429	.0019918	0.22	0.829	-.0034766	.0043346
lnpopinmil2	-.0034124	.0004988	-6.84	0.000	-.0043904	-.0024343
totagrnona~s	.0645003	.0085366	7.56	0.000	.0477611	.0812394
d1asiancou~s	-.0993185	.0115206	-8.62	0.000	-.1219088	-.0767281
d2laccount~s	.0250156	.010809	2.31	0.021	.0038206	.0462105
d3ssacount~s	-.2156348	.0111673	-19.31	0.000	-.2375324	-.1937371
yd~119801989	-.0739798	.0071701	-10.32	0.000	-.0880394	-.0599202
yd~219901999	-.0243965	.0068336	-3.57	0.000	-.0377963	-.0109968
_cons	-.2308402	.1151624	-2.00	0.045	-.4566583	-.0050221

3: Regression Results Using Country dummies and Year dummies for Turning Point Analysis

3.1: 109 Countries (88 Developing + 21 Developed)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	106.359023	142	.749007202	Number of obs =	3270
Residual	5.05918769	3127	.001617905	F(142, 3127) =	462.95
Total	111.41821	3269	.03408327	Prob > F =	0.0000
				R-squared =	0.9546
				Adj R-squared =	0.9525
				Root MSE =	.04022

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.3713869	.0176244	-21.07	0.000	-.4059434	-.3368304
lngdppc2co~s	.0191155	.0013165	14.52	0.000	.0165341	.0216969
lnpopinmil	.0516403	.0107709	4.79	0.000	.0305215	.0727591
lnpopinmil2	-.0021329	.0012528	-1.70	0.089	-.0045894	.0003235
totagrnona~s	.0731678	.0027303	26.80	0.000	.0678144	.0785212
cdum2	-.0199534	.0251568	-0.79	0.428	-.069279	.0293722
cdum3	.320239	.0412622	7.76	0.000	.2393352	.4011429
cdum4	.1631593	.0327069	4.99	0.000	.0990302	.2272884
cdum5	.2448466	.0332306	7.37	0.000	.1796907	.3100025
cdum6	.254597	.0273416	9.31	0.000	.2009877	.3082063
cdum7	-.4377247	.0394653	-11.09	0.000	-.5151051	-.3603443
cdum8	.2652892	.0288707	9.19	0.000	.2086816	.3218967
cdum9	.2879246	.0294277	9.78	0.000	.230225	.3456241
cdum10	-.2150884	.0123636	-17.40	0.000	-.2393301	-.1908468
cdum11	-.3797628	.0217134	-17.49	0.000	-.4223368	-.3371888
cdum12	-.1479377	.0133978	-11.04	0.000	-.174207	-.1216683
cdum13	-.114929	.0122468	-9.38	0.000	-.1389415	-.0909164

cdum14	-.0161497	.0458801	-0.35	0.725	-.1061079	.0738084
cdum15	.2103956	.0150356	13.99	0.000	.180915	.2398762
cdum16	-.6807788	.0164277	-41.44	0.000	-.7129889	-.6485687
cdum17	-.5973969	.0149992	-39.83	0.000	-.6268062	-.5679876
cdum18	-.3559396	.0175956	-20.23	0.000	-.3904396	-.3214396
cdum19	.2378054	.0382159	6.22	0.000	.1628747	.3127361
cdum20	-.2528995	.0117631	-21.50	0.000	-.2759638	-.2298353
cdum21	-.5127067	.0145286	-35.29	0.000	-.5411933	-.4842201
cdum22	.1354756	.0217017	6.24	0.000	.0929245	.1780267
cdum23	-.5521121	.0696265	-7.93	0.000	-.6886304	-.4155938
cdum24	.051348	.0285662	1.80	0.072	-.0046624	.1073583
cdum25	-.1568251	.0235183	-6.67	0.000	-.2029381	-.1107121
cdum26	-.4683158	.0294992	-15.88	0.000	-.5261555	-.4104761
cdum27	-.1447726	.0105119	-13.77	0.000	-.1653835	-.1241618
cdum28	.1570026	.0120506	13.03	0.000	.1333747	.1806305
cdum29	-.2169906	.0178974	-12.12	0.000	-.2520825	-.1818986
cdum30	.1613008	.0185018	8.72	0.000	.1250239	.1975777
cdum31	.2695113	.0265229	10.16	0.000	.2175072	.3215155
cdum32	.4624105	.0428937	10.78	0.000	.3783078	.5465133
cdum33	.1144645	.0153862	7.44	0.000	.0842963	.1446327
cdum34	-.0981915	.0326223	-3.01	0.003	-.1621547	-.0342283
cdum35	-.5267177	.0319599	-16.48	0.000	-.5893822	-.4640533
cdum36	.0905072	.0171113	5.29	0.000	.0569567	.1240576
cdum37	.2866008	.0241697	11.86	0.000	.2392108	.3339909
cdum38	.1971885	.0445626	4.42	0.000	.1098136	.2845633
cdum39	-.0314	.0141633	-2.22	0.027	-.0591703	-.0036297
cdum40	-.3805188	.0166266	-22.89	0.000	-.413119	-.3479187
cdum41	.1919199	.0480169	4.00	0.000	.097772	.2860678
cdum42	-.2119179	.0198376	-10.68	0.000	-.250814	-.1730219
cdum43	.1524604	.0247104	6.17	0.000	.10401	.2009107
cdum44	.3346668	.0387499	8.64	0.000	.2586889	.4106446
cdum45	-.0681079	.0162539	-4.19	0.000	-.0999773	-.0362385

cdum46	-.3026648	.0169228	-17.89	0.000	-.3358457	-.2694839
cdum47	.3456382	.0182341	18.96	0.000	.3098862	.3813901
cdum48	-.0212008	.0118111	-1.79	0.073	-.0443591	.0019574
cdum49	-.4736624	.065431	-7.24	0.000	-.6019544	-.3453704
cdum50	-.3337397	.0443425	-7.53	0.000	-.420683	-.2467964
cdum51	-.0385909	.0320736	-1.20	0.229	-.1014784	.0242966
cdum52	.2872796	.0211333	13.59	0.000	.2458431	.3287161
cdum53	.1683642	.0431402	3.90	0.000	.0837783	.2529501
cdum54	.1520808	.0565711	2.69	0.007	.0411606	.2630011
cdum55	.1359914	.0110819	12.27	0.000	.1142629	.1577198
cdum56	-.4642627	.0232907	-19.93	0.000	-.5099293	-.4185961
cdum57	.3636693	.0444955	8.17	0.000	.2764259	.4509126
cdum58	.125776	.0360585	3.49	0.000	.0550752	.1964768
cdum59	-.1888542	.0133296	-14.17	0.000	-.2149899	-.1627185
cdum60	-.1529607	.0126293	-12.11	0.000	-.1777232	-.1281982
cdum61	-.5102212	.0176672	-28.88	0.000	-.5448616	-.4755808
cdum62	-.6211733	.0170326	-36.47	0.000	-.6545694	-.5877771
cdum63	.1024259	.0240966	4.25	0.000	.0551792	.1496725
cdum64	-.4699491	.0162998	-28.83	0.000	-.5019084	-.4379897
cdum65	-.1586833	.0117649	-13.49	0.000	-.1817511	-.1356156
cdum66	.2773963	.0137388	20.19	0.000	.2504583	.3043343
cdum67	-.0225698	.0409465	-0.55	0.582	-.1028545	.057715
cdum68	.1144853	.0116376	9.84	0.000	.0916671	.1373035
cdum69	-.0776608	.0240231	-3.23	0.001	-.1247634	-.0305583
cdum70	-.6177597	.0197521	-31.28	0.000	-.656488	-.5790313
cdum71	-.0513074	.0120891	-4.24	0.000	-.0750108	-.027604
cdum72	-.5917632	.0222426	-26.60	0.000	-.6353747	-.5481517
cdum73	.2513759	.0325356	7.73	0.000	.1875826	.3151692
cdum74	.3231051	.018401	17.56	0.000	.2870259	.3591843
cdum75	-.5731886	.0160987	-35.60	0.000	-.6047536	-.5416235
cdum76	.2827421	.0271239	10.42	0.000	.2295597	.3359246
cdum77	-.2511832	.0388817	-6.46	0.000	-.3274195	-.174947

cdum78	.1536508	.0115617	13.29	0.000	.1309816	.1763201
cdum79	-.3086931	.0111053	-27.80	0.000	-.3304674	-.2869187
cdum80	.0804384	.0113468	7.09	0.000	.0581904	.1026864
cdum81	-.1831045	.0332435	-5.51	0.000	-.2482858	-.1179232
cdum82	.1595685	.023382	6.82	0.000	.1137229	.2054141
cdum83	-.566427	.0138283	-40.96	0.000	-.5935405	-.5393135
cdum84	-.4987642	.0141689	-35.20	0.000	-.5265455	-.470983
cdum85	-.2329566	.0412415	-5.65	0.000	-.3138198	-.1520934
cdum86	-.235542	.0122192	-19.28	0.000	-.2595004	-.2115836
cdum87	.0947062	.0301581	3.14	0.002	.0355745	.1538379
cdum88	.1693918	.037345	4.54	0.000	.0961685	.2426151
cdum89	-.1690648	.0199047	-8.49	0.000	-.2080924	-.1300373
cdum90	.3436844	.0489876	7.02	0.000	.2476332	.4397356
cdum91	.303005	.0337834	8.97	0.000	.2367652	.3692448
cdum92	.3269912	.0381252	8.58	0.000	.2522382	.4017442
cdum93	-.3052214	.0245062	-12.45	0.000	-.3532712	-.2571715
cdum94	.2757193	.0222177	12.41	0.000	.2321565	.3192822
cdum95	.017187	.0162054	1.06	0.289	-.0145873	.0489612
cdum96	.2713271	.0296403	9.15	0.000	.2132107	.3294436
cdum97	-.3701957	.0325113	-11.39	0.000	-.4339414	-.3064499
cdum98	-.2680626	.0119954	-22.35	0.000	-.2915823	-.2445429
cdum99	.3205325	.0401943	7.97	0.000	.2417227	.3993424
cdum100	.0649957	.0153945	4.22	0.000	.0348115	.09518
cdum101	-.1393782	.0351044	-3.97	0.000	-.2082081	-.0705483
cdum102	-.5138856	.0216616	-23.72	0.000	-.5563579	-.4714133
cdum103	.2056806	.0451839	4.55	0.000	.1170875	.2942737
cdum104	.1181977	.0644708	1.83	0.067	-.0082117	.2446071
cdum105	.2533342	.013709	18.48	0.000	.2264546	.2802137
cdum106	.148245	.0344958	4.30	0.000	.0806083	.2158818
cdum107	.1629028	.0265203	6.14	0.000	.1109038	.2149019
cdum108	-.4970739	.0145132	-34.25	0.000	-.5255302	-.4686176
cdum109	-.4430487	.0157818	-28.07	0.000	-.4739925	-.4121049

cyear2	.0057228	.0054545	1.05	0.294	-.0049718	.0164175
cyear3	.009449	.0054682	1.73	0.084	-.0012726	.0201707
cyear4	.0113571	.0054879	2.07	0.039	.0005969	.0221173
cyear5	.0161657	.0055246	2.93	0.003	.0053336	.0269978
cyear6	.0210442	.0055656	3.78	0.000	.0101316	.0319569
cyear7	.0259616	.00562	4.62	0.000	.0149423	.0369809
cyear8	.0296971	.0056811	5.23	0.000	.0185581	.0408362
cyear9	.0357053	.0057623	6.20	0.000	.0244069	.0470036
cyear10	.0387297	.0058475	6.62	0.000	.0272644	.050195
cyear11	.0426746	.0059406	7.18	0.000	.0310267	.0543225
cyear12	.0457384	.0060243	7.59	0.000	.0339264	.0575504
cyear13	.0503993	.0061212	8.23	0.000	.0383973	.0624013
cyear14	.0547131	.0062101	8.81	0.000	.0425368	.0668893
cyear15	.0534434	.006322	8.45	0.000	.0410477	.065839
cyear16	.063507	.0064362	9.87	0.000	.0508873	.0761266
cyear17	.0723797	.0065754	11.01	0.000	.0594872	.0852723
cyear18	.0753422	.0067245	11.20	0.000	.0621573	.0885271
cyear19	.0823654	.0068774	11.98	0.000	.0688807	.09585
cyear20	.0858934	.0070357	12.21	0.000	.0720983	.0996884
cyear21	.083142	.0072171	11.52	0.000	.0689913	.0972926
cyear22	.085077	.0073345	11.60	0.000	.0706961	.0994578
cyear23	.0856507	.0074612	11.48	0.000	.0710214	.1002801
cyear24	.0899536	.0076026	11.83	0.000	.075047	.1048603
cyear25	.0928287	.0077901	11.92	0.000	.0775545	.1081029
cyear26	.095105	.0079826	11.91	0.000	.0794534	.1107566
cyear27	.0961813	.0081972	11.73	0.000	.0801088	.1122537
cyear28	.0971523	.008392	11.58	0.000	.0806979	.1136067
cyear29	.1029849	.0085437	12.05	0.000	.0862331	.1197366
cyear30	.1095825	.0085539	12.81	0.000	.0928107	.1263543
_cons	1.269896	.0603851	21.03	0.000	1.151497	1.388294

3.2: 88 Developing Countries

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	79.5858518	121	.657734313	Number of obs =	2640
Residual	4.72546964	2518	.001876676	F(121, 2518) =	350.48
Total	84.3113215	2639	.031948208	Prob > F =	0.0000
				R-squared =	0.9440
				Adj R-squared =	0.9413
				Root MSE =	.04332

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.4459468	.0241486	-18.47	0.000	-.4933001	-.3985936
lngdppc2co~s	.0247614	.0018608	13.31	0.000	.0211125	.0284102
lnpopinmil	.0484541	.0126258	3.84	0.000	.0236962	.0732121
lnpopinmil2	-.0010339	.001377	-0.75	0.453	-.003734	.0016663
totagrnona~s	.0810102	.0033275	24.35	0.000	.0744854	.087535
cdum2	-.0264518	.0295871	-0.89	0.371	-.0844693	.0315658
cdum3	.2757034	.0486245	5.67	0.000	.1803554	.3710515
cdum4	.1283815	.0392706	3.27	0.001	.0513754	.2053875
cdum5	-.450942	.0463662	-9.73	0.000	-.5418619	-.3600222
cdum6	.271373	.034275	7.92	0.000	.204163	.338583
cdum7	-.215682	.0134782	-16.00	0.000	-.2421114	-.1892525
cdum8	-.3816625	.0252508	-15.11	0.000	-.4311771	-.332148
cdum9	-.1454095	.0150065	-9.69	0.000	-.1748358	-.1159831
cdum10	-.1220163	.0138096	-8.84	0.000	-.1490955	-.0949371
cdum11	-.0440289	.0546187	-0.81	0.420	-.1511311	.0630733
cdum12	.2085196	.017107	12.19	0.000	.1749743	.2420649
cdum13	-.6880605	.0183644	-37.47	0.000	-.7240714	-.6520497
cdum14	-.6148741	.0164283	-37.43	0.000	-.6470885	-.5826597
cdum15	-.3578004	.0203709	-17.56	0.000	-.3977459	-.3178549
cdum16	-.2551594	.0127275	-20.05	0.000	-.2801167	-.2302021

cdum17	-.5180107	.0159154	-32.55	0.000	-.5492193	-.4868021
cdum18	.1223139	.02546	4.80	0.000	.0723892	.1722385
cdum19	-.5856571	.0817295	-7.17	0.000	-.745921	-.4253931
cdum20	.0404108	.033754	1.20	0.231	-.0257776	.1065992
cdum21	-.1594268	.0274004	-5.82	0.000	-.2131564	-.1056971
cdum22	-.4906698	.0343439	-14.29	0.000	-.5580151	-.4233246
cdum23	-.1420698	.0113715	-12.49	0.000	-.1643681	-.1197714
cdum24	.1441748	.0136601	10.55	0.000	.1173886	.1709609
cdum25	-.2171454	.0206453	-10.52	0.000	-.2576289	-.1766619
cdum26	.1524642	.0214776	7.10	0.000	.1103485	.1945798
cdum27	.4359477	.0498107	8.75	0.000	.3382736	.5336218
cdum28	.1088071	.0175935	6.18	0.000	.0743079	.1433063
cdum29	-.1033156	.0384604	-2.69	0.007	-.1787329	-.0278983
cdum30	-.5476683	.0371871	-14.73	0.000	-.6205888	-.4747478
cdum31	.0859402	.0197155	4.36	0.000	.04728	.1246004
cdum32	-.0495486	.0166185	-2.98	0.003	-.0821359	-.0169614
cdum33	-.3817264	.0191036	-19.98	0.000	-.4191867	-.3442661
cdum34	-.2171112	.0226335	-9.59	0.000	-.2614934	-.172729
cdum35	.3106043	.0450683	6.89	0.000	.2222296	.398979
cdum36	-.0672336	.018533	-3.63	0.000	-.1035751	-.0308921
cdum37	-.3132496	.0193675	-16.17	0.000	-.3512275	-.2752716
cdum38	.3460682	.02103	16.46	0.000	.3048303	.387306
cdum39	-.0196901	.0130126	-1.51	0.130	-.0452066	.0058263
cdum40	-.5041939	.0767795	-6.57	0.000	-.6547514	-.3536365
cdum41	-.3463615	.0523402	-6.62	0.000	-.4489958	-.2437272
cdum42	-.0474584	.0379501	-1.25	0.211	-.121875	.0269583
cdum43	.1300672	.01215	10.71	0.000	.1062421	.1538922
cdum44	-.464553	.0270079	-17.20	0.000	-.517513	-.4115929
cdum45	.3515065	.0515913	6.81	0.000	.2503409	.4526721
cdum46	-.1925054	.0148584	-12.96	0.000	-.2216414	-.1633695
cdum47	-.1620297	.0138345	-11.71	0.000	-.1891579	-.1349015
cdum48	-.5138364	.0200136	-25.67	0.000	-.5530811	-.4745916

cdum49	|	-.635732	.0190282	-33.41	0.000	-.6730445	-.5984195
cdum50	|	.0905362	.0283363	3.20	0.001	.0349714	.1461011
cdum51	|	-.4758689	.0181881	-26.16	0.000	-.5115341	-.4402038
cdum52	|	-.1558471	.0129844	-12.00	0.000	-.1813084	-.1303859
cdum53	|	.2673397	.0157527	16.97	0.000	.2364502	.2982293
cdum54	|	-.053642	.0488877	-1.10	0.273	-.1495061	.0422222
cdum55	|	.1192844	.0128738	9.27	0.000	.0940401	.1445287
cdum56	|	-.0776635	.0280466	-2.77	0.006	-.1326602	-.0226668
cdum57	|	-.6286215	.0226248	-27.78	0.000	-.6729866	-.5842564
cdum58	|	-.0552907	.0135148	-4.09	0.000	-.0817919	-.0287895
cdum59	|	-.6006256	.0254866	-23.57	0.000	-.6506025	-.5506487
cdum60	|	-.5811894	.0178947	-32.48	0.000	-.6162792	-.5460996
cdum61	|	-.2605607	.0457992	-5.69	0.000	-.3503687	-.1707527
cdum62	|	.1420028	.0131146	10.83	0.000	.1162863	.1677193
cdum63	|	-.305834	.0120742	-25.33	0.000	-.3295103	-.2821576
cdum64	|	.0777667	.0124842	6.23	0.000	.0532863	.102247
cdum65	|	-.191009	.0393354	-4.86	0.000	-.2681421	-.113876
cdum66	|	-.5711496	.0152259	-37.51	0.000	-.6010061	-.5412932
cdum67	|	-.4964615	.0158577	-31.31	0.000	-.527557	-.465366
cdum68	|	-.2719365	.0483246	-5.63	0.000	-.3666966	-.1771765
cdum69	|	-.2393346	.0131831	-18.15	0.000	-.2651855	-.2134838
cdum70	|	.0786686	.0357555	2.20	0.028	.0085555	.1487818
cdum71	|	-.1668501	.0229792	-7.26	0.000	-.2119103	-.12179
cdum72	|	.2979585	.056902	5.24	0.000	.186379	.409538
cdum73	|	.2792196	.0394695	7.07	0.000	.2018236	.3566155
cdum74	|	.306785	.0443151	6.92	0.000	.2198872	.3936828
cdum75	|	-.3085664	.028426	-10.86	0.000	-.364307	-.2528257
cdum76	|	.2686763	.0258834	10.38	0.000	.2179214	.3194312
cdum77	|	.0180548	.0186076	0.97	0.332	-.0184329	.0545426
cdum78	|	-.3791473	.0384354	-9.86	0.000	-.4545156	-.3037791
cdum79	|	-.271455	.0129591	-20.95	0.000	-.2968666	-.2460433
cdum80	|	.3022622	.0464818	6.50	0.000	.2111157	.3934087

cdum81	.0637019	.0175155	3.64	0.000	.0293556	.0980482
cdum82	-.1587832	.0417012	-3.81	0.000	-.2405554	-.0770109
cdum83	-.5253081	.0250038	-21.01	0.000	-.5743382	-.476278
cdum84	.2278456	.0163284	13.95	0.000	.1958272	.2598641
cdum85	.1400318	.0401296	3.49	0.000	.0613415	.2187222
cdum86	.140635	.0315227	4.46	0.000	.0788219	.202448
cdum87	-.4973379	.0162432	-30.62	0.000	-.5291892	-.4654865
cdum88	-.4422372	.0179006	-24.71	0.000	-.4773386	-.4071359
ydum2	.0063625	.0065388	0.97	0.331	-.0064595	.0191845
ydum3	.0089755	.006556	1.37	0.171	-.0038803	.0218312
ydum4	.0105699	.006582	1.61	0.108	-.0023369	.0234766
ydum5	.0146326	.0066277	2.21	0.027	.0016363	.027629
ydum6	.0194084	.0066795	2.91	0.004	.0063106	.0325062
ydum7	.024507	.0067516	3.63	0.000	.0112677	.0377463
ydum8	.028163	.0068321	4.12	0.000	.014766	.04156
ydum9	.0351176	.0069292	5.07	0.000	.0215301	.0487051
ydum10	.0384633	.0070285	5.47	0.000	.0246811	.0522455
ydum11	.0419603	.0071347	5.88	0.000	.0279698	.0559508
ydum12	.0438473	.0072419	6.05	0.000	.0296467	.058048
ydum13	.0477632	.007366	6.48	0.000	.033319	.0622073
ydum14	.051563	.007485	6.89	0.000	.0368855	.0662405
ydum15	.0498443	.0076177	6.54	0.000	.0349067	.064782
ydum16	.0623408	.0077491	8.04	0.000	.0471454	.0775361
ydum17	.0728806	.0079126	9.21	0.000	.0573648	.0883964
ydum18	.0756113	.0080846	9.35	0.000	.0597581	.0914644
ydum19	.0834992	.0082708	10.10	0.000	.067281	.0997175
ydum20	.087159	.0084361	10.33	0.000	.0706167	.1037013
ydum21	.0836785	.008631	9.70	0.000	.066754	.100603
ydum22	.086379	.0087768	9.84	0.000	.0691686	.1035895
ydum23	.0862912	.0089301	9.66	0.000	.06878	.1038023
ydum24	.0912694	.0091149	10.01	0.000	.0733959	.1091428
ydum25	.0937637	.0093382	10.04	0.000	.0754523	.1120751

ydum26	.095228	.0095672	9.95	0.000	.0764675	.1139885
ydum27	.0962167	.009824	9.79	0.000	.0769528	.1154806
ydum28	.0973945	.0100734	9.67	0.000	.0776415	.1171474
ydum29	.1034142	.0102894	10.05	0.000	.0832377	.1235908
ydum30	.1102224	.0103828	10.62	0.000	.0898627	.1305821
_cons	1.50681	.0799964	18.84	0.000	1.349945	1.663676

3.3: 19 Asian Countries (Only Developing)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	16.5332397	52	.317946917	Number of obs =	570
Residual	.95629761	517	.001849705	F(52, 517) =	171.89
Total	17.4895373	569	.030737324	Prob > F =	0.0000
				R-squared =	0.9453
				Adj R-squared =	0.9398
				Root MSE =	.04301

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.7972159	.0668902	-11.92	0.000	-.9286259	-.6658058
lngdppc2co~s	.0530561	.005053	10.50	0.000	.0431291	.062983
lnpopinmil	.1457023	.0304755	4.78	0.000	.0858312	.2055734
lnpopinmil2	.0025291	.0022916	1.10	0.270	-.001973	.0070312
totagrnona~s	.0897671	.0076311	11.76	0.000	.0747754	.1047587
cdum2	.6810367	.1598072	4.26	0.000	.3670854	.9949881
cdum3	-.4552329	.0805596	-5.65	0.000	-.6134974	-.2969685
cdum4	1.071474	.1480917	7.24	0.000	.7805387	1.36241
cdum5	-.3256602	.0703781	-4.63	0.000	-.4639224	-.187398
cdum6	.0525362	.0201232	2.61	0.009	.0130029	.0920694
cdum7	.4735299	.0292262	16.20	0.000	.4161133	.5309465
cdum8	.9481018	.101871	9.31	0.000	.7479698	1.148234
cdum9	1.58736	.217402	7.30	0.000	1.16026	2.01446
cdum10	.677553	.0582474	11.63	0.000	.5631222	.7919837
cdum11	1.053245	.1208709	8.71	0.000	.8157868	1.290704
cdum12	.0551756	.0566949	0.97	0.331	-.0562051	.1665564
cdum13	.2030623	.0125262	16.21	0.000	.1784538	.2276709
cdum14	.5446173	.0988986	5.51	0.000	.3503247	.7389098
cdum15	.3279388	.023785	13.79	0.000	.2812116	.374666
cdum16	.5312372	.0615506	8.63	0.000	.4103172	.6521572

cdum17	.1344887	.0288252	4.67	0.000	.0778597	.1911177
cdum18	1.475158	.2071364	7.12	0.000	1.068226	1.882091
cdum19	1.303631	.1938829	6.72	0.000	.9227359	1.684526
ydum2	.0136814	.013995	0.98	0.329	-.0138127	.0411755
ydum3	.0163807	.0140672	1.16	0.245	-.0112552	.0440166
ydum4	.017432	.0141941	1.23	0.220	-.0104531	.0453171
ydum5	.0341527	.0143475	2.38	0.018	.0059661	.0623393
ydum6	.0284912	.0145095	1.96	0.050	-.0000137	.0569962
ydum7	.0272184	.0147296	1.85	0.065	-.0017188	.0561555
ydum8	.0213423	.0149805	1.42	0.155	-.0080879	.0507725
ydum9	.029509	.0152589	1.93	0.054	-.0004682	.0594861
ydum10	.0262789	.015518	1.69	0.091	-.0042071	.0567649
ydum11	.0261523	.0158117	1.65	0.099	-.0049108	.0572154
ydum12	.0224301	.0161657	1.39	0.166	-.0093285	.0541887
ydum13	.031322	.0165086	1.90	0.058	-.0011102	.0637542
ydum14	.0318811	.0168314	1.89	0.059	-.0011852	.0649475
ydum15	.0336395	.0172098	1.95	0.051	-.0001703	.0674492
ydum16	.0381825	.0175845	2.17	0.030	.0036367	.0727284
ydum17	.0416826	.0179859	2.32	0.021	.0063481	.0770171
ydum18	.0404349	.0183229	2.21	0.028	.0044384	.0764314
ydum19	.0533271	.018797	2.84	0.005	.0163992	.0902551
ydum20	.0560325	.0191901	2.92	0.004	.0183324	.0937326
ydum21	.0494812	.0195835	2.53	0.012	.0110081	.0879542
ydum22	.0469853	.0199408	2.36	0.019	.0078103	.0861603
ydum23	.0444458	.0203757	2.18	0.030	.0044164	.0844752
ydum24	.0456294	.0208744	2.19	0.029	.0046204	.0866384
ydum25	.0476958	.0214087	2.23	0.026	.0056372	.0897545
ydum26	.0456664	.0219002	2.09	0.038	.002642	.0886908
ydum27	.0449413	.0224108	2.01	0.045	.0009139	.0889688
ydum28	.046297	.0229884	2.01	0.045	.0011349	.091459
ydum29	.0471771	.0234696	2.01	0.045	.0010696	.0932845
ydum30	.0542953	.0238384	2.28	0.023	.0074632	.1011274
_cons	1.59893	.2527714	6.33	0.000	1.102345	2.095515

3.4: LAC (24 Developing Countries)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	5.37624367	57	.094320064	Number of obs =	720
Residual	.419157123	662	.000633168	F(57, 662) =	148.97
Total	5.7954008	719	.008060363	Prob > F =	0.0000
				R-squared =	0.9277
				Adj R-squared =	0.9214
				Root MSE =	.02516

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.1166352	.0768305	-1.52	0.129	-.267496	.0342257
lngdppc2co~s	.0065226	.004717	1.38	0.167	-.0027395	.0157848
lnpopinmil	.090844	.0139332	6.52	0.000	.0634854	.1182025
lnpopinmil2	.0144527	.0018512	7.81	0.000	.0108179	.0180876
totagrnona~s	.0512164	.0043856	11.68	0.000	.042605	.0598278
ydum2	.0020109	.0072717	0.28	0.782	-.0122675	.0162894
ydum3	.0015318	.007279	0.21	0.833	-.0127609	.0158245
ydum4	.006207	.0072963	0.85	0.395	-.0081196	.0205337
ydum5	.0088744	.0073118	1.21	0.225	-.0054827	.0232315
ydum6	.0096706	.0073396	1.32	0.188	-.004741	.0240823
ydum7	.0156456	.0073935	2.12	0.035	.001128	.0301632
ydum8	.0168914	.0074522	2.27	0.024	.0022587	.0315241
ydum9	.0198377	.0075202	2.64	0.009	.0050713	.0346041
ydum10	.0249617	.0075916	3.29	0.001	.0100552	.0398682
ydum11	.0288486	.0076751	3.76	0.000	.0137782	.043919
ydum12	.0284739	.0077751	3.66	0.000	.013207	.0437407
ydum13	.0343154	.0079073	4.34	0.000	.0187889	.0498418
ydum14	.0298641	.0080125	3.73	0.000	.0141311	.045597
ydum15	.0291447	.0081455	3.58	0.000	.0131506	.0451389
ydum16	.0337811	.0082449	4.10	0.000	.0175919	.0499703

ydum17	.0352357	.0083933	4.20	0.000	.018755	.0517163
ydum18	.0341388	.0085959	3.97	0.000	.0172603	.0510173
ydum19	.0322949	.0087546	3.69	0.000	.0151048	.0494849
ydum20	.0344878	.0088722	3.89	0.000	.0170668	.0519089
ydum21	.0337107	.0090292	3.73	0.000	.0159814	.0514399
ydum22	.0306021	.0091139	3.36	0.001	.0127065	.0484978
ydum23	.0348508	.0091879	3.79	0.000	.0168099	.0528916
ydum24	.0400981	.0093426	4.29	0.000	.0217534	.0584429
ydum25	.0410911	.0095867	4.29	0.000	.022267	.0599151
ydum26	.0373133	.0098447	3.79	0.000	.0179827	.056644
ydum27	.0340892	.0101516	3.36	0.001	.0141559	.0540225
ydum28	.0336344	.0104435	3.22	0.001	.0131281	.0541408
ydum29	.0358325	.0106724	3.36	0.001	.0148767	.0567883
ydum30	.0339133	.0105937	3.20	0.001	.013112	.0547147
cdum2	-.4777434	.0857091	-5.57	0.000	-.6460379	-.3094489
cdum3	.0463218	.0206449	2.24	0.025	.0057845	.0868591
cdum4	-.4855716	.0641318	-7.57	0.000	-.6114978	-.3596453
cdum5	-.9116823	.1059366	-8.61	0.000	-1.119694	-.7036701
cdum6	-.3663061	.0722218	-5.07	0.000	-.5081175	-.2244948
cdum7	-.555021	.0833545	-6.66	0.000	-.7186921	-.3913499
cdum8	-.1889521	.0556477	-3.40	0.001	-.2982193	-.0796849
cdum9	-.2936381	.0687159	-4.27	0.000	-.4285656	-.1587107
cdum10	.1781826	.0098253	18.14	0.000	.15889	.1974752
cdum11	-.2880923	.0650484	-4.43	0.000	-.4158183	-.1603662
cdum12	.0666533	.0111396	5.98	0.000	.0447801	.0885265
cdum13	-.4815593	.0670391	-7.18	0.000	-.6131941	-.3499244
cdum14	.1769058	.0398206	4.44	0.000	.0987158	.2550958
cdum15	-.3387043	.0605977	-5.59	0.000	-.4576913	-.2197174
cdum16	-.8222776	.0978851	-8.40	0.000	-1.01448	-.630075
cdum17	-.1794684	.052475	-3.42	0.001	-.2825059	-.0764309
cdum18	-.2296739	.0591865	-3.88	0.000	-.3458897	-.1134581
cdum19	.0153895	.0118434	1.30	0.194	-.0078656	.0386446

cdum20	.037067	.0145119	2.55	0.011	.008572	.0655619
cdum21	.0713173	.0125702	5.67	0.000	.046635	.0959996
cdum22	.0417935	.0301574	1.39	0.166	-.0174223	.1010093
cdum23	-.1035349	.0557081	-1.86	0.064	-.2129207	.005851
cdum24	-.4019314	.0783422	-5.13	0.000	-.5557606	-.2481022
_cons	.362882	.3169677	1.14	0.253	-.2595011	.9852651

3.5: SSA (38 Developing Countries)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	28.557093	71	.402212578	Number of obs =	1140
Residual	2.6073325	1068	.002441323	F(71, 1068) =	164.75
Total	31.1644255	1139	.027361216	Prob > F =	0.0000
				R-squared =	0.9163
				Adj R-squared =	0.9108
				Root MSE =	.04941

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.2928471	.0438237	-6.68	0.000	-.3788374	-.2068568
lngdppc2co~s	.010218	.0036175	2.82	0.005	.0031198	.0173161
lnpopinmil	.0624648	.0307828	2.03	0.043	.0020631	.1228665
lnpopinmil2	-.0200646	.0027925	-7.19	0.000	-.025544	-.0145853
totagrnona~s	.0848282	.0056158	15.11	0.000	.0738089	.0958474
ydum2	.0063746	.0113666	0.56	0.575	-.0159287	.028678
ydum3	.0101334	.0114552	0.88	0.377	-.0123439	.0326107
ydum4	.0083288	.0115983	0.72	0.473	-.0144293	.0310869
ydum5	.0060069	.0118213	0.51	0.611	-.0171886	.0292025
ydum6	.0158234	.0120386	1.31	0.189	-.0077986	.0394455
ydum7	.0230787	.0123395	1.87	0.062	-.0011337	.047291
ydum8	.0314328	.0126558	2.48	0.013	.0065998	.0562659
ydum9	.0400754	.0130226	3.08	0.002	.0145226	.0656283
ydum10	.042659	.0134343	3.18	0.002	.0162983	.0690196
ydum11	.0431996	.013878	3.11	0.002	.0159684	.0704309
ydum12	.045181	.0142768	3.16	0.002	.0171672	.0731947
ydum13	.0418676	.0147133	2.85	0.005	.0129974	.0707378
ydum14	.0519065	.0151541	3.43	0.001	.0221712	.0816417
ydum15	.0456748	.0156667	2.92	0.004	.0149338	.0764157
ydum16	.0660939	.0161068	4.10	0.000	.0344893	.0976984

ydum17	.0841967	.0166073	5.07	0.000	.0516099	.1167834
ydum18	.0902219	.0171322	5.27	0.000	.0566054	.1238385
ydum19	.1005637	.0177624	5.66	0.000	.0657106	.1354168
ydum20	.1048407	.0183675	5.71	0.000	.0688002	.1408811
ydum21	.0999324	.0190031	5.26	0.000	.0626447	.13722
ydum22	.1074343	.019522	5.50	0.000	.0691283	.1457402
ydum23	.1047932	.0200717	5.22	0.000	.0654088	.1441776
ydum24	.1099561	.0206004	5.34	0.000	.0695342	.150378
ydum25	.1121545	.0211309	5.31	0.000	.0706917	.1536173
ydum26	.1184396	.0216864	5.46	0.000	.0758868	.1609925
ydum27	.1197008	.0222569	5.38	0.000	.0760285	.1633731
ydum28	.1220299	.0228318	5.34	0.000	.0772295	.1668302
ydum29	.1323882	.0233997	5.66	0.000	.0864735	.1783029
ydum30	.1439829	.0238515	6.04	0.000	.0971818	.190784
cdum2	.1524795	.0406477	3.75	0.000	.0727211	.2322379
cdum3	-.4392454	.0215591	-20.37	0.000	-.4815485	-.3969423
cdum4	-.3993233	.0154378	-25.87	0.000	-.4296152	-.3690314
cdum5	-.0626432	.0283921	-2.21	0.028	-.1183539	-.0069325
cdum6	-.0646939	.0196785	-3.29	0.001	-.1033069	-.0260809
cdum7	-.2914105	.0154464	-18.87	0.000	-.3217192	-.2611018
cdum8	.0484457	.0741546	0.65	0.514	-.0970594	.1939509
cdum9	-.0925077	.0596073	-1.55	0.121	-.2094684	.0244531
cdum10	.0874508	.0252055	3.47	0.001	.0379928	.1369088
cdum11	.0795518	.0290556	2.74	0.006	.0225392	.1365644
cdum12	-.1167501	.0662756	-1.76	0.078	-.2467952	.013295
cdum13	.2730396	.0510156	5.35	0.000	.1729374	.3731417
cdum14	-.1977337	.0499374	-3.96	0.000	-.2957202	-.0997472
cdum15	.0747272	.0330106	2.26	0.024	.0099541	.1395002
cdum16	-.1351127	.0461767	-2.93	0.004	-.22572	-.0445054
cdum17	-.1174859	.0441822	-2.66	0.008	-.2041797	-.0307922
cdum18	-.0119399	.0363989	-0.33	0.743	-.0833614	.0594816
cdum19	.02839	.0253077	1.12	0.262	-.0212685	.0780485

cdum20	-.2439635	.0265298	-9.20	0.000	-.2960199	-.191907
cdum21	-.3900383	.0220678	-17.67	0.000	-.4333394	-.3467372
cdum22	-.2278702	.0212422	-10.73	0.000	-.2695514	-.1861889
cdum23	.0342894	.0289097	1.19	0.236	-.022437	.0910157
cdum24	.5534273	.0480005	11.53	0.000	.4592413	.6476133
cdum25	-.3423473	.0324223	-10.56	0.000	-.4059658	-.2787287
cdum26	.2058747	.0392536	5.24	0.000	.1288518	.2828976
cdum27	-.3381609	.020076	-16.84	0.000	-.3775537	-.2987681
cdum28	-.3468765	.0144743	-23.97	0.000	-.3752778	-.3184752
cdum29	-.248137	.017281	-14.36	0.000	-.2820456	-.2142284
cdum30	.242315	.1353673	1.79	0.074	-.023301	.507931
cdum31	-.0408435	.0150784	-2.71	0.007	-.0704301	-.0112569
cdum32	.573308	.0644651	8.89	0.000	.4468155	.6998006
cdum33	.0468056	.0473494	0.99	0.323	-.0461028	.139714
cdum34	.2472214	.0538258	4.59	0.000	.141605	.3528377
cdum35	-.0700134	.0143683	-4.87	0.000	-.0982067	-.0418202
cdum36	-.2154147	.038339	-5.62	0.000	-.290643	-.1401864
cdum37	-.2529212	.0176636	-14.32	0.000	-.2875804	-.2182619
cdum38	-.1774331	.0221105	-8.02	0.000	-.2208179	-.1340482
_cons	.9124035	.1269561	7.19	0.000	.6632918	1.161515

3.6:88 Non-Asian Countries (69 Developing + 19 Developed)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	87.040729	121	.719344868	Number of obs =	2640
Residual	3.84940645	2518	.001528756	F(121, 2518) =	470.54
				Prob > F =	0.0000
				R-squared =	0.9576
				Adj R-squared =	0.9556
Total	90.8901354	2639	.034441127	Root MSE =	.0391

agricultur~c	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.3063446	.0201568	-15.20	0.000	-.3458701	-.266819
lngdppc2co~s	.0129877	.0014923	8.70	0.000	.0100615	.0159139
lnpopinmil	.0237782	.011959	1.99	0.047	.0003276	.0472288
lnpopinmil2	-.0054582	.0015634	-3.49	0.000	-.0085239	-.0023926
totagrnona~s	.0693152	.0029929	23.16	0.000	.0634464	.075184
cdum2	.0845143	.0270117	3.13	0.002	.0315468	.1374818
cdum3	.2951291	.0467675	6.31	0.000	.2034224	.3868358
cdum4	.3289809	.0358153	9.19	0.000	.2587504	.3992115
cdum5	.4255313	.0367049	11.59	0.000	.3535563	.4975063
cdum6	.4035396	.0301307	13.39	0.000	.3444561	.4626232
cdum7	.4227809	.0318289	13.28	0.000	.3603673	.4851944
cdum8	.2402451	.0325131	7.39	0.000	.1764901	.3040002
cdum9	-.2103484	.0127213	-16.54	0.000	-.2352938	-.1854031
cdum10	-.1185796	.0136723	-8.67	0.000	-.1453897	-.0917696
cdum11	-.1183774	.012359	-9.58	0.000	-.1426123	-.0941426
cdum12	.2079439	.050716	4.10	0.000	.1084947	.3073932
cdum13	.2578809	.0155822	16.55	0.000	.2273258	.288436
cdum14	-.6528001	.0175123	-37.28	0.000	-.6871401	-.61846
cdum15	-.5886572	.0161125	-36.53	0.000	-.6202522	-.5570622

cdum16	-.3035724	.0183741	-16.52	0.000	-.3396023	-.2675424
cdum17	.446385	.042328	10.55	0.000	.3633837	.5293863
cdum18	-.2698405	.0120808	-22.34	0.000	-.2935299	-.2461512
cdum19	-.5006595	.0155329	-32.23	0.000	-.531118	-.470201
cdum20	.2308262	.0233261	9.90	0.000	.1850858	.2765665
cdum21	.1775075	.0308995	5.74	0.000	.1169164	.2380985
cdum22	-.2282178	.0251734	-9.07	0.000	-.2775804	-.1788552
cdum23	-.3676301	.0319405	-11.51	0.000	-.4302625	-.3049977
cdum24	-.1507588	.01024	-14.72	0.000	-.1708384	-.1306792
cdum25	.1932574	.0122428	15.79	0.000	.1692503	.2172645
cdum26	-.165006	.018761	-8.80	0.000	-.2017945	-.1282175
cdum27	.2361913	.0196456	12.02	0.000	.1976682	.2747144
cdum28	.4166182	.029249	14.24	0.000	.3592637	.4739727
cdum29	.4038986	.0484059	8.34	0.000	.3089791	.4988181
cdum30	.1686927	.0160355	10.52	0.000	.1372485	.2001369
cdum31	.038931	.0353996	1.10	0.272	-.0304843	.1083463
cdum32	-.4147958	.034749	-11.94	0.000	-.4829354	-.3466562
cdum33	.4173612	.0265483	15.72	0.000	.3653024	.46942
cdum34	.4402161	.0494663	8.90	0.000	.3432174	.5372148
cdum35	-.0253311	.0147442	-1.72	0.086	-.0542432	.0035809
cdum36	-.432781	.0173666	-24.92	0.000	-.4668354	-.3987267
cdum37	.4537982	.0534159	8.50	0.000	.3490547	.5585418
cdum38	-.1616459	.0212102	-7.62	0.000	-.2032372	-.1200547
cdum39	.2794201	.0269979	10.35	0.000	.2264798	.3323604
cdum40	.2794204	.0435003	6.42	0.000	.1941204	.3647204
cdum41	-.0158115	.016998	-0.93	0.352	-.049143	.0175199
cdum42	-.3534073	.0178038	-19.85	0.000	-.3883189	-.3184956
cdum43	.2952088	.0192426	15.34	0.000	.2574757	.3329418
cdum44	-.000729	.0118101	-0.06	0.951	-.0238875	.0224295
cdum45	.3973005	.0230621	17.23	0.000	.3520779	.4425231
cdum46	.4018666	.0478223	8.40	0.000	.3080916	.4956415
cdum47	-.3894956	.0249034	-15.64	0.000	-.4383288	-.3406624

cdum48	-.2243121	.0136424	-16.44	0.000	-.2510636	-.1975607
cdum49	-.1758576	.013094	-13.43	0.000	-.2015337	-.1501815
cdum50	-.4712117	.0187624	-25.11	0.000	-.508003	-.4344205
cdum51	-.5931831	.0182813	-32.45	0.000	-.629031	-.5573353
cdum52	-.4430521	.0173924	-25.47	0.000	-.477157	-.4089473
cdum53	-.1858368	.0118493	-15.68	0.000	-.2090721	-.1626014
cdum54	.2704144	.0141531	19.11	0.000	.2426615	.2981674
cdum55	.1816679	.0451108	4.03	0.000	.0932097	.270126
cdum56	.0133685	.0257187	0.52	0.603	-.0370634	.0638004
cdum57	-.5672533	.0210408	-26.96	0.000	-.6085123	-.5259944
cdum58	-.0590235	.0121584	-4.85	0.000	-.082865	-.035182
cdum59	.4291668	.0359471	11.94	0.000	.3586779	.4996556
cdum60	.4135364	.0198719	20.81	0.000	.3745695	.4525033
cdum61	-.5491147	.0172217	-31.89	0.000	-.5828848	-.5153445
cdum62	.4332454	.0299628	14.46	0.000	.3744911	.4919997
cdum63	.1809823	.0116287	15.56	0.000	.1581794	.2037852
cdum64	.1011471	.0112446	9.00	0.000	.0790975	.1231966
cdum65	.2788645	.0254382	10.96	0.000	.2289827	.3287464
cdum66	-.5533762	.0144896	-38.19	0.000	-.581789	-.5249634
cdum67	-.4742551	.014663	-32.34	0.000	-.503008	-.4455022
cdum68	-.2672889	.0466842	-5.73	0.000	-.3588324	-.1757455
cdum69	-.243736	.0127363	-19.14	0.000	-.2687107	-.2187613
cdum70	.2337244	.0327519	7.14	0.000	.169501	.2979478
cdum71	.3662439	.0412027	8.89	0.000	.2854492	.4470385
cdum72	.3037635	.0559688	5.43	0.000	.194014	.4135131
cdum73	.2583847	.037693	6.85	0.000	.1844723	.3322971
cdum74	.2663421	.0426798	6.24	0.000	.182651	.3500332
cdum75	-.2261386	.0262907	-8.60	0.000	-.2776922	-.1745851
cdum76	.2334678	.0239815	9.74	0.000	.1864423	.2804933
cdum77	-.0214274	.0169182	-1.27	0.205	-.0546024	.0117476
cdum78	.4350625	.0327548	13.28	0.000	.3708334	.4992916
cdum79	-.2731544	.0123571	-22.11	0.000	-.2973855	-.2489234

cdum80	.1146911	.0160182	7.16	0.000	.0832809	.1461012
cdum81	.026838	.0383788	0.70	0.484	-.0484192	.1020953
cdum82	-.4519102	.0231191	-19.55	0.000	-.4972446	-.4065758
cdum83	.4534658	.0501919	9.03	0.000	.3550443	.5518874
cdum84	.4783733	.072359	6.61	0.000	.3364841	.6202625
cdum85	.3079765	.0143228	21.50	0.000	.2798909	.3360621
cdum86	.2894494	.0287843	10.06	0.000	.233006	.3458928
cdum87	-.4730242	.0151013	-31.32	0.000	-.5026364	-.443412
cdum88	-.4078685	.0164638	-24.77	0.000	-.4401526	-.3755845
ydum2	.0046874	.0059009	0.79	0.427	-.0068837	.0162586
ydum3	.0082961	.0059162	1.40	0.161	-.003305	.0198973
ydum4	.0100878	.0059394	1.70	0.090	-.0015588	.0217344
ydum5	.0132643	.0059808	2.22	0.027	.0015365	.0249921
ydum6	.0213179	.0060251	3.54	0.000	.0095033	.0331325
ydum7	.0282943	.0060854	4.65	0.000	.0163614	.0402272
ydum8	.0347443	.0061533	5.65	0.000	.0226783	.0468104
ydum9	.0413704	.0062417	6.63	0.000	.029131	.0536098
ydum10	.0464213	.0063393	7.32	0.000	.0339905	.0588521
ydum11	.051737	.0064451	8.03	0.000	.0390987	.0643753
ydum12	.0561522	.0065389	8.59	0.000	.0433301	.0689744
ydum13	.0599441	.0066507	9.01	0.000	.0469027	.0729856
ydum14	.0653883	.0067488	9.69	0.000	.0521546	.0786219
ydum15	.063879	.0068794	9.29	0.000	.0503892	.0773689
ydum16	.075548	.0070058	10.78	0.000	.0618102	.0892857
ydum17	.0861977	.0071648	12.03	0.000	.0721482	.1002473
ydum18	.0910889	.0073373	12.41	0.000	.0767012	.1054766
ydum19	.0976361	.0075256	12.97	0.000	.082879	.1123931
ydum20	.1016571	.0077169	13.17	0.000	.086525	.1167892
ydum21	.1004741	.0079248	12.68	0.000	.0849342	.1160139
ydum22	.1037387	.0080524	12.88	0.000	.0879487	.1195287
ydum23	.1049922	.0081873	12.82	0.000	.0889376	.1210467
ydum24	.1104455	.0083398	13.24	0.000	.0940919	.126799

ydum25 |	.1141472	.0085503	13.35	0.000	.0973809	.1309135
ydum26 |	.1179024	.008772	13.44	0.000	.1007014	.1351034
ydum27 |	.1202499	.0090167	13.34	0.000	.102569	.1379307
ydum28 |	.1216528	.0092327	13.18	0.000	.1035484	.1397572
ydum29 |	.1287049	.0094008	13.69	0.000	.1102707	.1471391
ydum30 |	.1349014	.0093782	14.38	0.000	.1165117	.153291
_cons |	1.144353	.0698558	16.38	0.000	1.007373	1.281334

3.7: 4 Countries (Brazil + China + India + Indonesia)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	1.97149034	37	.053283523	Number of obs =	120
Residual	.01073548	82	.00013092	F(37, 82) =	406.99
Total	1.98222582	119	.01665736	Prob > F =	0.0000
				R-squared =	0.9946
				Adj R-squared =	0.9921
				Root MSE =	.01144

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.5712661	.0777564	-7.35	0.000	-.7259483	-.4165839
lngdppc2co~s	.0286681	.005975	4.80	0.000	.0167819	.0405543
lnpopinmil	-.8219607	.2406558	-3.42	0.001	-1.300702	-.3432196
lnpopinmil2	.0069384	.0109325	0.63	0.527	-.0148099	.0286866
totagrnona~s	.0300047	.0084387	3.56	0.001	.0132174	.0467919
ydum2	.0279885	.0088016	3.18	0.002	.0104794	.0454977
ydum3	.0530083	.0106082	5.00	0.000	.0319051	.0741114
ydum4	.0845263	.0126055	6.71	0.000	.0594499	.1096027
ydum5	.1108586	.0154315	7.18	0.000	.0801604	.1415569
ydum6	.1304904	.0185784	7.02	0.000	.0935319	.1674488
ydum7	.1514806	.0212833	7.12	0.000	.1091413	.1938199
ydum8	.175581	.0248176	7.07	0.000	.1262109	.2249512
ydum9	.2040877	.0279626	7.30	0.000	.1484613	.2597142
ydum10	.2224678	.0313555	7.10	0.000	.1600917	.2848438
ydum11	.245193	.0339491	7.22	0.000	.1776574	.3127286
ydum12	.2613817	.0366875	7.12	0.000	.1883986	.3343648
ydum13	.2833396	.0397262	7.13	0.000	.2043116	.3623675
ydum14	.3039258	.0427533	7.11	0.000	.2188759	.3889757
ydum15	.3320784	.045155	7.35	0.000	.2422507	.4219061

ydum16	.3505993	.0490872	7.14	0.000	.2529491	.4482495
ydum17	.3770789	.0519379	7.26	0.000	.2737579	.4803998
ydum18	.3921623	.0545585	7.19	0.000	.2836281	.5006966
ydum19	.4097685	.0561309	7.30	0.000	.2981064	.5214307
ydum20	.4295518	.0583895	7.36	0.000	.3133966	.545707
ydum21	.4366652	.0612467	7.13	0.000	.314826	.5585044
ydum22	.4560815	.0635677	7.17	0.000	.3296252	.5825379
ydum23	.4709462	.0657705	7.16	0.000	.3401077	.6017846
ydum24	.4927365	.0681778	7.23	0.000	.3571091	.6283639
ydum25	.5100016	.0708942	7.19	0.000	.3689704	.6510329
ydum26	.5267306	.0738695	7.13	0.000	.3797806	.6736806
ydum27	.5463681	.0766328	7.13	0.000	.3939211	.6988151
ydum28	.5708102	.0792843	7.20	0.000	.4130884	.728532
ydum29	.5900678	.0814595	7.24	0.000	.4280189	.7521167
ydum30	.6105674	.0832982	7.33	0.000	.4448607	.7762741
cdum2	.8627403	.2410188	3.58	0.001	.3832772	1.342203
cdum3	.7166479	.2005305	3.57	0.001	.3177289	1.115567
cdum4	-.2987711	.0183756	-16.26	0.000	-.3353261	-.2622161
_cons	6.236826	1.085973	5.74	0.000	4.07648	8.397171

4: Regression Results Using Country dummies and Decadal dummies for Turning Point Analysis

4.1: 109 Countries (88 Developing + 21 Developed)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	106.093002	115	.922547846	Number of obs =	3270
Residual	5.32520805	3154	.001688398	F(115, 3154) =	546.40
Total	111.41821	3269	.03408327	Prob > F =	0.0000
				R-squared =	0.9522
				Adj R-squared =	0.9505
				Root MSE =	.04109

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.4445285	.0168516	-26.38	0.000	-.4775697	-.4114874
lngdppc2co~s	.0258242	.0012115	21.32	0.000	.0234488	.0281996
lnpopinmil	.1262535	.0089546	14.10	0.000	.108696	.143811
lnpopinmil2	-.0014913	.0012781	-1.17	0.243	-.0039973	.0010147
totagrnona~s	.0695793	.0027662	25.15	0.000	.0641555	.0750031
yd~119801989	-.0362043	.0038955	-9.29	0.000	-.0438422	-.0285665
yd~219901999	-.011921	.0024847	-4.80	0.000	-.0167928	-.0070492
cdum2	-.20111	.0204222	-9.85	0.000	-.2411521	-.1610679
cdum3	.5307056	.0381549	13.91	0.000	.4558947	.6055166
cdum4	-.0855847	.0255502	-3.35	0.001	-.1356813	-.035488
cdum5	-.0049052	.0261105	-0.19	0.851	-.0561004	.04629
cdum6	.0632935	.022399	2.83	0.005	.0193753	.1072116
cdum7	-.713478	.0326465	-21.85	0.000	-.7774885	-.6494675
cdum8	.0577884	.0233059	2.48	0.013	.0120921	.1034846
cdum9	.4606358	.0261942	17.59	0.000	.4092764	.5119952
cdum10	-.2457688	.0123599	-19.88	0.000	-.270003	-.2215345
cdum11	-.2414921	.0187151	-12.90	0.000	-.278187	-.2047971

cdum12 |	-.2124517	.0125221	-16.97	0.000	-.2370039	-.1878995
cdum13 |	-.0824115	.0122013	-6.75	0.000	-.1063348	-.0584882
cdum14 |	-.3592815	.0363301	-9.89	0.000	-.4305146	-.2880485
cdum15 |	.1235958	.0134179	9.21	0.000	.0972871	.1499046
cdum16 |	-.7564539	.0154984	-48.81	0.000	-.786842	-.7260659
cdum17 |	-.6332958	.015011	-42.19	0.000	-.662728	-.6038635
cdum18 |	-.4613772	.0155343	-29.70	0.000	-.4918355	-.430919
cdum19 |	-.0555052	.0296096	-1.87	0.061	-.1135613	.0025509
cdum20 |	-.2416282	.01196	-20.20	0.000	-.2650784	-.218178
cdum21 |	-.562297	.014235	-39.50	0.000	-.5902078	-.5343862
cdum22 |	-.0192455	.0176867	-1.09	0.277	-.0539241	.0154332
cdum23 |	-1.021444	.0585317	-17.45	0.000	-1.136208	-.9066795
cdum24 |	-.1595944	.0228254	-6.99	0.000	-.2043485	-.1148403
cdum25 |	-.0038619	.0200833	-0.19	0.848	-.0432396	.0355158
cdum26 |	-.6587711	.0253449	-25.99	0.000	-.7084653	-.6090768
cdum27 |	-.1354092	.0107073	-12.65	0.000	-.1564031	-.1144154
cdum28 |	.1158452	.0117611	9.85	0.000	.0927849	.1389055
cdum29 |	-.3252093	.0157593	-20.64	0.000	-.3561087	-.2943098
cdum30 |	.0372796	.0155714	2.39	0.017	.0067485	.0678107
cdum31 |	.0963438	.0224457	4.29	0.000	.052334	.1403535
cdum32 |	.7079718	.0384755	18.40	0.000	.6325323	.7834113
cdum33 |	.0229488	.0135858	1.69	0.091	-.0036892	.0495868
cdum34 |	-.3364359	.0262871	-12.80	0.000	-.3879774	-.2848943
cdum35 |	-.7376267	.0272074	-27.11	0.000	-.7909727	-.6842807
cdum36 |	.1810569	.0156709	11.55	0.000	.1503308	.2117831
cdum37 |	.1299989	.0205311	6.33	0.000	.0897432	.1702547
cdum38 |	-.1486629	.0342709	-4.34	0.000	-.2158583	-.0814674
cdum39 |	.0076544	.0140845	0.54	0.587	-.0199613	.0352701
cdum40 |	-.2849939	.0148296	-19.22	0.000	-.3140705	-.2559174
cdum41 |	-.1816997	.0368694	-4.93	0.000	-.2539902	-.1094093
cdum42 |	-.3270796	.0177256	-18.45	0.000	-.3618344	-.2923248
cdum43 |	-.0250848	.0199781	-1.26	0.209	-.0642562	.0140865

cdum44	.558654	.0346582	16.12	0.000	.4906992	.6266088
cdum45	-.1678742	.0142183	-11.81	0.000	-.1957522	-.1399962
cdum46	-.2138829	.0154549	-13.84	0.000	-.2441856	-.1835801
cdum47	.4557019	.0160415	28.41	0.000	.424249	.4871548
cdum48	-.0647599	.0114728	-5.64	0.000	-.0872548	-.042265
cdum49	-.9142884	.0550523	-16.61	0.000	-1.02223	-.8063465
cdum50	-.6502298	.0362161	-17.95	0.000	-.7212394	-.5792203
cdum51	-.2735019	.0257804	-10.61	0.000	-.3240499	-.2229538
cdum52	.1614977	.018547	8.71	0.000	.1251322	.1978631
cdum53	-.1661187	.0332058	-5.00	0.000	-.231226	-.1010115
cdum54	-.2868581	.0435153	-6.59	0.000	-.3721793	-.201537
cdum55	.1073829	.0110396	9.73	0.000	.0857374	.1290283
cdum56	-.6179889	.0198276	-31.17	0.000	-.6568652	-.5791125
cdum57	.6419536	.038685	16.59	0.000	.5661033	.7178039
cdum58	-.1519929	.0279248	-5.44	0.000	-.2067455	-.0972402
cdum59	-.128176	.0125532	-10.21	0.000	-.1527893	-.1035628
cdum60	-.1243767	.0126371	-9.84	0.000	-.1491545	-.0995989
cdum61	-.6052839	.0161278	-37.53	0.000	-.6369059	-.5736619
cdum62	-.6941114	.0162538	-42.70	0.000	-.7259805	-.6622422
cdum63	-.0730227	.0194097	-3.76	0.000	-.1110796	-.0349659
cdum64	-.5449892	.0153811	-35.43	0.000	-.5751471	-.5148313
cdum65	-.1222154	.0115803	-10.55	0.000	-.1449211	-.0995097
cdum66	.3259303	.0134145	24.30	0.000	.2996282	.3522324
cdum67	-.3348775	.0319692	-10.48	0.000	-.39756	-.272195
cdum68	.1496795	.0114771	13.04	0.000	.1271762	.1721828
cdum69	-.2471334	.0197579	-12.51	0.000	-.2858731	-.2083937
cdum70	-.7284679	.0178254	-40.87	0.000	-.7634184	-.6935173
cdum71	-.0164902	.011988	-1.38	0.169	-.0399952	.0070148
cdum72	-.7261356	.0196161	-37.02	0.000	-.7645973	-.6876739
cdum73	.0092015	.0257199	0.36	0.721	-.0412278	.0596309
cdum74	.2189217	.0164169	13.34	0.000	.1867328	.2511106
cdum75	-.6425973	.0153519	-41.86	0.000	-.672698	-.6124965

cdum76	.1101073	.0232025	4.75	0.000	.0646137	.1556009
cdum77	-.5268408	.0318983	-16.52	0.000	-.5893843	-.4642974
cdum78	.1300016	.0116137	11.19	0.000	.1072305	.1527728
cdum79	-.3314506	.0111796	-29.65	0.000	-.3533706	-.3095305
cdum80	.0451096	.0111814	4.03	0.000	.023186	.0670332
cdum81	-.4231855	.0269617	-15.70	0.000	-.4760497	-.3703213
cdum82	-.0054891	.0190891	-0.29	0.774	-.0429174	.0319393
cdum83	-.6132362	.0135559	-45.24	0.000	-.6398155	-.5866569
cdum84	-.5644342	.0133501	-42.28	0.000	-.5906101	-.5382583
cdum85	-.0143422	.0377906	-0.38	0.704	-.0884389	.0597544
cdum86	-.2434383	.0124566	-19.54	0.000	-.2678622	-.2190144
cdum87	-.130683	.0238939	-5.47	0.000	-.1775323	-.0838338
cdum88	-.1189473	.0288452	-4.12	0.000	-.1755044	-.0623901
cdum89	-.2977957	.0170868	-17.43	0.000	-.331298	-.2642934
cdum90	.6036324	.044877	13.45	0.000	.5156414	.6916235
cdum91	.4947577	.0303866	16.28	0.000	.4351782	.5543372
cdum92	.551803	.0338793	16.29	0.000	.4853752	.6182308
cdum93	-.4666358	.0208836	-22.34	0.000	-.5075826	-.425689
cdum94	.4042937	.0198536	20.36	0.000	.3653664	.443221
cdum95	.1059977	.0146922	7.21	0.000	.0771905	.1348049
cdum96	.0615278	.0241262	2.55	0.011	.0142231	.1088325
cdum97	-.6091887	.0260751	-23.36	0.000	-.6603146	-.5580628
cdum98	-.2794095	.0122111	-22.88	0.000	-.3033521	-.2554669
cdum99	.5656399	.0353066	16.02	0.000	.4964136	.6348662
cdum100	-.0261812	.0136271	-1.92	0.055	-.0529	.0005377
cdum101	-.404675	.0276067	-14.66	0.000	-.4588038	-.3505461
cdum102	-.6431013	.0191736	-33.54	0.000	-.6806954	-.6055073
cdum103	-.1449816	.0347441	-4.17	0.000	-.213105	-.0768582
cdum104	-.3742426	.0501742	-7.46	0.000	-.4726199	-.2758653
cdum105	.197282	.0130886	15.07	0.000	.1716189	.2229451
cdum106	.3689096	.0297218	12.41	0.000	.3106335	.4271857
cdum107	-.0340874	.0210646	-1.62	0.106	-.0753891	.0072144

```
cdum108 |  -.5627588   .0137313   -40.98   0.000    -.5896821   -.5358356

cdum109 |  -.5268524   .0144482   -36.46   0.000    -.5551812   -.4985236

  _cons |   1.447221   .0598057    24.20   0.000     1.329959    1.564483
```

4.2: 88 Developing Countries

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
				Number of obs =	2640
				F(94, 2545) =	433.04
Model	79.3502349	94	.844151435	Prob > F =	0.0000
Residual	4.96108663	2545	.001949346	R-squared =	0.9412
				Adj R-squared =	0.9390
Total	84.3113215	2639	.031948208	Root MSE =	.04415

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.5170755	.0233851	-22.11	0.000	-.5629312	-.4712197
lngdppc2co~s	.0313419	.0017587	17.82	0.000	.0278933	.0347904
lnpopinmil	.1248281	.010247	12.18	0.000	.1047348	.1449215
lnpopinmil2	-.0002572	.0013999	-0.18	0.854	-.0030023	.0024878
totagrnona~s	.080339	.003374	23.81	0.000	.073723	.0869551
yd~119801989	-.0371763	.0046155	-8.05	0.000	-.0462268	-.0281258
yd~219901999	-.0134857	.0029505	-4.57	0.000	-.0192713	-.0077001
cdum2	-.2125212	.0233322	-9.11	0.000	-.2582732	-.1667691
cdum3	.4931812	.0444111	11.10	0.000	.4060957	.5802667
cdum4	-.1267622	.0300578	-4.22	0.000	-.1857025	-.0678219
cdum5	-.7346663	.0372907	-19.70	0.000	-.8077896	-.6615431
cdum6	.4491429	.0299086	15.02	0.000	.3904952	.5077906
cdum7	-.2464854	.0133793	-18.42	0.000	-.2727208	-.2202501
cdum8	-.238768	.0211574	-11.29	0.000	-.2802554	-.1972806
cdum9	-.2111044	.0137541	-15.35	0.000	-.2380749	-.184134
cdum10	-.0873535	.0136247	-6.41	0.000	-.1140701	-.0606368
cdum11	-.3977338	.0420755	-9.45	0.000	-.4802394	-.3152282
cdum12	.1198789	.0148749	8.06	0.000	.0907107	.1490471
cdum13	-.765049	.0170065	-44.99	0.000	-.7983971	-.7317009
cdum14	-.6516308	.0163076	-39.96	0.000	-.6836084	-.6196532

cdum15	-.4671201	.0174956	-26.70	0.000	-.5014271	-.4328131
cdum16	-.2425149	.0128805	-18.83	0.000	-.2677723	-.2172576
cdum17	-.5671543	.0154433	-36.73	0.000	-.5974369	-.5368716
cdum18	-.034864	.0202568	-1.72	0.085	-.0745854	.0048574
cdum19	-1.070728	.0667297	-16.05	0.000	-1.201578	-.9398778
cdum20	-.1762462	.0262163	-6.72	0.000	-.2276536	-.1248389
cdum21	-.0014702	.0227387	-0.06	0.948	-.0460584	.0431181
cdum22	-.6869642	.0286718	-23.96	0.000	-.7431866	-.6307418
cdum23	-.1314719	.0115357	-11.40	0.000	-.1540923	-.1088515
cdum24	.1027764	.0131964	7.79	0.000	.0768996	.1286532
cdum25	-.3285976	.0177038	-18.56	0.000	-.3633129	-.2938823
cdum26	.0262928	.0176044	1.49	0.135	-.0082276	.0608133
cdum27	.6882186	.043841	15.70	0.000	.6022508	.7741863
cdum28	.0154382	.0151301	1.02	0.308	-.0142303	.0451066
cdum29	-.3478745	.0301464	-11.54	0.000	-.4069884	-.2887605
cdum30	-.7640567	.0307836	-24.82	0.000	-.8244201	-.7036933
cdum31	.1800184	.0176618	10.19	0.000	.1453854	.2146513
cdum32	-.0080459	.0163989	-0.49	0.624	-.0402024	.0241107
cdum33	-.2825056	.016557	-17.06	0.000	-.314972	-.2500391
cdum34	-.3345778	.0197354	-16.95	0.000	-.3732769	-.2958786
cdum35	.5408041	.0395507	13.67	0.000	.4632494	.6183589
cdum36	-.1683082	.0158082	-10.65	0.000	-.1993066	-.1373099
cdum37	-.2206623	.0172524	-12.79	0.000	-.2544925	-.1868322
cdum38	.4597338	.017992	25.55	0.000	.4244533	.4950143
cdum39	-.0640068	.0124684	-5.13	0.000	-.0884561	-.0395574
cdum40	-.9595226	.062749	-15.29	0.000	-1.082567	-.8364783
cdum41	-.6726728	.041553	-16.19	0.000	-.754154	-.5911916
cdum42	-.2894919	.0296459	-9.77	0.000	-.3476244	-.2313595
cdum43	.1001131	.0119751	8.36	0.000	.0766312	.1235949
cdum44	-.6216599	.0223964	-27.76	0.000	-.6655769	-.577743
cdum45	.6372222	.0437641	14.56	0.000	.5514054	.723039
cdum46	-.1305899	.0137231	-9.52	0.000	-.1574995	-.1036803

cdum47	-.1316224	.0137183	-9.59	0.000	-.1585226	-.1047222
cdum48	-.610778	.0178637	-34.19	0.000	-.645807	-.5757491
cdum49	-.7105281	.017831	-39.85	0.000	-.7454929	-.6755633
cdum50	-.0885863	.0222215	-3.99	0.000	-.1321603	-.0450123
cdum51	-.551863	.0168602	-32.73	0.000	-.5849241	-.518802
cdum52	-.1171251	.0125886	-9.30	0.000	-.14181	-.0924401
cdum53	.3184426	.0151944	20.96	0.000	.288648	.3482372
cdum54	-.3744017	.0372404	-10.05	0.000	-.4474264	-.3013771
cdum55	.1571431	.0124985	12.57	0.000	.1326348	.1816515
cdum56	-.2507748	.0224442	-11.17	0.000	-.2947855	-.206764
cdum57	-.7429212	.0198919	-37.35	0.000	-.7819271	-.7039153
cdum58	-.0183838	.0132514	-1.39	0.165	-.0443685	.0076008
cdum59	-.7377244	.0219096	-33.67	0.000	-.7806869	-.6947619
cdum60	-.6514571	.0167875	-38.81	0.000	-.6843757	-.6185385
cdum61	-.5443835	.0365359	-14.90	0.000	-.6160266	-.4727403
cdum62	.1193247	.0131141	9.10	0.000	.0936094	.1450401
cdum63	-.3287606	.0120875	-27.20	0.000	-.3524629	-.3050582
cdum64	.0408146	.0121375	3.36	0.001	.0170143	.064615
cdum65	-.4388467	.031006	-14.15	0.000	-.4996463	-.3780472
cdum66	-.6187912	.0147462	-41.96	0.000	-.647707	-.5898755
cdum67	-.5631905	.0146805	-38.36	0.000	-.5919774	-.5344035
cdum68	-.0466179	.0436571	-1.07	0.286	-.132225	.0389892
cdum69	-.2462109	.0134052	-18.37	0.000	-.272497	-.2199247
cdum70	-.1528426	.0275581	-5.55	0.000	-.2068813	-.0988039
cdum71	-.2981792	.0192217	-15.51	0.000	-.3358709	-.2604875
cdum72	.5640848	.0513752	10.98	0.000	.4633434	.6648262
cdum73	.4768386	.0348797	13.67	0.000	.4084431	.5452341
cdum74	.5378832	.0385863	13.94	0.000	.4622196	.6135469
cdum75	-.4736901	.0235851	-20.08	0.000	-.5199381	-.4274421
cdum76	.4020845	.022612	17.78	0.000	.3577447	.4464243
cdum77	.1104611	.0164352	6.72	0.000	.0782334	.1426887
cdum78	-.6249893	.0299679	-20.86	0.000	-.6837533	-.5662252

cdum79	-.2825491	.0131505	-21.49	0.000	-.3083359	-.2567623
cdum80	.552808	.0399486	13.84	0.000	.4744729	.631143
cdum81	-.0288982	.015117	-1.91	0.056	-.0585411	.0007448
cdum82	-.4311358	.0319324	-13.50	0.000	-.4937519	-.3685196
cdum83	-.6588341	.0215289	-30.60	0.000	-.7010501	-.6166181
cdum84	.1710984	.0154581	11.07	0.000	.1407867	.2014101
cdum85	.3669318	.0337095	10.89	0.000	.300831	.4330326
cdum86	-.0608557	.0244569	-2.49	0.013	-.108813	-.0128983
cdum87	-.5643742	.0150949	-37.39	0.000	-.5939738	-.5347746
cdum88	-.527981	.0160285	-32.94	0.000	-.5594113	-.4965508
_cons	1.670764	.0796841	20.97	0.000	1.514512	1.827017

4.3: 19 Asian Countries (Developing Only)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	16.5056025	25	.660224098	Number of obs =	570
Residual	.983934839	544	.001808704	F(25, 544) =	365.03
Total	17.4895373	569	.030737324	Prob > F =	0.0000
				R-squared =	0.9437
				Adj R-squared =	0.9412
				Root MSE =	.04253

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.782458	.0650549	-12.03	0.000	-.9102475	-.6546684
lngdppc2co~s	.0526743	.0048912	10.77	0.000	.0430665	.0622822
lnpopinmil	.1899093	.02298	8.26	0.000	.1447689	.2350496
lnpopinmil2	.0025947	.0022647	1.15	0.252	-.0018539	.0070433
totagrnona~s	.0914391	.0074871	12.21	0.000	.0767318	.1061463
yd~119801989	-.0043911	.0098629	-0.45	0.656	-.0237652	.0149829
yd~219901999	.0003815	.0061483	0.06	0.951	-.0116958	.0124587
cdum2	.9167579	.1186759	7.72	0.000	.6836388	1.149877
cdum3	-.563189	.0638336	-8.82	0.000	-.6885795	-.4377984
cdum4	1.280485	.1136222	11.27	0.000	1.057293	1.503677
cdum5	-.4175389	.056564	-7.38	0.000	-.5286496	-.3064283
cdum6	.0255814	.0161908	1.58	0.115	-.0062227	.0573855
cdum7	.4921499	.0275827	17.84	0.000	.4379682	.5463316
cdum8	1.084585	.0806096	13.45	0.000	.9262412	1.242929
cdum9	1.90678	.1619566	11.77	0.000	1.588643	2.224916
cdum10	.7368159	.0513696	14.34	0.000	.6359087	.837723
cdum11	1.227946	.090979	13.50	0.000	1.049233	1.406659
cdum12	.1388642	.0424821	3.27	0.001	.0554151	.2223132
cdum13	.1997437	.0123275	16.20	0.000	.1755284	.223959
cdum14	.6832011	.0759175	9.00	0.000	.5340738	.8323284

cdum15 |	.3420079	.0225539	15.16	0.000	.2977044	.3863114
cdum16 |	.6101144	.049612	12.30	0.000	.5126599	.7075689
cdum17 |	.1518578	.0273396	5.55	0.000	.0981537	.2055619
cdum18 |	1.775152	.1561513	11.37	0.000	1.468419	2.081885
cdum19 |	1.588436	.1444731	10.99	0.000	1.304643	1.87223
_cons |	1.347408	.2307368	5.84	0.000	.8941635	1.800652

4.4: LAC (24 Developing Countries)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS		
Model	5.35963974	30	.178654658	Number of obs =	720
Residual	.435761059	689	.000632454	F(30, 689) =	282.48
Total	5.7954008	719	.008060363	Prob > F =	0.0000
				R-squared =	0.9248
				Adj R-squared =	0.9215
				Root MSE =	.02515

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.1161461	.0763472	-1.52	0.129	-.2660472	.033755
lngdppc2co~s	.0069466	.0046756	1.49	0.138	-.0022335	.0161267
lnpopinmil	.1091689	.0120684	9.05	0.000	.0854737	.1328642
lnpopinmil2	.0155209	.0018047	8.60	0.000	.0119776	.0190642
totagrnona~s	.052701	.0042825	12.31	0.000	.0442928	.0611093
yd~119801989	-.0166619	.0048045	-3.47	0.001	-.0260952	-.0072287
yd~219901999	.0005381	.0030928	0.17	0.862	-.0055343	.0066105
cdum2	-.5972394	.0728434	-8.20	0.000	-.7402611	-.4542178
cdum3	.0385647	.0204889	1.88	0.060	-.0016635	.078793
cdum4	-.5526918	.0597113	-9.26	0.000	-.6699297	-.4354539
cdum5	-1.067747	.0887302	-12.03	0.000	-1.241961	-.8935327
cdum6	-.457802	.0637975	-7.18	0.000	-.5830629	-.3325411
cdum7	-.6669197	.0726335	-9.18	0.000	-.8095292	-.5243101
cdum8	-.2485971	.0512121	-4.85	0.000	-.3491476	-.1480466
cdum9	-.3770526	.0615733	-6.12	0.000	-.4979463	-.2561588
cdum10	.1846654	.0090367	20.44	0.000	.1669227	.2024081
cdum11	-.3628576	.0592016	-6.13	0.000	-.4790948	-.2466205
cdum12	.0691315	.0108434	6.38	0.000	.0478415	.0904215
cdum13	-.5584746	.0611586	-9.13	0.000	-.6785543	-.4383949
cdum14	.1567977	.0392964	3.99	0.000	.0796426	.2339529

cdum15 |	-.4000686	.0567108	-7.05	0.000	-.5114154	-.2887218
cdum16 |	-.9646096	.0820978	-11.75	0.000	-1.125802	-.8034177
cdum17 |	-.2337003	.0485929	-4.81	0.000	-.3291083	-.1382923
cdum18 |	-.2897207	.0553536	-5.23	0.000	-.3984027	-.1810386
cdum19 |	.0230942	.011304	2.04	0.041	.0008997	.0452887
cdum20 |	.0333157	.0144371	2.31	0.021	.0049697	.0616617
cdum21 |	.0742698	.0121994	6.09	0.000	.0503174	.0982221
cdum22 |	.0251564	.0296638	0.85	0.397	-.0330858	.0833987
cdum23 |	-.1660552	.0505114	-3.29	0.001	-.26523	-.0668804
cdum24 |	-.5063732	.0679356	-7.45	0.000	-.6397589	-.3729875
_cons |	.3955438	.3151935	1.25	0.210	-.2233112	1.014399

4.5: SSA (38 Developing Countries)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS
Model	28.3951994	44	.645345442
Residual	2.76922611	1095	.002528974
Total	31.1644255	1139	.027361216

Number of obs =	1140
F(44, 1095) =	255.18
Prob > F =	0.0000
R-squared =	0.9111
Adj R-squared =	0.9076
Root MSE =	.05029

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.3994775	.0410443	-9.73	0.000	-.4800118	-.3189431
lngdppc2co~s	.0192015	.0033835	5.68	0.000	.0125627	.0258404
lnpopinmil	.2117681	.0198956	10.64	0.000	.1727304	.2508058
lnpopinmil2	-.0220868	.0028087	-7.86	0.000	-.0275979	-.0165757
totagrnona~s	.0821009	.0056456	14.54	0.000	.0710234	.0931783
yd~119801989	-.0237912	.0092952	-2.56	0.011	-.0420296	-.0055528
yd~219901999	-.0132915	.005541	-2.40	0.017	-.0241636	-.0024194
cdum2	.3128169	.0318343	9.83	0.000	.2503537	.3752801
cdum3	-.5259555	.0168452	-31.22	0.000	-.559008	-.492903
cdum4	-.4178802	.0153652	-27.20	0.000	-.4480286	-.3877317
cdum5	-.1897812	.0204614	-9.28	0.000	-.2299291	-.1496332
cdum6	.0120337	.0157606	0.76	0.445	-.0188906	.042958
cdum7	-.329855	.0143961	-22.91	0.000	-.3581021	-.3016079
cdum8	.4111965	.0473685	8.68	0.000	.3182531	.5041398
cdum9	-.3828913	.0385061	-9.94	0.000	-.4584455	-.3073372
cdum10	.1828411	.0202984	9.01	0.000	.1430129	.2226693
cdum11	-.0529366	.0205469	-2.58	0.010	-.0932524	-.0126207
cdum12	-.4410802	.0425555	-10.36	0.000	-.5245797	-.3575807
cdum13	.4636746	.0412514	11.24	0.000	.3827338	.5446153
cdum14	.0460183	.0320812	1.43	0.152	-.0169294	.1089659

cdum15	-.0805347	.0223698	-3.60	0.000	-.1244272	-.0366422
cdum16	.0887228	.0301023	2.95	0.003	.029658	.1477875
cdum17	-.3336997	.0284923	-11.71	0.000	-.3896054	-.277794
cdum18	.1613217	.0242411	6.65	0.000	.1137575	.2088859
cdum19	.1382558	.0187154	7.39	0.000	.1015337	.1749779
cdum20	-.3628517	.0189894	-19.11	0.000	-.4001113	-.3255921
cdum21	-.475136	.0176707	-26.89	0.000	-.5098083	-.4404636
cdum22	-.3128756	.0166569	-18.78	0.000	-.3455586	-.2801927
cdum23	.1654434	.0203654	8.12	0.000	.1254839	.205403
cdum24	.7495607	.0366903	20.43	0.000	.6775694	.821552
cdum25	-.492469	.0223639	-22.02	0.000	-.5363499	-.4485881
cdum26	.3657345	.030085	12.16	0.000	.3067038	.4247653
cdum27	-.4139773	.0162969	-25.40	0.000	-.4459541	-.3820006
cdum28	-.3798087	.0137212	-27.68	0.000	-.4067316	-.3528858
cdum29	-.3074057	.014798	-20.77	0.000	-.3364414	-.27837
cdum30	.8252957	.099357	8.31	0.000	.6303441	1.020247
cdum31	-.0014152	.013982	-0.10	0.919	-.0288498	.0260194
cdum32	.266729	.0435567	6.12	0.000	.1812649	.3521931
cdum33	-.1855951	.0303555	-6.11	0.000	-.2451565	-.1260336
cdum34	.4999093	.0361758	13.82	0.000	.4289275	.5708911
cdum35	-.0364849	.013597	-2.68	0.007	-.063164	-.0098058
cdum36	-.397772	.0256028	-15.54	0.000	-.4480081	-.3475358
cdum37	-.3157111	.0148674	-21.24	0.000	-.3448829	-.2865392
cdum38	-.2699519	.0168942	-15.98	0.000	-.3031006	-.2368031
_cons	1.060435	.1258033	8.43	0.000	.8135921	1.307278

4.6:88 Non-Asian Countries (69 Developing + 19 Developed)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS
Model	86.7354366	94	.922717411
Residual	4.15469878	2545	.001632495
Total	90.8901354	2639	.034441127

Number of obs	=	2640
F(94, 2545)	=	565.22
Prob > F	=	0.0000
R-squared	=	0.9543
Adj R-squared	=	0.9526
Root MSE	=	.0404

agricultur~c	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.4138801	.019099	-21.67	0.000	-.4513312	-.376429
lngdppc2co~s	.0224571	.0013563	16.56	0.000	.0197975	.0251167
lnpopinmil	.1165122	.0100917	11.55	0.000	.0967235	.136301
lnpopinmil2	-.0045958	.0016121	-2.85	0.004	-.007757	-.0014346
totagrnona~s	.0634453	.0030455	20.83	0.000	.0574735	.0694171
yd~119801989	-.046152	.0043313	-10.66	0.000	-.0546452	-.0376587
yd~219901999	-.0161465	.0027538	-5.86	0.000	-.0215464	-.0107466
cdum2	-.1412552	.0217584	-6.49	0.000	-.1839212	-.0985891
cdum3	.5531214	.0440979	12.54	0.000	.4666499	.6395929
cdum4	.0169205	.0279473	0.61	0.545	-.0378813	.0717222
cdum5	.1075881	.028729	3.74	0.000	.0512534	.1639227
cdum6	.1579261	.0245239	6.44	0.000	.1098372	.2060149
cdum7	.1574378	.0255553	6.16	0.000	.1073265	.2075491
cdum8	.4543048	.0293082	15.50	0.000	.3968344	.5117751
cdum9	-.2515373	.0127545	-19.72	0.000	-.2765476	-.226527
cdum10	-.1993363	.0126848	-15.71	0.000	-.22421	-.1744626
cdum11	-.0785037	.0123985	-6.33	0.000	-.1028159	-.0541915
cdum12	-.2205973	.0404795	-5.45	0.000	-.2999735	-.1412211
cdum13	.1497334	.0137556	10.89	0.000	.1227601	.1767067
cdum14	-.7519355	.0164174	-45.80	0.000	-.7841283	-.7197426

cdum15	-.6400674	.0161562	-39.62	0.000	-.6717479	-.6083868
cdum16	-.4352098	.0160464	-27.12	0.000	-.4666752	-.4037444
cdum17	.0734235	.0327209	2.24	0.025	.0092611	.1375859
cdum18	-.2596857	.0124259	-20.90	0.000	-.2840516	-.2353198
cdum19	-.5679938	.0151881	-37.40	0.000	-.5977762	-.5382115
cdum20	.036803	.0188211	1.96	0.051	-.0001032	.0737092
cdum21	-.0855858	.0245692	-3.48	0.001	-.1337634	-.0374081
cdum22	-.0405872	.0215928	-1.88	0.060	-.0829285	.0017541
cdum23	-.6115193	.0271449	-22.53	0.000	-.6647478	-.5582909
cdum24	-.1394896	.0105451	-13.23	0.000	-.1601674	-.1188118
cdum25	.1414314	.011965	11.82	0.000	.1179693	.1648935
cdum26	-.30064	.0163295	-18.41	0.000	-.3326604	-.2686196
cdum27	.0810882	.0163479	4.96	0.000	.0490317	.1131448
cdum28	.1926553	.0246056	7.83	0.000	.1444061	.2409044
cdum29	.7078378	.0442563	15.99	0.000	.6210559	.7946198
cdum30	.0545709	.0140066	3.90	0.000	.0271054	.0820364
cdum31	-.2586593	.0284218	-9.10	0.000	-.3143914	-.2029271
cdum32	-.6848478	.0292753	-23.39	0.000	-.7422536	-.6274419
cdum33	.2150763	.0223921	9.60	0.000	.1711676	.2589849
cdum34	.0021774	.0380995	0.06	0.954	-.0725318	.0768866
cdum35	.0219874	.01479	1.49	0.137	-.0070143	.050989
cdum36	-.3170856	.0155226	-20.43	0.000	-.3475239	-.2866473
cdum37	-.0194647	.0411308	-0.47	0.636	-.100118	.0611886
cdum38	-.3094263	.0187475	-16.50	0.000	-.3461883	-.2726643
cdum39	.0540965	.0216779	2.50	0.013	.0115883	.0966047
cdum40	.5567128	.0396004	14.06	0.000	.4790606	.634365
cdum41	-.1405383	.0146821	-9.57	0.000	-.1693284	-.1117482
cdum42	-.2490512	.0164632	-15.13	0.000	-.2813338	-.2167686
cdum43	.4313114	.0168853	25.54	0.000	.3982011	.4644216
cdum44	-.055113	.0114608	-4.81	0.000	-.0775865	-.0326395
cdum45	.2337065	.0200692	11.65	0.000	.1943529	.2730601
cdum46	-.0211612	.0368664	-0.57	0.566	-.0934525	.0511301

cdum47 |	-.5835494	.0209498	-27.85	0.000	-.6246297	-.542469
cdum48 |	-.1509977	.0128767	-11.73	0.000	-.1762476	-.1257479
cdum49 |	-.1454888	.0132783	-10.96	0.000	-.1715261	-.1194514
cdum50 |	-.5934245	.0169651	-34.98	0.000	-.6266913	-.5601577
cdum51 |	-.6900468	.0173616	-39.75	0.000	-.7240911	-.6560025
cdum52 |	-.5414405	.0163076	-33.20	0.000	-.5734181	-.509463
cdum53 |	-.1427933	.011755	-12.15	0.000	-.1658437	-.1197429
cdum54 |	.3300866	.01389	23.76	0.000	.3028497	.3573235
cdum55 |	-.2092989	.0353633	-5.92	0.000	-.2786427	-.1399552
cdum56 |	-.198447	.0209371	-9.48	0.000	-.2395024	-.1573915
cdum57 |	-.7093472	.0188011	-37.73	0.000	-.7462142	-.6724801
cdum58 |	-.0160139	.0121227	-1.32	0.187	-.0397853	.0077575
cdum59 |	.1202848	.0282933	4.25	0.000	.0648045	.1757651
cdum60 |	.278667	.0175831	15.85	0.000	.2441883	.3131457
cdum61 |	-.6409626	.0163373	-39.23	0.000	-.6729984	-.6089269
cdum62 |	.2082543	.0254439	8.18	0.000	.1583613	.2581472
cdum63 |	.1505745	.0117567	12.81	0.000	.1275208	.1736283
cdum64 |	.0576824	.0111191	5.19	0.000	.035879	.0794859
cdum65 |	.0703587	.0206514	3.41	0.001	.0298635	.110854
cdum66 |	-.6155367	.0141884	-43.38	0.000	-.6433585	-.5877148
cdum67 |	-.5579119	.0137234	-40.65	0.000	-.5848221	-.5310018
cdum68 |	.0017301	.043613	0.04	0.968	-.0837905	.0872507
cdum69 |	-.2580927	.0130901	-19.72	0.000	-.2837611	-.2324243
cdum70 |	-.047608	.0258657	-1.84	0.066	-.098328	.003112
cdum71 |	.0022557	.0318061	0.07	0.943	-.0601127	.0646241
cdum72 |	.6245728	.0523491	11.93	0.000	.5219217	.7272239
cdum73 |	.4953995	.0344485	14.38	0.000	.4278496	.5629494
cdum74 |	.544841	.03858	14.12	0.000	.4691896	.6204924
cdum75 |	-.4305894	.0221428	-19.45	0.000	-.4740091	-.3871696
cdum76 |	.3926967	.0215535	18.22	0.000	.3504325	.4349609
cdum77 |	.088466	.0152956	5.78	0.000	.0584728	.1184592
cdum78 |	.165442	.0265031	6.24	0.000	.1134722	.2174118

cdum79 |	-.2909161	.0126789	-22.94	0.000	-.315778	-.2660541
cdum80 |	.0008284	.0140122	0.06	0.953	-.026648	.0283049
cdum81 |	-.3046839	.030183	-10.09	0.000	-.3638697	-.2454982
cdum82 |	-.6169078	.0202415	-30.48	0.000	-.6565993	-.5772163
cdum83 |	.0087918	.0386417	0.23	0.820	-.0669807	.0845642
cdum84 |	-.1449398	.0568798	-2.55	0.011	-.2564752	-.0334044
cdum85 |	.2366913	.013668	17.32	0.000	.2098897	.2634929
cdum86 |	.0426741	.0227409	1.88	0.061	-.0019184	.0872666
cdum87 |	-.5572841	.0142014	-39.24	0.000	-.5851317	-.5294366
cdum88 |	-.5140215	.0149293	-34.43	0.000	-.5432963	-.4847467
_cons |	1.425944	.0687031	20.76	0.000	1.291224	1.560664

4.7: 4 Countries (Brazil, China, India and Indonesia)

Agricultural Value Added Share minus Agricultural Employment Share

Source	SS	df	MS
Model	1.96235438	10	.196235438
Residual	.019871443	109	.000182307
Total	1.98222582	119	.01665736

Number of obs	120
F(10, 109)	1076.40
Prob > F	0.0000
R-squared	0.9900
Adj R-squared	0.9891
Root MSE	.0135

agrvaddeds~e	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.5828485	.074051	-7.87	0.000	-.7296153	-.4360817
lngdppc2co~s	.039893	.0054905	7.27	0.000	.029011	.050775
lnpopinmil	.8164816	.1038332	7.86	0.000	.6106877	1.022276
lnpopinmil2	-.0460963	.0090676	-5.08	0.000	-.064068	-.0281245
totagrnona~s	.0003789	.0077419	0.05	0.961	-.0149652	.015723
yd~119801989	.0096089	.0089082	1.08	0.283	-.0080469	.0272648
yd~219901999	.0061802	.0050265	1.23	0.222	-.0037821	.0161425
cdum2	-.8808916	.0567938	-15.51	0.000	-.9934551	-.7683281
cdum3	-.731318	.0503071	-14.54	0.000	-.8310251	-.6316109
cdum4	-.2433132	.0162968	-14.93	0.000	-.275613	-.2110134
_cons	-.9974224	.4714917	-2.12	0.037	-1.931904	-.0629413

5: Regression Results for the 4 Countries (BIIC) (Using dummies for China, India and Indonesia and Year dummies)

5.1. Agricultural Value Added Share

Source	SS	df	MS
Model	.848691001	37	.022937595
Residual	.005458668	82	.000066569
Total	.854149669	119	.007177728

Number of obs	=	120
F(37, 82)	=	344.57
Prob > F	=	0.0000
R-squared	=	0.9936
Adj R-squared	=	0.9907
Root MSE	=	.00816

agric~dshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-.3127086	.0554458	-5.64	0.000	-.4230079	-.2024092
lngdppc2co~s	.0113078	.0042606	2.65	0.010	.0028321	.0197835
lnpopinmil	-.6617877	.1716046	-3.86	0.000	-1.003164	-.3204115
lnpopinmil2	.0045543	.0077956	0.58	0.561	-.0109537	.0200623
totagrnona~s	.0590648	.0060174	9.82	0.000	.0470943	.0710353
d1china	1.104884	.1718634	6.43	0.000	.7629928	1.446775
d2india	.9310687	.1429924	6.51	0.000	.6466112	1.215526
d3indonesia	-.0071171	.0131031	-0.54	0.588	-.0331834	.0189492
dyear2	.0196399	.0062762	3.13	0.002	.0071546	.0321252
dyear3	.0369484	.0075644	4.88	0.000	.0219004	.0519965
dyear4	.0541047	.0089886	6.02	0.000	.0362235	.071986
dyear5	.0685629	.0110038	6.23	0.000	.0466729	.090453
dyear6	.0782185	.0132477	5.90	0.000	.0518645	.1045725
dyear7	.0864477	.0151765	5.70	0.000	.0562568	.1166387
dyear8	.1035574	.0176967	5.85	0.000	.068353	.1387618
dyear9	.121184	.0199393	6.08	0.000	.0815184	.1608496
dyear10	.1328399	.0223587	5.94	0.000	.0883613	.1773184
dyear11	.1464697	.0242081	6.05	0.000	.098312	.1946274

dyear12	.1525554	.0261608	5.83	0.000	.1005133	.2045975
dyear13	.1646212	.0283276	5.81	0.000	.1082687	.2209738
dyear14	.1749991	.0304861	5.74	0.000	.1143525	.2356457
dyear15	.1887216	.0321987	5.86	0.000	.1246681	.2527751
dyear16	.2025292	.0350027	5.79	0.000	.1328977	.2721606
dyear17	.2191709	.0370354	5.92	0.000	.1454958	.2928461
dyear18	.2254283	.0389041	5.79	0.000	.1480358	.3028209
dyear19	.2352936	.0400253	5.88	0.000	.1556705	.3149166
dyear20	.24616	.0416358	5.91	0.000	.1633331	.3289869
dyear21	.2468893	.0436732	5.65	0.000	.1600093	.3337693
dyear22	.2579728	.0453282	5.69	0.000	.1678005	.3481451
dyear23	.2638088	.046899	5.63	0.000	.1705117	.3571059
dyear24	.2767545	.0486156	5.69	0.000	.1800426	.3734664
dyear25	.2861947	.0505526	5.66	0.000	.1856295	.38676
dyear26	.2969554	.0526742	5.64	0.000	.1921697	.4017411
dyear27	.3092282	.0546446	5.66	0.000	.2005227	.4179337
dyear28	.3244505	.0565353	5.74	0.000	.2119837	.4369173
dyear29	.3353834	.0580864	5.77	0.000	.2198311	.4509357
dyear30	.3464893	.0593975	5.83	0.000	.2283287	.4646498
_cons	4.845804	.7743754	6.26	0.000	3.305325	6.386283

5.2: Agricultural Employment Share

Source	SS	df	MS		
Model	4.24010277	37	.114597372	Number of obs =	120
Residual	.006075668	82	.000074094	F(37, 82) =	1546.66
Total	4.24617844	119	.035682172	Prob > F =	0.0000
				R-squared =	0.9986
				Adj R-squared =	0.9979
				Root MSE =	.00861

agric~tshare	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	.2585573	.0584955	4.42	0.000	.1421912	.3749235
lngdppc2co~s	-.0173603	.004495	-3.86	0.000	-.0263022	-.0084184
lnpopinmil	.1601747	.1810434	0.88	0.379	-.1999783	.5203276
lnpopinmil2	-.0023841	.0082244	-0.29	0.773	-.0187451	.0139769
totagrnona~s	.02906	.0063484	4.58	0.000	.0164311	.0416889
d1china	.2421419	.1813164	1.34	0.185	-.1185542	.6028381
d2india	.2144194	.1508574	1.42	0.159	-.0856841	.5145228
d3indonesia	.2916542	.0138238	21.10	0.000	.2641541	.3191542
dyear2	-.0083486	.0066214	-1.26	0.211	-.0215206	.0048233
dyear3	-.0160599	.0079805	-2.01	0.047	-.0319356	-.0001842
dyear4	-.0304216	.009483	-3.21	0.002	-.0492864	-.0115569
dyear5	-.0422959	.011609	-3.64	0.000	-.0653899	-.0192018
dyear6	-.052272	.0139764	-3.74	0.000	-.0800755	-.0244685
dyear7	-.065033	.0160113	-4.06	0.000	-.0968845	-.0331815
dyear8	-.0720238	.0186701	-3.86	0.000	-.1091646	-.0348831
dyear9	-.082904	.021036	-3.94	0.000	-.1247513	-.0410566
dyear10	-.0896282	.0235885	-3.80	0.000	-.1365532	-.0427032
dyear11	-.0987235	.0255396	-3.87	0.000	-.14953	-.047917
dyear12	-.1088266	.0275997	-3.94	0.000	-.1637311	-.053922
dyear13	-.1187186	.0298857	-3.97	0.000	-.1781707	-.0592665
dyear14	-.128927	.0321629	-4.01	0.000	-.1929094	-.0649447

dyear15	-.1433572	.0339698	-4.22	0.000	-.2109338	-.0757805
dyear16	-.1480705	.0369279	-4.01	0.000	-.2215319	-.0746091
dyear17	-.1579084	.0390724	-4.04	0.000	-.2356359	-.0801809
dyear18	-.1667344	.0410439	-4.06	0.000	-.2483838	-.085085
dyear19	-.1744754	.0422268	-4.13	0.000	-.2584779	-.0904729
dyear20	-.1833923	.0439259	-4.18	0.000	-.2707749	-.0960096
dyear21	-.1897764	.0460754	-4.12	0.000	-.281435	-.0981178
dyear22	-.1981093	.0478214	-4.14	0.000	-.2932413	-.1029772
dyear23	-.207138	.0494786	-4.19	0.000	-.3055666	-.1087093
dyear24	-.2159826	.0512896	-4.21	0.000	-.3180139	-.1139512
dyear25	-.2238075	.0533332	-4.20	0.000	-.3299041	-.1177108
dyear26	-.2297758	.0555714	-4.13	0.000	-.3403251	-.1192265
dyear27	-.2371405	.0576502	-4.11	0.000	-.3518251	-.1224559
dyear28	-.2463603	.059645	-4.13	0.000	-.3650131	-.1277075
dyear29	-.2546851	.0612813	-4.16	0.000	-.3765931	-.132777
dyear30	-.2640788	.0626646	-4.21	0.000	-.3887386	-.139419
_cons	-1.391029	.8169683	-1.70	0.092	-3.016239	.2341815

5.3: Ln Agricultural Value Added (in millions) (constant 2000 US$)

```
      Source |       SS       df       MS              Number of obs =     120
-------------+------------------------------           F( 37,    82) = 1038.58
       Model |  80.7410075    37  2.18218939           Prob > F      =  0.0000
    Residual |  .172292851    82  .002101132           R-squared     =  0.9979
-------------+------------------------------           Adj R-squared =  0.9969
       Total |  80.9133003   119   .6799437           Root MSE      =  .04584

------------------------------------------------------------------------------
lnagrvainm~s |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lngdppccon~s |   .4221234   .3115006     1.36   0.179    -.1975506    1.041797
lngdppc2co~s |  -.0370688   .0239366    -1.55   0.125    -.0846863    .0105486
  lnpopinmil |  -3.472076   .9640937    -3.60   0.001    -5.389965   -1.554186
 lnpopinmil2 |   .0937274   .0437968     2.14   0.035     .0066016    .1808533
totagrnona~s |  -.0263491   .0338063    -0.78   0.438    -.0936006    .0409024
     d1china |   6.143912   .9655478     6.36   0.000      4.22313    8.064694
     d2india |   5.014748   .8033472     6.24   0.000     3.416635    6.612862
 d3indonesia |   .0428983   .0736148     0.58   0.562    -.1035451    .1893416
      dyear2 |   .1016023   .0352601     2.88   0.005     .0314587    .1717459
      dyear3 |   .1747436   .0424978     4.11   0.000      .090202    .2592852
      dyear4 |   .2692309   .0504991     5.33   0.000     .1687721    .3696897
      dyear5 |   .3707484   .0618205     6.00   0.000     .2477678     .493729
      dyear6 |   .4569264   .0744273     6.14   0.000     .3088667     .604986
      dyear7 |   .5002222   .0852634     5.87   0.000     .3306062    .6698381
      dyear8 |    .590761   .0994221     5.94   0.000     .3929787    .7885432
      dyear9 |   .6904597   .1120212     6.16   0.000     .4676139    .9133054
     dyear10 |   .7678622   .1256136     6.11   0.000     .5179768    1.017748
     dyear11 |   .8310202   .1360039     6.11   0.000     .5604651    1.101575
     dyear12 |   .8637035    .146974     5.88   0.000     .5713253    1.156082
     dyear13 |   .9556738   .1591473     6.00   0.000      .639079    1.272269
     dyear14 |   1.022451   .1712744     5.97   0.000     .6817316     1.36317
```

dyear15	1.106235	.180896	6.12	0.000	.7463755	1.466095
dyear16	1.17497	.1966489	5.97	0.000	.7837731	1.566168
dyear17	1.263022	.2080688	6.07	0.000	.8491072	1.676937
dyear18	1.30594	.2185673	5.98	0.000	.8711403	1.74074
dyear19	1.365118	.2248664	6.07	0.000	.9177869	1.812449
dyear20	1.432436	.2339146	6.12	0.000	.9671056	1.897767
dyear21	1.481708	.245361	6.04	0.000	.9936071	1.96981
dyear22	1.558442	.254659	6.12	0.000	1.051844	2.06504
dyear23	1.604008	.2634838	6.09	0.000	1.079854	2.128161
dyear24	1.688806	.2731279	6.18	0.000	1.145467	2.232144
dyear25	1.748968	.2840102	6.16	0.000	1.183981	2.313955
dyear26	1.810955	.2959294	6.12	0.000	1.222257	2.399653
dyear27	1.884471	.3069993	6.14	0.000	1.273751	2.49519
dyear28	1.962003	.3176218	6.18	0.000	1.330152	2.593854
dyear29	2.03242	.3263357	6.23	0.000	1.383234	2.681606
dyear30	2.070853	.3337018	6.21	0.000	1.407014	2.734693
_cons	23.35525	4.350527	5.37	0.000	14.70066	32.00983

5.4: Ln Agricultural Value Added per Worker (constant 2000 US$)

Source	SS	df	MS		
Model	68.7710524	37	1.85867709	Number of obs =	120
Residual	.451575778	82	.005507022	F(37, 82) =	337.51
Total	69.2226282	119	.581702758	Prob > F =	0.0000
				R-squared =	0.9935
				Adj R-squared =	0.9905
				Root MSE =	.07421

lnagrvapwo~r	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
lngdppccon~s	-1.529205	.5043019	-3.03	0.003	-2.532422	-.5259882
lngdppc2co~s	.0794743	.038752	2.05	0.043	.0023843	.1565643
lnpopinmil	-9.895631	1.560813	-6.34	0.000	-13.00059	-6.790676
lnpopinmil2	.3635566	.0709046	5.13	0.000	.2225048	.5046084
totagrnona~s	-.2059657	.0547305	-3.76	0.000	-.3148422	-.0970893
d1china	8.362297	1.563167	5.35	0.000	5.25266	11.47193
d2india	7.108484	1.300574	5.47	0.000	4.521228	9.695739
d3indonesia	-.8996159	.1191783	-7.55	0.000	-1.136699	-.6625324
dyear2	.1583694	.0570842	2.77	0.007	.0448109	.271928
dyear3	.2853421	.0688015	4.15	0.000	.148474	.4222102
dyear4	.4807375	.0817552	5.88	0.000	.3181003	.6433747
dyear5	.6713522	.1000839	6.71	0.000	.4722535	.8704509
dyear6	.8337942	.1204936	6.92	0.000	.594094	1.073494
dyear7	.9515903	.1380365	6.89	0.000	.6769916	1.226189
dyear8	1.092508	.1609588	6.79	0.000	.7723098	1.412706
dyear9	1.270993	.1813559	7.01	0.000	.9102181	1.631768
dyear10	1.401388	.2033613	6.89	0.000	.9968372	1.805938
dyear11	1.52608	.2201827	6.93	0.000	1.088067	1.964094
dyear12	1.620235	.2379427	6.81	0.000	1.146891	2.093579
dyear13	1.775208	.2576506	6.89	0.000	1.262659	2.287758
dyear14	1.91133	.2772835	6.89	0.000	1.359725	2.462936

dyear15	2.091104	.2928604	7.14	0.000	1.508512	2.673697
dyear16	2.19213	.3183635	6.89	0.000	1.558804	2.825456
dyear17	2.345115	.3368517	6.96	0.000	1.675009	3.01522
dyear18	2.442043	.3538481	6.90	0.000	1.738126	3.145959
dyear19	2.540964	.364046	6.98	0.000	1.81676	3.265167
dyear20	2.651201	.3786946	7.00	0.000	1.897857	3.404545
dyear21	2.742117	.3972256	6.90	0.000	1.951909	3.532325
dyear22	2.870974	.4122786	6.96	0.000	2.050821	3.691128
dyear23	2.971697	.4265654	6.97	0.000	2.123123	3.820272
dyear24	3.114085	.4421786	7.04	0.000	2.234451	3.993719
dyear25	3.225364	.4597964	7.01	0.000	2.310682	4.140045
dyear26	3.328733	.479093	6.95	0.000	2.375665	4.281802
dyear27	3.457154	.4970145	6.96	0.000	2.468433	4.445874
dyear28	3.595676	.5142118	6.99	0.000	2.572745	4.618607
dyear29	3.720044	.5283191	7.04	0.000	2.669049	4.771039
dyear30	3.817957	.5402444	7.07	0.000	2.743239	4.892675
_cons	53.81764	7.043257	7.64	0.000	39.80636	67.82893

5.5: Agricultural Value Added Share minus Agricultural Employment Share

```
      Source |       SS       df       MS              Number of obs =     120
-------------+------------------------------           F( 37,    82) =  406.99
       Model |  1.97149034    37  .053283523           Prob > F      =  0.0000
    Residual |   .01073548    82   .00013092           R-squared     =  0.9946
-------------+------------------------------           Adj R-squared =  0.9921
       Total |  1.98222582   119   .01665736           Root MSE      =  .01144

------------------------------------------------------------------------------
agricultur~c |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
lngdppccon~s |  -.5712661   .0777564    -7.35   0.000    -.7259483   -.4165839
lngdppc2co~s |   .0286681    .005975     4.80   0.000     .0167819    .0405543
  lnpopinmil |  -.8219607   .2406558    -3.42   0.001    -1.300702   -.3432196
 lnpopinmil2 |   .0069384   .0109325     0.63   0.527    -.0148099    .0286866
totagrnona~s |   .0300047   .0084387     3.56   0.001     .0132174    .0467919
     d1china |   .8627403   .2410188     3.58   0.001     .3832772    1.342203
     d2india |   .7166479   .2005305     3.57   0.001     .3177289    1.115567
 d3indonesia |  -.2987711   .0183756   -16.26   0.000    -.3353261   -.2622161
      dyear2 |   .0279885   .0088016     3.18   0.002     .0104794    .0454977
      dyear3 |   .0530083   .0106082     5.00   0.000     .0319051    .0741114
      dyear4 |   .0845263   .0126055     6.71   0.000     .0594499    .1096027
      dyear5 |   .1108586   .0154315     7.18   0.000     .0801604    .1415569
      dyear6 |   .1304904   .0185784     7.02   0.000     .0935319    .1674488
      dyear7 |   .1514806   .0212833     7.12   0.000     .1091413    .1938199
      dyear8 |    .175581   .0248176     7.07   0.000     .1262109    .2249512
      dyear9 |   .2040877   .0279626     7.30   0.000     .1484613    .2597142
     dyear10 |   .2224678   .0313555     7.10   0.000     .1600917    .2848438
     dyear11 |    .245193   .0339491     7.22   0.000     .1776574    .3127286
     dyear12 |   .2613817   .0366875     7.12   0.000     .1883986    .3343648
     dyear13 |   .2833396   .0397262     7.13   0.000     .2043116    .3623675
     dyear14 |   .3039258   .0427533     7.11   0.000     .2188759    .3889757
```

dyear15	.3320784	.045155	7.35	0.000	.2422507	.4219061
dyear16	.3505993	.0490872	7.14	0.000	.2529491	.4482495
dyear17	.3770789	.0519379	7.26	0.000	.2737579	.4803998
dyear18	.3921623	.0545585	7.19	0.000	.2836281	.5006966
dyear19	.4097685	.0561309	7.30	0.000	.2981064	.5214307
dyear20	.4295518	.0583895	7.36	0.000	.3133966	.545707
dyear21	.4366652	.0612467	7.13	0.000	.314826	.5585044
dyear22	.4560815	.0635677	7.17	0.000	.3296252	.5825379
dyear23	.4709462	.0657705	7.16	0.000	.3401077	.6017846
dyear24	.4927365	.0681778	7.23	0.000	.3571091	.6283639
dyear25	.5100016	.0708942	7.19	0.000	.3689704	.6510329
dyear26	.5267306	.0738695	7.13	0.000	.3797806	.6736806
dyear27	.5463681	.0766328	7.13	0.000	.3939211	.6988151
dyear28	.5708102	.0792843	7.20	0.000	.4130884	.728532
dyear29	.5900678	.0814595	7.24	0.000	.4280189	.7521167
dyear30	.6105674	.0832982	7.33	0.000	.4448607	.7762741
_cons	6.236826	1.085973	5.74	0.000	4.07648	8.397171

Annex 3:

Statistics on Structural Features of the Countries

Millennium Development Goals	BRAZIL					CHINA					INDIA					INDONESIA				
	1990	1995	2000	2005	2011	1990	1995	2000	2005	2011	1990	1995	2000	2005	2011	1990	1995	2000	2005	2011
Goal 1: Eradicate Extreme Poverty and Hunger																				
Employment to population ratio, 15+, total (%)	60	65	62	64	65	75	75	74	72	71	59	58	57	58	54	63	64	63	60	63
Employment to population ratio, ages 15-24, total (%)	54	58	52	54	53	72	69	61	58	56	46	44	42	42	34	46	43	45	37	40
GDP per person employed (constant 1990 PPP $)	10,474	11,656	12,100	12,087	13,690	2,562	3,941	4,660	7,825	14,196	3,531	4,111	5,063	6,285	8,939	5,945	8,205	7,588	9,140	11,037
Income share held by lowest 20%	2	2	2	3	3	8	7	6	5	5	9	9	..	9	9	9	9	10	8	8
Malnutrition prevalence, weight for age (% of children under 5)	5	5	4	2	..	13	11	7	5	3	60	41	44	44	..	31	27	25	24	19
Poverty gap at $1.25 a day (PPP) (%)	7	5	6	5	4	21	22	11	4	3	16	14	..	11	7	16	11	13	5	3
Poverty headcount ratio at $1.25 a day (PPP) (% of population)	17	11	12	9	6	60	54	36	16	12	54	49	..	42	33	54	43	48	21	18
Vulnerable employment, total (% of total employment)	29	36	27	28	25	..	..	..	..	..	..	83	83	83	81	..	63	65	63	57
Goal 2: Achieve Universal Primary Education																				
Literacy rate, youth female (% of females ages 15-24)	..	..	96	98	99	91	..	99	..	99	49	..	68	74	..	95	..	..	96	99
Literacy rate, youth male (% of males ages 15-24)	..	..	93	97	97	97	..	99	..	99	74	..	84	88	..	97	..	..	97	100
Persistence to last grade of primary, total (% of cohort)	70	65	80	76	..	87	77	..	..	..	53	57	59	66	..	80	89	86	83	92
Primary completion rate, total (% of relevant age group)	92	89	108	106	..	109	97	..	..	..	63	73	71	86	..	92	93	93	96	109
Adjusted net enrollment rate, primary (% of primary school age children)	..	..	92	96	..	97	94	..	..	..	..	..	83	94	..	95	92	94	95	100

Goal 3: Promote Gender Equality and Empower Women																				
Proportion of seats held by women in national parliaments (%)	5	7	6	9	9	21	..	22	20	21	5	7	9	8	11	12	11	8	11	18
Ratio of female to male primary enrollment (%)	99	..	94	94	..	90	96	103	104	104	74	81	84	96	..	96	96	97	97	102
Ratio of female to male secondary enrollment (%)	..	..	110	110	..	73	85	95	103	105	57	64	71	82	92	83	85	95	99	100
Ratio of female to male tertiary enrollment (%)	110	112	130	129	..	..	53	..	91	113	52	57	66	71	73	..	63	88	91	89
Share of women employed in the non-agricultural sector (% of total non-agricultural employment)	35.1	38.5	40.3	41.5	..	37.8	38.7	39.1	..	..	12.7	14.4	16.6	18.1	..	29.2	29.0	31.7	30.3	..
Goal 4: Reduce Child Mortality																				
Immunization, measles (% of children ages 12-23 months)	78	87	99	99	97	98	80	84	86	99	56	72	55	64	74	58	63	74	77	89
Mortality rate, infant (per 1,000 live births)	49	41	31	22	14	39	36	29	20	13	81	73	64	56	47	54	45	38	31	25
Mortality rate, under-5 (per 1,000 live births)	58	48	36	25	16	49	46	35	24	15	114	101	88	75	61	82	65	53	42	32
Goal 5: Improve Maternal Health																				
Adolescent fertility rate (births per 1,000 women ages 15-19)	..	90	87	80	76	..	7	8	8	9	..	116	106	91	77	..	48	49	47	43
Births attended by skilled health staff (% of total)	70	88	96	97	..	94	89	97	98	100	..	34	43	47	..	41	50	67	72	82
Contraceptive prevalence (% of women ages 15-49)	59	77	..	81	..	85	90	84	85	..	45	41	47	56	..	50	54	55	58	61
Maternal mortality ratio (modeled estimate, per 100,000 live births)	120	96	81	67	56	120	84	61	45	37	600	480	390	280	200	600	420	340	270	220
Pregnant women receiving prenatal care (%)	..	86	..	97	98	70	79	89	90	94	..	62	62	74	..	76	82	88	89	93
Unmet need for contraception (% of married women ages 15-49)	18	7	..	..	..	..	..	..	..	..	..	17	16	13	..	14	11	..	9	15

Goal 6: Combat HIV/AIDS, Malaria, and Other Diseases																				
Children with fever receiving antimalarial drugs (% of children under age 5 with fever)	..	..	..	..	..	..	..	..	..	..	..	..	12	8	..	..	..	1	1	..
Condom use, population ages 15-24, female (% of females ages 15-24)	..	18	..	..	..	..	..	..	..	..	..	..	..	6	..	..	..	..	1	..
Condom use, population ages 15-24, male (% of males ages 15-24)	..	51	..	..	..	..	..	..	..	..	..	..	..	15	..	..	..	..	..	..
Incidence of tuberculosis (per 100,000 people)	84	71	60	51	42	153	129	109	92	75	216	216	216	209	181	206	205	204	199	187
Prevalence of HIV, female (% ages 15-24)	..	..	..	..	0.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0.2
Prevalence of HIV, male (% ages 15-24)	..	..	..	..	0.1	..	..	..	..	..	..	..	..	..	..	..	..	..	..	0.2
Prevalence of HIV, total (% of population ages 15-49)	0.2	0.4	0.4	0.4	0.3	..	..	..	..	0.1	..	..	..	..	..	0.1	0.1	0.1	0.1	0.3
Tuberculosis case detection rate (%, all forms)	60	79	74	84	91	21	33	33	74	89	80	58	49	49	59	20	9	19	56	70
Goal 7: Ensure Environmental Sustainability																				
CO2 emissions (kg per PPP $ of GDP)	0	0	0	0	0	3	2	1	1	1	1	1	1	1	1	1	1	1	0	0
CO2 emissions (metric tons per capita)	1	2	2	2	2	2	3	3	4	6	1	1	1	1	2	1	1	1	2	2
Forest area (% of land area)	68.0	..	64.5	62.7	61.2	16.8	..	19.0	20.7	22.5	21.5	..	22.0	22.8	23.1	65.4	..	54.9	54.0	51.7
Improved sanitation facilities (% of population with access)	68	71	74	76	79	24	34	44	55	64	18	21	25	30	34	32	38	44	50	54
Improved water source (% of population with access)	89	91	94	96	98	67	74	80	87	91	69	75	81	86	92	70	74	78	80	82
Marine protected areas (% of territorial waters)	8	12	14	16	16	0	1	1	1	1	2	2	2	2	2	0	1	1	2	2

Net ODA received per capita (current US$)	1	2	1	1	4	2	3	1	1	-1	2	2	1	2	3	9	7	8	11	2
Goal 8: Develop a Global Partnership for Development																				
Debt service (PPG and IMF only, % of exports of goods, services and primary income)	19	24	37	30	7	11	9	5	1	1	29	32	16	10	2	26	18	11	10	5
Internet users (per 100 people)	0.0	0.1	2.9	21.0	45.0	0.0	0.0	1.8	8.5	38.3	0.0	0.0	0.5	2.4	10.1	0.0	0.0	0.9	3.6	18.0
Mobile cellular subscriptions (per 100 people)	0	1	13	46	124	0	0	7	30	73	0	0	0	8	72	0	0	2	21	103
Telephone lines (per 100 people)	6	8	18	21	22	1	3	11	27	21	1	1	3	4	3	1	2	3	6	16
Fertility rate, total (births per woman)	3	3	2	2	2	2	2	2	2	2	4	4	3	3	3	3	3	2	2	2
Other																				
GNI per capita, Atlas method (current US$)	2,700	3,880	3,860	3,960	10,720	330	530	930	1,740	4,940	390	370	450	730	1,420	600	980	560	1,220	2,940
GNI, Atlas method (current US$) (billions)	403.9	628.4	673.8	736.5	2,107.7	370.0	643.6	1,168.8	2,265.6	6,643.2	340.5	360.6	473.7	829.6	1,766.2	111.0	194.8	119.5	276.8	712.7
Gross capital formation (% of GDP)	20.2	18.0	18.2	16.2	19.7	36.1	41.9	35.1	42.1	48.4	24.9	26.1	24.2	34.3	35.4	30.7	31.9	22.2	25.1	32.8
Life expectancy at birth, total (years)	66	68	70	72	73	69	70	71	72	73	58	60	62	63	65	62	64	66	67	69
Literacy rate, adult total (% of people ages 15 and above)	..	..	86	90	90	78	..	91	..	94	48	..	61	63	..	82	..	..	92	93
Population, total (billions)	0.1	0.2	0.2	0.2	0.2	1.1	1.2	1.3	1.3	1.3	0.9	1.0	1.1	1.1	1.2	0.2	0.2	0.2	0.2	0.2
Trade (% of GDP)	15.2	16.0	21.7	26.6	24.5	29.2	38.8	44.2	68.6	58.7	15.2	22.5	26.5	41.3	54.2	49.1	54.0	71.4	64.0	51.2

Note: .. Data is not available
Source: MDG Country Tables, World Bank

http://ddpext.worldbank.org/ext/ddpreports/ViewSharedReport?REPORT_ID=1336&REQUEST_TYPE=VIEWADVANCED

Table 2: Number of Undernourished Persons (millions) by Region/Country (1990-92 to 2010-12)

Region/Country	1990-92	2000-02	2005-07	2010-12
World	1000	922	884	868
Developing countries	980	905	870	852
North Africa	5	5	5	4
Sub Saharan Africa	170	203	208	234
Africa (Total)	175	208	212	239
East Asia	261	197	180	167
China	254	187	169	158
East Asia (excluding China)	7	10	10	9
South Asia	327	316	318	304
India	240	231	234	217
South Asia (excluding India)	87	85	84	87
South East Asia	134	101	84	65
Indonesia	37	38	33	21
South East Asia (excluding Indonesia)	97	63	51	44
West Asia	8	13	16	21
Caucasus and Central Asia	9	10	7	6
Asia (Total)	739	638	605	563
Oceania	1	1	1	1
Caribbean	9	7	7	7
Latin America	57	51	45	42
Brazil	23	20	16	13
Latin America (excluding Brazil)	34	31	29	29
Latin America and the Caribbean (Total)	65	59	52	49
Developed countries	21	17	14	17

Source: FAO: *FAO Hunger Portal. http://www.fao.org/hunger/en/*

Table 3: Prevalence of Undernourishment in Total Population (%)by Region/Country (1990-92 to 2010-12)

Region/Country	1990-92	2000-02	2005-07	2010-12
World	18.6	14.9	13.5	12.5
Developing countries	23.2	18.2	16.3	14.9
North Africa	< 5	< 5	< 5	< 5
Sub Saharan Africa	32.8	29.7	26.8	26.8
Africa (Total)	27.3	25.1	22.8	22.9
East Asia	20.8	14.3	12.7	11.5
China	21.4	14.3	12.6	11.5
East Asia (excluding China)	10.4	14.0	14.2	11.7
South Asia	26.8	21.3	19.8	17.6
India	26.9	21.6	20.2	17.5
South Asia (excluding India)	26.4	20.4	18.7	17.8
South East Asia	29.6	19.2	14.9	10.9
Indonesia	19.9	17.4	14.3	8.6
West Asia	6.6	7.9	9.0	10.1
Caucasus and Central Asia	12.8	14.5	9.6	7.4
Asia (Total)	23.7	17.6	15.7	13.9
Oceania	13.6	15.9	12.9	12.1
Caribbean	28.5	21.8	20.1	17.8
Latin America	13.6	10.5	8.6	7.7
Brazil	14.9	11.1	8.4	6.9
Latin America and the Caribbean (Total)	14.6	11.2	9.3	8.3
Developed countries	< 5	< 5	< 5	< 5

Source: FAO: *FAO Hunger Portal.* http://www.fao.org/hunger/en/

Table 4: Poverty Line Using 2005 PPP and $1.25/day by Region/Country (1981-2010)

	1981		1990		2005		2010	
Region/Country	Headcount (%)	Num of Poor (million)	Headcount (%)	Num of Poor (million)	Headcount (%)	Num of Poor (million)	Headcount (%)	Num of Poor (million)
East Asia and Pacific	77.18	1,096.50	56.24	926.42	17.11	332.08	12.48	250.9
China*	84.02	835.0664	60.18	683.1513	16.25	211.8545	11.62	155.5105
China--Rural	94.08	745.4241	74.07	610.4405	26.11	202.8799	20.57	151.6832
China--Urban	44.48	89.65389	23.38	72.72115	1.71	9.00657	0.64	3.84576
Indonesia*	70.91	109.3999	54.27	100.0467	21.44	48.73312	18.06	43.32052
Indonesia--Rural	73.2	87.0714	57.12	73.07933	24.01	28.3246	17.75	19.71315
Indonesia--Urban	63.22	22.33563	47.8	26.96398	18.67	20.41191	18.33	23.61087
South Asia	61.14	568.38	53.81	617.26	39.43	598.26	31.03	506.77
India*	59.83	428.676	51.31	448.3416	40.82	466.295	32.67	400.0834
India--Rural	62.51	343.3424	53.96	351.2634	43.05	350.9135	34.28	293.4402
India--Urban	51.03	85.33747	43.56	97.06039	35.25	115.3345	28.93	106.6389
Europe and Central Asia	1.91	8.21	1.86	8.64	1.33	6.26	0.66	3.15
Latin America and the Caribbean	11.89	43.33	12.24	53.43	8.66	47.6	5.53	32.29
Middle East and North Africa	9.56	16.48	5.75	12.96	3.45	10.47	2.41	7.98
Sub-Saharan Africa	51.45	204.93	56.53	289.68	52.31	394.78	48.47	413.73
Total	52.16	1,937.83	43.05	1,908.45	25.09	1,389.20	20.63	1,214.98

Source: PovcalNet, World Bank. http://iresearch.worldbank.org/PovcalNet/index.htm?1

Table 5: Tariff Rate (Most Favoured Nation) (1999-2009)

Country Name	Indicator Name	1999	2005	2009
Brazil	Tariff rate, most favored nation, simple mean, all products (%)	15.76	12.35	13.65
Brazil	Tariff rate, most favored nation, simple mean, manufactured products (%)	17.01	13.46	15.16
Brazil	Tariff rate, most favored nation, simple mean, primary products (%)	11.44	8.6	8.76
China	Tariff rate, most favored nation, simple mean, all products (%)	17.12	9.81	9.68
China	Tariff rate, most favored nation, simple mean, manufactured products (%)	16.84	9.55	9.25
China	Tariff rate, most favored nation, simple mean, primary products (%)	18.16	10.72	11.12
India	Tariff rate, most favored nation, simple mean, all products (%)	32.96	19.88	14.03
India	Tariff rate, most favored nation, simple mean, manufactured products (%)	34.16	17.39	11.38
India	Tariff rate, most favored nation, simple mean, primary products (%)	28.78	28.36	22.72
Indonesia	Tariff rate, most favored nation, simple mean, all products (%)	11.19	6.95	6.81
Indonesia	Tariff rate, most favored nation, simple mean, manufactured products (%)	11.18	7.13	6.91
Indonesia	Tariff rate, most favored nation, simple mean, primary products (%)	11.3	6.47	6.6

Source: WDI and Global Development Finance, World Bank

Table 6: Total Food Production, Import, Export and Domestic Supply Quantity (Tonnes) (Brazil, China, India and Indonesia)(1961-2007)

		Food Production (Tonnes)					
countries	**item**	**1961**	**1970**	**1980**	**1990**	**2000**	**2007**
Brazil	Cereals - Excluding Beer + (Total)	13240658	21183140	29962177	30019220	42204231	65758366
Brazil	Fruits - Excluding Wine + (Total)	6886641	11465728	19473807	29824091	37010973	39194929
Brazil	Oilcrops + (Total)	2198171	4472112	17507259	22129669	36473828	63978649
Brazil	Pulses + (Total)	1800809	2284883	2004863	2271707	3057688	3188935
Brazil	Vegetables + (Total)	2050183	2637667	4115357	5635715	7228997	9888485
Brazil	Eggs + (Total)	219300	337536	792430	1256301	1569464	1857817
Brazil	Fish, Seafood + (Total)	274300	572740	808517	640228	838626	1071624
Brazil	Meat + (Total)	2119990	3095640	5316689	7709088	15424850	21814555
Brazil	Milk - Excluding Butter + (Total)	5294550	7421813	12060760	15075930	20526990	27080560
Brazil	Total Food	34084602	53471259	92041859	114561949	164335647	233833920
China	Cereals - Excluding Beer + (Total)	90939516	163173932	232709555	340605564	344128426	395285766
China	Fruits - Excluding Wine + (Total)	3263053	4973710	8416030	20952150	64490801	102429797
China	Oilcrops + (Total)	10565158	17882631	21411430	36009527	51744966	52804525
China	Pulses + (Total)	8520593	6926062	6752443	6136720	4696498	3777005
China	Vegetables + (Total)	58222940	41217254	55404826	128382471	328801294	447700831
China	Eggs + (Total)	1523372	1931429	2934878	8175280	22212670	25654250
China	Fish, Seafood + (Total)	3210446	3955778	5571256	14778684	37298809	46841430
China	Meat + (Total)	2549889	7655281	14787120	30421462	62109622	70428499

China	Milk - Excluding Butter + (Total)	1845001	1959253	2927692	7036738	12373714	39823670
China	Total Food	180639968	249675330	350915230	592498596	927856800	1184745773
India	Cereals - Excluding Beer + (Total)	69562831	92818018	113746704	156784005	192485381	212344093
India	Fruits - Excluding Wine + (Total)	13372500	15786680	20357397	27358959	43000880	61514700
India	Oilcrops + (Total)	10988800	13792470	13620800	25998090	29890410	48333150
India	Pulses + (Total)	12859873	12085700	9167100	12856900	13712800	15087800
India	Vegetables + (Total)	18468500	25985900	35975100	48936575	72283100	82658000
India	Eggs + (Total)	170000	290000	583000	1161000	1927000	2844000
India	Fish, Seafood + (Total)	961000	1756100	2442242	3799553	5603736	7008548
India	Meat + (Total)	1696090	2015308	2626812	3590518	3994828	4305677
India	Milk - Excluding Butter + (Total)	20375000	20800000	31560000	53678000	79661000	103284000
India	Total Food	148454594	185330176	230079155	334163600	442559135	537379968
Indonesia	Cereals - Excluding Beer + (Total)	10343128	15718997	23768756	36868255	44292966	51411542
Indonesia	Fruits - Excluding Wine + (Total)	2292000	3576000	4268210	5973042	8412932	16649426
Indonesia	Oilcrops + (Total)	6546595	7282097	10225143	15377831	19274784	25604620
Indonesia	Pulses + (Total)	301000	293000	374000	703492	290876	321000
Indonesia	Vegetables + (Total)	1625500	2179300	2466963	4565118	6995665	8475836
Indonesia	Eggs + (Total)	56000	75600	259400	484000	783000	1382134
Indonesia	Fish, Seafood + (Total)	903100	1217800	1825475	3016710	4831314	6316479
Indonesia	Meat + (Total)	338105	430184	668585	1448400	1695263	2440374
Indonesia	Milk - Excluding Butter + (Total)	200883	173800	246400	597600	786957	923883
Indonesia	Total Food	22606311	30946778	44102932	69034448	87363757	113525294

		Food Imports (Tonnes)					
countries	**item**	**1961**	**1970**	**1980**	**1990**	**2000**	**2007**
Brazil	Cereals - Excluding Beer + (Total)	2002528	2200259	6985248	3749934	11598657	10559861
Brazil	Fruits - Excluding Wine + (Total)	69763	170203	211102	295714	338177	448717
Brazil	Oilcrops + (Total)	153	15476	508041	110573	929327	210000
Brazil	Pulses + (Total)	6610	11690	61447	88992	121060	143781
Brazil	Vegetables + (Total)	18285	22402	33392	148639	268502	412897
Brazil	Eggs + (Total)	1	6	53	3771	393	2866
Brazil	Fish, Seafood + (Total)	90714	188855	128727	283992	363713	416233
Brazil	Meat + (Total)	20	1126	65450	244369	68686	36983
Brazil	Milk - Excluding Butter + (Total)	110781	238475	669057	860172	1542353	275211
Brazil	Total Food	2298855	2848492	8662517	5786156	15230868	12506549
China	Cereals - Excluding Beer + (Total)	7335851	7600064	18039875	21046364	10563514	8958448
China	Fruits - Excluding Wine + (Total)	177989	430222	629395	1008533	2718334	3436624
China	Oilcrops + (Total)	315532	682871	1614468	2709946	15922784	35042040
China	Pulses + (Total)	81979	50553	90544	169546	300988	381404
China	Vegetables + (Total)	140782	287394	488092	736341	1121962	1380239
China	Eggs + (Total)	27069	47103	72523	89332	88900	100249
China	Fish, Seafood + (Total)	64191	320743	1003683	3981527	9577561	9407428
China	Meat + (Total)	43887	80097	189360	522932	2713214	2536724
China	Milk - Excluding Butter + (Total)	102853	249450	747578	1211131	2109404	2266200
China	Total Food	8290133	9748497	22875518	31475652	45116661	63509356
India	Cereals - Excluding Beer + (Total)	3966251	4261560	416423	212023	99454	2742230

India	Fruits - Excluding Wine + (Total)	104146	129035	64552	106376	256684	597284
India	Oilcrops + (Total)	459116	91635	53170	4787	7355	67134
India	Pulses + (Total)	236	4275	73484	861075	352511	2951834
India	Vegetables + (Total)	111	117	89	10019	13016	35973
India	Eggs + (Total)	1016	4	30	0	23	307
India	Fish, Seafood + (Total)	18643	0	924	646	33121	108290
India	Meat + (Total)	85	24	8	0	37	1300
India	Milk - Excluding Butter + (Total)	459517	285161	308499	8387	11201	14650
India	Total Food	5009121	4771811	917179	1203313	773402	6519002
Indonesia	Cereals - Excluding Beer + (Total)	1247646	1526600	3612861	1892213	6988640	7785863
Indonesia	Fruits - Excluding Wine + (Total)	3377	7950	33664	45572	296617	562055
Indonesia	Oilcrops + (Total)	0	38	109364	606202	1455211	2451174
Indonesia	Pulses + (Total)	74	89	4183	63595	38696	52768
Indonesia	Vegetables + (Total)	109	27889	121612	50495	305265	598394
Indonesia	Eggs + (Total)	0	86	254	116	2610	5028
Indonesia	Fish, Seafood + (Total)	28411	5632	82429	193621	464559	302399
Indonesia	Meat + (Total)	326	1745	3240	6739	54182	71413
Indonesia	Milk - Excluding Butter + (Total)	117189	262506	866858	356254	1293543	1939906
Indonesia	Total Food	1397132	1832535	4834465	3214807	10899323	13769000

Food Exports (Tonnes)

countries	item	1961	1970	1980	1990	2000	2007
Brazil	Cereals - Excluding Beer + (Total)	133726	1565975	50879	12781	102007	11700052

Brazil	Fruits - Excluding Wine + (Total)	387547	703553	5375752	12304779	12957954	12992229
Brazil	Oilcrops + (Total)	84025	353167	1577584	4079762	11521527	23787305
Brazil	Pulses + (Total)	7268	908	1722	2419	4805	30998
Brazil	Vegetables + (Total)	1797	16453	59146	39392	175109	348145
Brazil	Eggs + (Total)	128	16	9172	2769	7169	28055
Brazil	Fish, Seafood + (Total)	1800	10100	55041	48531	69192	103978
Brazil	Meat + (Total)	51104	162612	379884	556904	1711580	6826807
Brazil	Milk - Excluding Butter + (Total)	0	3502	12849	414	51109	611958
Brazil	Total Food	667395	2816286	7522029	17047751	26600452	56429527
China	Cereals - Excluding Beer + (Total)	327102	1803291	1612981	4500163	14427853	11700515
China	Fruits - Excluding Wine + (Total)	301042	737745	757945	837986	2143240	6443283
China	Oilcrops + (Total)	373204	471426	276422	1745118	1038119	1375293
China	Pulses + (Total)	94470	91762	74775	813205	583104	864421
China	Vegetables + (Total)	170089	608506	1192618	2076753	4153010	11082502
China	Eggs + (Total)	18012	46675	64288	45562	68734	134642
China	Fish, Seafood + (Total)	19600	240470	510521	1522296	3752661	8172807
China	Meat + (Total)	27379	151368	274826	844198	1673105	1540532
China	Milk - Excluding Butter + (Total)	5408	31412	21087	102116	544760	1009146
China	Total Food	1336306	4182655	4785463	12487397	28384586	42323141
India	Cereals - Excluding Beer + (Total)	665	49327	705571	655283	2764595	9938175
India	Fruits - Excluding Wine + (Total)	30791	21313	152134	76036	286946	728821
India	Oilcrops + (Total)	33898	27697	36339	121207	537368	708971

India	Pulses + (Total)	6892	38128	851	15465	244627	174360
India	Vegetables + (Total)	111745	157142	154667	298061	575560	1857996
India	Eggs + (Total)	1375	10	2218	1635	22613	106353
India	Fish, Seafood + (Total)	47911	70323	111364	158184	513587	690706
India	Meat + (Total)	1007	3244	52474	72311	300331	502480
India	Milk - Excluding Butter + (Total)	0	554	1443	4391	356827	1009354
India	Total Food	234284	367738	1217061	1402573	5602454	15717216
Indonesia	Cereals - Excluding Beer + (Total)	3000	286187	37816	161623	96433	292681
Indonesia	Fruits - Excluding Wine + (Total)	0	8023	17790	99678	352865	434499
Indonesia	Oilcrops + (Total)	1242982	1030990	254272	37279	390261	703329
Indonesia	Pulses + (Total)	0	5	960	2116	6054	23814
Indonesia	Vegetables + (Total)	65	31874	33544	74772	105786	107972
Indonesia	Eggs + (Total)	0	0	0	162	230	19
Indonesia	Fish, Seafood + (Total)	856	17229	78202	338429	585978	902462
Indonesia	Meat + (Total)	0	652	1647	6526	8960	8598
Indonesia	Milk - Excluding Butter + (Total)	0	0	183	163386	367351	181773
Indonesia	Total Food	1246903	1374960	424414	883971	1913918	2655147
Domestic Food Supply (Tonnes)							
countries	**item**	**1961**	**1970**	**1980**	**1990**	**2000**	**2007**
Brazil	Cereals - Excluding Beer + (Total)	15109460	21425071	34313752	38248352	52940580	64118174
Brazil	Fruits - Excluding Wine + (Total)	6568857	10932378	14309157	17815026	24391197	26653617
Brazil	Oilcrops + (Total)	2220299	4135421	15402916	19221671	26080440	38901924

Brazil	Pulses + (Total)	1800151	2295665	2214588	2358280	3173969	3401717
Brazil	Vegetables + (Total)	2066672	2643617	4089603	5744962	7322420	9953302
Brazil	Eggs + (Total)	219173	337526	783311	1257303	1562688	1832628
Brazil	Fish, Seafood + (Total)	363214	751395	882241	900581	1133147	1383879
Brazil	Meat + (Total)	2068507	2934154	5002255	7396553	13781957	15024731
Brazil	Milk - Excluding Butter + (Total)	5405331	7656786	12716968	15935688	22021171	26767740
Brazil	Total Food	35821664	53112013	89714791	108878416	152407569	188037712
China	Cereals - Excluding Beer + (Total)	96820083	166689220	253072106	314838667	379100831	386389966
China	Fruits - Excluding Wine + (Total)	3134085	4656881	8294853	21115497	65065275	99426168
China	Oilcrops + (Total)	10491915	17588179	23185043	36589119	63813567	86923156
China	Pulses + (Total)	8805602	6278854	6722212	4292911	4411382	3493988
China	Vegetables + (Total)	58188633	40871141	54702951	127042059	325774829	438021931
China	Eggs + (Total)	1532429	1931858	2943113	8219051	22232836	25619857
China	Fish, Seafood + (Total)	3255037	4036051	6045492	17241914	43113171	48075384
China	Meat + (Total)	2566397	7584311	14701737	30100711	63205982	71489691
China	Milk - Excluding Butter + (Total)	1942446	2177291	3653131	8145753	13943331	41082542
China	Total Food	186736627	251813786	373320638	567585682	980661204	1200522683
India	Cereals - Excluding Beer + (Total)	71523017	95912263	113177599	146958745	177792540	202884215
India	Fruits - Excluding Wine + (Total)	13445856	15894402	20269815	27389299	42970668	61383163
India	Oilcrops + (Total)	11342087	13796026	13774504	25870516	30364198	45333834
India	Pulses + (Total)	12853218	12051848	9239733	13702510	13820684	17865274
India	Vegetables + (Total)	18356866	25828875	35820523	48648532	71720556	80835977

India	Eggs + (Total)	169641	289994	580812	1156865	1899410	2752953
India	Fish, Seafood + (Total)	931731	1685777	2327802	3642015	5108270	6426132
India	Meat + (Total)	1695168	2012087	2574347	3518207	3694533	3804497
India	Milk - Excluding Butter + (Total)	20834517	21084607	31867056	53681996	79315231	102289296
India	Total Food	151152101	188555879	229632191	324568685	426686090	523575341
Indonesia	Cereals - Excluding Beer + (Total)	10968831	16344842	25604965	38598845	51286574	56031494
Indonesia	Fruits - Excluding Wine + (Total)	2295377	3575927	4284084	5917365	8422868	16526982
Indonesia	Oilcrops + (Total)	5301911	6243787	9317064	15938331	20299394	27280535
Indonesia	Pulses + (Total)	301074	293084	377223	764971	323518	349954
Indonesia	Vegetables + (Total)	1625544	2175315	2555031	4540841	7195145	8966258
Indonesia	Eggs + (Total)	56000	75686	259654	483954	785380	1387143
Indonesia	Fish, Seafood + (Total)	930656	1206202	1836702	2871300	4708807	5716416
Indonesia	Meat + (Total)	338431	431277	670178	1448613	1740485	2503189
Indonesia	Milk - Excluding Butter + (Total)	318072	436306	1113075	790469	1681775	2682016
Indonesia	Total Food	22135896	30782426	46017976	71354689	96443946	121443987

Source: FAOSTAT

Table 7: Agriculture and Population Scenario (Brazil, China, India and Indonesia) (1961-2050)

Countries	Indicators	1961	1970	1980	1990	2000	2009	2020	2050
Brazil	Arable land (1000 ha)	22118	35000	45000	50681	57700	61200	na	na
Brazil	Permanent crops (1000 ha)	6278	6259	7864	6727	7500	7300	na	na
Brazil	Permanent meadows and pastures (1000 ha)	122135	154138	171414	184200	196206	196000	na	na
Brazil	Arable land and Permanent crops (1000 ha)	28396	41259	52864	57408	65200	68500	na	na
Brazil	Total Agricultural area (Arable Land+Permanent Crops+Permanent meadows and pastures) (1000 ha)	150531	195397	224278	241608	261406	264500	na	na
Brazil	% share of Arable land and Permanent crops of Total Agricultural area	18.86	21.12	23.57	23.76	24.94	25.90	na	na
Brazil	% share of Permanent Meadows and Pastures of Total Agricultural area	81.14	78.88	76.43	76.24	75.06	74.10	na	na
Brazil	Forest area (1000 ha)	na	na	na	574839	545943	521716.4	na	na
Brazil	Total Population - (1000)	74976	96078	121712	149650	174425	193247	210433	222843
Brazil	Rural population (1000)	39647	42362	42030	39026	32806	26820	22092	14326
Brazil	Urban population (1000)	35329	53716	79682	110624	141619	166427	188341	208517
Brazil	% Share of Rural Population of Total Population	52.88	44.09	34.53	26.08	18.81	13.88	10.50	6.43

Brazil	% Share of Urban Population of Total Population	47.12	55.91	65.47	73.92	81.19	86.12	89.50	93.57
Brazil	Agricultural population (1000)	na	na	44007	35006	27660	21705	15495	na
Brazil	% Share of Agricultural Population of Total Population	na	na	36.16	23.39	15.86	11.23	7.36	na
Brazil	Non-agricultural population (1000)	na	na	77705	114644	146765	171541	194939	na
Brazil	% Share of Non-agricultural Population of Total Population	na	na	63.84	76.61	84.14	88.77	92.64	na
Brazil	Total Economically Active Population (1000)	na	na	44743	59390	82919	99519	110933	na
Brazil	Total Economically Active Population in Agriculture (1000)	na	na	16342	14062	13325	11336	8289	na
Brazil	% Share of Total Economically Active Population of Total Population	na	na	36.76	39.69	47.54	51.50	52.72	na
Brazil	% Share of Total Economically Active Population in Agriculture of Total Economically Active Population	na	na	36.52	23.68	16.07	11.39	7.47	na

Brazil	Arable land and Permanent crops (Total)/Total Population (ha/person)	0.38	0.43	0.43	0.38	0.37	0.35	na	na
Brazil	Arable land and Permanent crops (Total)/ Agricultural Population (ha/person)	na	na	1.20	1.64	2.36	3.16	na	na
Brazil	Permanent Meadows and Pastures (Total)/Total Population (ha/person)	1.63	1.60	1.41	1.23	1.12	1.01	na	na
Brazil	Permanent Meadows and Pastures (Total)/ Agricultural Population (ha/ person)	na	na	3.90	5.26	7.09	9.03	na	na
Brazil	Total Area Equipped for Irrigation (1000 ha)	490	796	1600	2700	3228	4500	na	na
Brazil	Total Fertilizers Consumption Nitrogen + Phosphate + Potash) (Tonnes of Nutrients)	270004	1001917	4200519	3207800	6568000	7902823	na	na
China	Arable land (1000 ha)	103397	100067	96949	123681	120971	109999	na	na
China	Permanent crops (1000 ha)	1851	2451	3270	7716	11231	14321	na	na
China	Permanent meadows and pastures (1000 ha)	238000	273000	334001	400001	400001	400001	na	na
China	Arable land and Permanent crops (1000 ha)	105248	102518	100219	131397	132202	124320	na	na

China	Total Agricultural area (Arable Land+Permanent Crops+Permanent meadows and pastures) (1000 ha)	343248	375518	434220	531398	532203	524321	na	na
China	% share of Arable land and Permanent crops of Total Agricultural area	30.66	27.30	23.08	24.73	24.84	23.71	na	na
China	% share of Permanent Meadows and Pastures of Total Agricultural area	69.34	72.70	76.92	75.27	75.16	76.29	na	na
China	Forest area (1000 ha)	na	na	na	157140.6	177000.5	204097.3	na	na
China	Total Population - (1000)	681349	833391	1006281	1171582	1298268	1365580	1419526	1325889
China	Rural population (1000)	563180	685398	807648	857291	829407	731312	635350	352235
China	Urban population (1000)	118169	147994	198633	314291	468861	634267	784177	973654
China	% Share of Rural Population of Total Population	82.65661	82.24207	80.26068	73.173794	63.885654	53.55322	44.7579	26.56595
China	% Share of Urban Population of Total Population	17.34339	17.75805	19.73932	26.826206	36.114346	46.44671	55.24217	73.43405
China	Agricultural population (1000)	na	na	743212	841893	864486	838683	775652	na
China	% Share of Agricultural Population of Total Population	na	na	73.86	71.86	66.59	61.42	54.64	na

China	Non-agricultural population (1000)	na	na	263068	329689	433782	526897	643875	na
China	% Share of Non-agricultural Population of Total Population	na	na	26.14	28.14	33.41	38.58	45.36	na
China	Total Economically Active Population (1000)	na	na	514849	670987	757621	818009	832990	na
China	Total Economically Active Population in Agriculture (1000)	na	na	380386	482507	504849	502691	455474	na
China	% Share of Total Economically Active Population of Total Population	na	na	51.16	57.27	58.36	59.90	58.68	na
China	% Share of Total Economically Active Population in Agriculture of Total Economically Active Population	na	na	73.88	71.91	66.64	61.45	54.68	na
China	Arable land and Permanent crops (Total)/Total Population (ha/person)	0.15	0.12	0.10	0.11	0.10	0.09	na	na
China	Arable land and Permanent crops (Total)/ Agricultural Population (ha/person)	na	na	0.13	0.16	0.15	0.15	na	na

China	Permanent Meadows and Pastures (Total)/Total Population (ha/person)	0.35	0.33	0.33	0.34	0.31	0.29	na	na
China	Permanent Meadows and Pastures (Total)/ Agricultural Population (ha/ person)	na	na	0.45	0.48	0.46	0.48	na	na
China	Total Area Equipped for Irrigation (1000 ha)	45206	46429	48850	50157	54201	64504	na	na
China	Total Fertilizers Consumption (Nitrogen + Phosphate + Potash) (Tonnes of Nutrients)	728000	4407000	15334700	27273700	34217868	47950847	na	na
India	Arable land (1000 ha)	155806	160560	162955	162788	162717	157923	na	na
India	Permanent crops (1000 ha)	5180	4500	5300	6650	9200	11700	na	na
India	Permanent meadows and pastures (1000 ha)	13921	12990	12100	11602	10656	10340	na	na
India	Arable land and Permanent crops (1000 ha)	160986	165060	168255	169438	171917	169623	na	na
India	Total Agricultural area (Arable Land+Permanent Crops+Permanent meadows and pastures) (1000 ha)	174907	178050	180355	181040	182573	179963	na	na
India	% share of Arable land and Permanent crops of Total Agricultural area	92.04	92.70	93.29	93.59	94.16	94.25	na	na

India	% share of Permanent Meadows and Pastures of Total Agricultural area	7.96	7.30	6.71	6.41	5.84	5.75	na	na
India	Forest area (1000 ha)	na	na	na	63939	65390	68289	na	na
India	Total Population - (1000)	456950	553874	700059	873785	1053898	1207740	1386909	1692008
India	Rural population (1000)	374133	444427	538360	650556	762340	848778	916910	774401
India	Urban population (1000)	82817	109447	161698	223230	291558	358963	469999	917606
India	% Share of Rural Population of Total Population	81.87614	80.23973	76.90209	74.45264	72.335273	70.27821	66.11176	45.76816
India	% Share of Urban Population of Total Population	18.12386	19.76027	23.09777	25.547474	27.664727	29.72188	33.88824	54.23178
India	Agricultural population (1000)	na	na	438614	504038	559446	589823	604986	na
India	% Share of Agricultural Population of Total Population	na	na	62.65	57.68	53.08	48.84	43.62	na
India	Non-agricultural population (1000)	na	na	261445	369748	494452	617918	781923	na
India	% Share of Non-agricultural Population of Total Population	na	na	37.35	42.32	46.92	51.16	56.38	na
India	Total Economically Active Population (1000)	na	na	261991	331032	406191	485793	592343	na

India	Total Economically Active Population in Agriculture (1000)	na	na	178564	210181	239959	266751	294251	na
India	% Share of Total Economically Active Population of Total Population	na	na	37.42	37.88	38.54	40.22	42.71	na
India	% Share of Total Economically Active Population in Agriculture of Total Economically Active Population	na	na	68.16	63.49	59.08	54.91	49.68	na
India	Arable land and Permanent crops (Total)/Total Population (ha/person)	0.35	0.30	0.24	0.19	0.16	0.14	na	na
India	Arable land and Permanent crops (Total)/ Agricultural Population (ha/person)	na	na	0.38	0.34	0.31	0.29	na	na
India	Permanent Meadows and Pastures (Total)/Total Population (ha/person)	0.03	0.02	0.02	0.01	0.01	0.01	na	na
India	Permanent Meadows and Pastures (Total)/ Agricultural Population (ha/ person)	na	na	0.03	0.02	0.02	0.02	na	na
India	Total Area Equipped for Irrigation (1000 ha)	25945	31475	40835	49500	60432	66700	na	na

India	Total Fertilizers Consumption (Nitrogen + Phosphate + Potash) (Tonnes of Nutrients)	338300	2256600	5532600	12018000	16702300	26536469	na	na
Indonesia	Arable land (1000 ha)	18000	18000	18000	20253	20500	23600	na	na
Indonesia	Permanent crops (1000 ha)	8000	8000	8000	11720	14000	19000	na	na
Indonesia	Permanent meadows and pastures (1000 ha)	12600	12400	12000	13110	11177	11000	na	na
Indonesia	Arable land and Permanent crops (1000 ha)	26000	26000	26000	31973	34500	42600	na	na
Indonesia	Total Agricultural area (Arable Land+Permanent Crops+Permanent meadows and pastures) (1000 ha)	38600	38400	38000	45083	45677	53600	na	na
Indonesia	% share of Arable land and Permanent crops of Total Agricultural area	67.36	67.71	68.42	70.92	75.53	79.48	na	na
Indonesia	% share of Permanent Meadows and Pastures of Total Agricultural area	32.64	32.29	31.58	29.08	24.47	20.52	na	na
Indonesia	Forest area (1000 ha)	na	na	na	118545	99409	95117	na	na
Indonesia	Total Population - (1000)	94226	118362	150820	184346	213395	237414	262569	293456
Indonesia	Rural population (1000)	80243	98156	117482	127965	123768	132977	136296	99923
Indonesia	Urban population (1000)	13982	20206	33338	56381	89627	104438	126273	193532

Indonesia	% Share of Rural Population of Total Population	85.16015	82.92864	77.8955	69.415664	57.999485	56.0106	51.90864	34.05042
Indonesia	% Share of Urban Population of Total Population	14.83879	17.07136	22.1045	30.584336	42.000515	43.98982	48.09136	65.94924
Indonesia	Agricultural population (1000)	na	na	80848	93867	93918	90176	81778	na
Indonesia	% Share of Agricultural Population of Total Population	na	na	53.61	50.92	44.01	37.98	31.15	na
Indonesia	Non-agricultural population (1000)	na	na	69972	90479	119477	147238	180792	na
Indonesia	% Share of Non-agricultural Population of Total Population	na	na	46.39	49.08	55.99	62.02	68.86	na
Indonesia	Total Economically Active Population (1000)	na	na	56714	77789	100361	117635	137724	na
Indonesia	Total Economically Active Population in Agriculture (1000)	na	na	32796	42925	48438	49513	48107	na
Indonesia	% Share of Total Economically Active Population of Total Population	na	na	37.60	42.20	47.03	49.55	52.45	na

Indonesia	% Share of Total Economically Active Population in Agriculture of Total Economically Active Population	na	na	57.83	55.18	48.26	42.09	34.93	na
Indonesia	Arable land and Permanent crops (Total)/Total Population (ha/person)	0.28	0.22	0.17	0.17	0.16	0.18	na	na
Indonesia	Arable land and Permanent crops (Total)/ Agricultural Population (ha/person)	na	na	0.32	0.34	0.37	0.47	na	na
Indonesia	Permanent Meadows and Pastures (Total)/Total Population (ha/person)	0.13	0.10	0.08	0.07	0.05	0.05	na	na
Indonesia	Permanent Meadows and Pastures (Total)/ Agricultural Population (ha/ person)	na	na	0.15	0.14	0.12	0.12	na	na
Indonesia	Total Area Equipped for Irrigation (1000 ha)	3900	3900	4107	4410	5500	6722	na	na
Indonesia	Total Fertilizers Consumption (Nitrogen + Phosphate + Potash) (Tonnes of Nutrients)	135990	240193	1173025	2500800	2493500	5144435	na	na

na—not applicable or data is not available

Source: FAOSTAT 2011

Table 8: Total Private Capital Flows (% of GDP) (Brazil, China, India and Indonesia) (1990-2010)

Country Name	Indicator Name	1990	2000	2005	2010
Brazil	Private capital flows, total (% of GDP)	0.180971269	5.809307173	1.976243226	4.786166046
China	Private capital flows, total (% of GDP)	0.676870335	2.794598956	4.473820053	2.513552635
India	Private capital flows, total (% of GDP)	0.029221417	1.177773349	2.011036734	2.887480258
Indonesia	Private capital flows, total (% of GDP)	0.87392345	-3.915310778	3.309507374	3.383771559

Source: WDI and Global Development Finance, World Bank

Table 9: Capital Flows (% of GDP) (Brazil, China, India and Indonesia) (1995 & 2009)

									Debt	
	Net private Capital		**FDI**		**Portfolio**		**Bonds**		**Others**	
Country	1995	2009	1995	2009	1995	2009	1995	2009	1995	2009
Brazil	2.4	5.5	0.6	1.6	0.4	2.4	0.3	1.2	1.1	0.3
China	5.6	1.9	4.9	1.6	0	0.5	0	0	0.7	-0.2
India	1.3	4.7	0.6	2.5	0.4	1.5	0.1	0.1	0.2	0.6
Indonesia	4	3	2.2	0.9	0.7	0.1	1.1	0.9	0	1.1

Source: WDI and Global Development Finance, World Bank

Table 10: Aid Flows as % of GDP by Region (1965-2009)

Region	1965-80	1981-90	1991-00	2001-05	2006-09
East Asia & Pacific (developing only)	0.951431	0.913659	0.75199	0.33221	0.173027
Latin America & Caribbean (developing only)	0.475804	0.42835	0.341256	0.293933	0.219662
Middle East & North Africa (developing only)	3.160643	2.122978	1.962562	2.020323	1.692378
South Asia	2.051639	1.620644	1.232094	0.88841	0.809769
Sub-Saharan Africa (developing only)	2.362354	4.236332	5.130803	5.067383	4.635913

Source: WDI and Global Development Finance, World Bank

Table 11: Manufacturing, Value Added (% of GDP) (Brazil, China, India and Indonesia)(1960-2011)

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2011
Brazil	29.61	26.20	29.32	30.26	33.49	33.75	28.70	18.62	17.22	18.09	16.23	14.60
China		29.23	33.75	38.13	40.23	34.73	32.66	33.65	32.12	32.51	29.62	n.a.
India	13.71	14.23	13.70	15.24	16.18	15.98	16.16	17.30	15.38	15.39	14.87	14.39
Indonesia	9.22	8.36	10.29	9.80	12.99	15.98	20.66	24.13	27.75	27.41	24.79	24.28

n.a.- Not Available

Source: WDI and Global Development Finance, World Bank

Table 12: Services, etc. Value Added (% of GDP) (Brazil, China, India and Indonesia)(1960-2011)

	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2011
Brazil	42.34	47.71	49.35	47.73	45.16	43.15	53.21	66.70	66.67	65.02	66.63	67.01
China	32.80	26.97	24.29	21.88	21.60	28.67	31.54	32.86	39.02	40.51	43.19	43.35
India	38.25	38.73	37.22	40.05	39.92	43.06	44.18	46.05	50.76	53.06	54.45	55.72
Indonesia	33.50	31.42	36.37	36.35	34.31	40.94	41.47	41.06	38.47	40.33	37.71	38.13

Source: WDI and Global Development Finance, World Bank

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