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Original articles analysing issues and problems relevant to the region from the above perspective are welcomed for publication in the *Journal*. The articles should have a strong emphasis on the policy implications flowing from the analysis. Analytical book reviews will also be considered for publication.

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Chief Editor
Asia-Pacific Development Journal
Macroeconomic Policy and Financing for Development Division
ESCAP, United Nations Building
Rajadamnern Nok Avenue
Bangkok 10200
Thailand
Fax: 66 2 288-3007 or 66 2 288-1000
Email: escap-mpdd@un.org

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References to dollars (\$) are to United States dollars, unless otherwise stated.

References to “tons” are to metric tons, unless otherwise specified.

A solidus (/) between dates (e.g. 1980/81) indicates a financial year, a crop year or an academic year.

Use of a hyphen between dates (e.g. 1980-1985) indicates the full period involved, including the beginning and end years.

The following symbols have been used in the tables throughout the journal:

Two dots (..) indicate that data are not available or are not separately reported.

An em-dash (—) indicates that the amount is nil or negligible.

A hyphen (-) indicates that the item is not applicable.

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FOSTERING PRODUCTIVITY IN THE RURAL AND AGRICULTURAL SECTOR FOR INCLUSIVE GROWTH IN ASIA AND THE PACIFIC

G.A. Upali Wickramasinghe*

In recent years, income poverty has been declining steadily in the Asia-Pacific region, but rural poverty remains widespread and deep, and continues to pose a serious challenge for policymakers. Improving agricultural productivity has been a core strategy for economic development and poverty alleviation for several decades, as this type of productivity was thought to facilitate structural transformation, which enables “surplus agricultural labour” to find employment in non-agricultural sectors. However, it has now been realized that the share of agriculture in national output declines more rapidly than the share of agricultural employment in total employment, trapping millions in “unproductive” agriculture and making them relatively poorer. Understanding this process and identifying appropriate responses is critical for poverty alleviation and inclusive growth. Based on data analysis and policy reviews, in the present paper, it has been found that structural transformation processes are incomplete in many developing countries. Reducing rural poverty and promoting inclusive growth cannot be realized by confining to agriculture, but instead they can be achieved by seeking a broader policy framework that facilitates enhanced intersectoral linkages.

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* Food and Agriculture Organization of the United Nations, Rome (email: Upali.GalketiAratchilage@fao.org).

I. INTRODUCTION

Income poverty has been declining steadily in the Asia-Pacific region in recent years. However, rural poverty remains widespread and deep, and continues to pose a serious challenge for policymakers, partly because of the large number of people affected by it and partly because of its chronic nature, which is rooted in structural, institutional and sociological aspects. For a large majority of the rural poor, agriculture remains an important source of livelihood, although by no means it is the only, or the most important, livelihood (Haggblade, Hazell and Reardon, 2007; IFAD, 2016). Theoretical models and empirical studies have well documented that agricultural productivity growth is a critical condition for reducing rural poverty and promoting inclusive growth prospects. Agricultural productivity growth is considered to play a central role in the industrialization process. In the Clark-Kuznets-Chenery-Syrquin framework, it was suggested that a rise in per capita income is directly linked to the structural transformation process in which the share of agriculture in total output and the share of agricultural employment in total employment decline almost simultaneously, allowing “surplus agricultural labour” to find employment in the industrial and services sectors. However, that fairly “typical” process of transformation has not occurred in many developing countries. While the share of agriculture in output has declined, the share of agriculture employment in total employment has been found to change at a much slower rate, thus trapping millions in the agricultural sector with lower marginal productivity. In the process, agricultural workers have become relatively poorer compared to their counterparts in the industrial and services sectors.

Lack of progress in agricultural development and limited opportunities available for the rural poor in non-farm activities have forced the rural poor to migrate to urban centres in search of productive employment. Only a limited number of them find productive employment opportunities outside agriculture, and even when they secure jobs, incomes generated in urban areas tend to be highly volatile (de Haan and Rogaly, 2002). This has led to an appreciation of the importance of promoting economic activities rooted in rural areas and strengthening linkages with non-agricultural sectors. The need to strengthen rural economies and ensure that the rural poor can benefit from growth processes is fundamental to inclusive growth. The rural poor need to overcome many obstacles in order to reap the benefits associated with national growth, which include: high transaction cost differentials between rural and urban areas and their buying and selling prices; barriers to accessing technology, finance and public services; and widely differing capacities to participate in non-farm income generating activities.

In the present paper, the historical evolution of agricultural productivity and some key variables that determine inclusive growth in selected countries in Asia and the Pacific are reviewed and some policies that contributed to agricultural productivity growth and inclusive growth are identified. The rest of the paper is organized as follows. The next section contains a review of the literature, followed by a review of salient features of agricultural productivity growth in Asia and the Pacific. Section IV includes a review of agricultural policies pursued by four countries in the region. In section V, a review of economic transformation and its links to inclusive growth are provided, and section VI concludes.

II. LITERATURE REVIEW

In development economics literature, which largely emerged to explain the process of economic transformation in industrialized countries, agricultural productivity has been identified as being essential for economic growth. Growth in agricultural productivity had resulted in increased demand for manufacturing goods, which in turn had led to a process of structural transformation in which the share of agriculture in national incomes and employment fell with a parallel rise in employment in the manufacturing and services sectors. The same process of transformation had occurred much later in Japan and the Republic of Korea. This transformation process is viewed as robust, and is associated with declining shares of agriculture in total output and agricultural employment in total employment and increasing per worker agricultural value added; simultaneously the shares of manufacturing and services in total output had increased (Clark, 1940; Kuznets, 1957; Chenery and Syrquin, 1975; Timmer, 1988). If economic and social conditions are conducive for the process of transformation to be spontaneous and without many internal or external barriers, higher agricultural productivity enables sectoral differences to decline, thus providing a foundation for economic growth that benefits agricultural workers.

The literature recognized two channels through which agricultural productivity could spur industrial growth: demand channel and supply channel. The demand channel proposes that agricultural productivity generates sufficient demand for manufactured goods and other services if consumers facing different incomes but the same prices do not demand goods in the same proportions. The growth in demand for manufactured commodities in turn is thought to induce a reallocation of labour away from agriculture, allowing surplus agricultural labour to find employment in non-agricultural sectors and thus completing the transformation (Murphy, Shleifer and Vishny, 1989). The supply channel is based on the hypothesis that at initial stages, agricultural productivity increases more rapidly than productivity growth in the industrial sector and that goods produced in the two sectors complement each other,

but demand for agricultural goods does not grow as rapidly as for manufactured goods, thus inducing labour to be reallocated to manufacturing activities (Baumol, 1967).

The view that growth in agricultural productivity can lead to industrial growth and transformation has been challenged on the ground that the process could take place only in closed market economies. In subsequent literature, under an open market assumption, the possibility for growth in agricultural productivity to slow industrial growth because of the possibility for reallocating labour from agriculture to a sector with more comparative advantage has become apparent (Wright, 1979; Matsuyama, 1992).

More recent empirical evidence has shown that technical change in agricultural production can lead to industrial growth if the technical change is labour-saving (Bustos, Caprettini and Ponticelli, 2016). Advanced knowledge of genetic structures and mechanisms, especially in agricultural biotechnology, has been shown to push the agricultural productivity frontier dramatically, which is likely to contribute to a rise in the productivity of secondary crops, such as millets, cassava and root crops, that provide sustenance to millions (Naylor and Manning, 2005).

Recent research has enhanced the understanding of additional conditions required for growth in agricultural productivity to induce economic transformation. It has been found that the process works better under a relatively better distribution of income and resources among people (Ravallion and Datt, 1996; Timmer, 2007; World Bank, 2008). Furthermore, growth processes that occur in rural areas help the poor to move out of poverty faster and are conducive for more rapid economic growth and transformation (Ravallion, Chen and Sangraula, 2007). Vertical integration of agricultural production within larger production and processing systems along with the “supermarket revolution” has also been found to help transform food retail markets and supply chains (Reardon and others, 2003; Reardon and Timmer, 2007).

Structural transformation is associated with two additional transformations that help the rural sector: spatial reorganization and institutional transformation (Brooks, 2012). Need for spatial reorganization is thought to have emerged from higher agricultural productivity, which induces farm enterprises to consolidate land and establish relatively large farming operations, and growth of satellite cities and the development of larger urban centres. In the process, agricultural workers who manage to acquire technical skills find employment in the modern sector. This has an additional advantage: a reduction in the unit costs of providing services, including electricity, telephone connectivity, sanitation, education and health care. As unit costs decline, greater demand makes it possible for a large number of suppliers to enter markets, making prices more competitive. This involves the replacement of old

production processes and institutions with new economic structures and institutions, marked by the shift of labour, capital and other resources to more productive sectors. The second aspect is related to institutional transformation in which more formal contractual arrangements replace traditional systems in the management of land, labour, credit and marketing arrangements; this is found to be conducive for the emergence of specialized skills and markets, which consequently reduce transaction costs and lead to overall economic transformation (Wickramasinghe and Weinberger, 2013).

III. AGRICULTURAL PRODUCTIVITY GROWTH

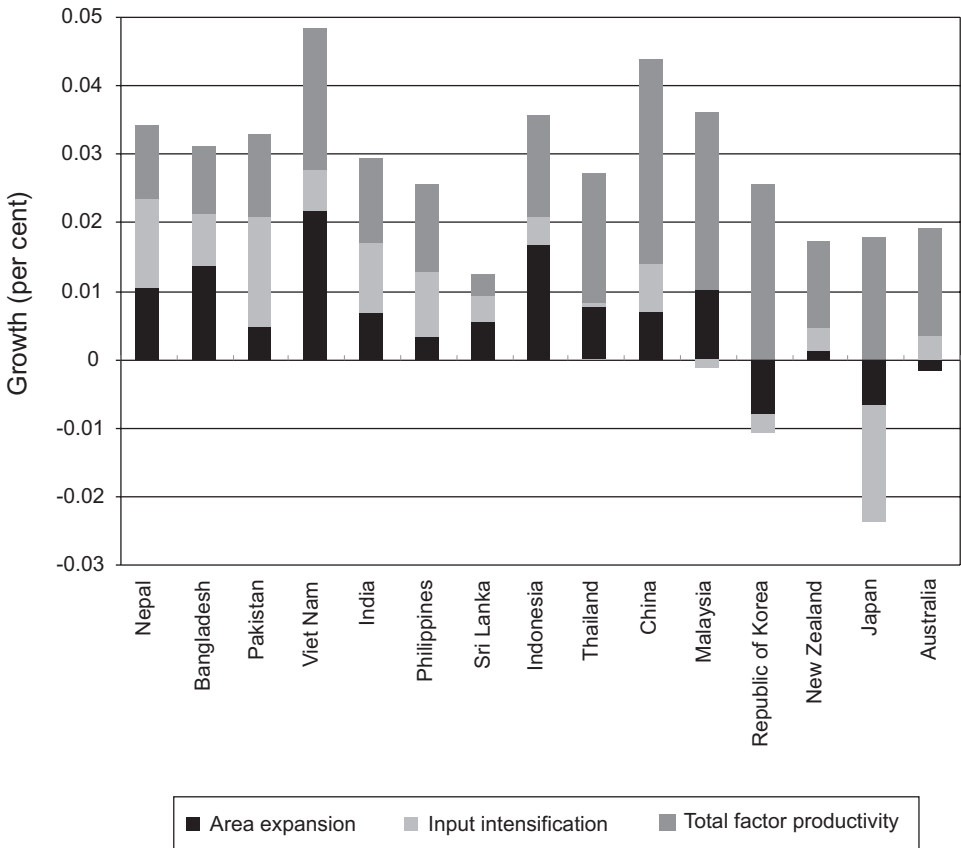
The growth theory discussed above gives pre-eminence to agricultural productivity growth as a key factor that triggers economic growth and transformation. In this section, an overview of agricultural productivity growth in selected countries in Asia and the Pacific is presented, and policy reforms that have supported agricultural productivity growth¹ for four countries are reviewed.

Figure 1 presents data on average annual growth rates of agricultural output, decomposed by area expansion, input intensification and total factor productivity (TFP) growth. Countries are organized by per capita gross domestic product (GDP) (constant 2010). It was found that the higher the per capita GDP, the higher the proportion of agricultural output generated from growth of TFP. China and Viet Nam are two exceptions, where higher TFP growth rates have been realized at relatively

¹ Growth in agricultural output originates from three sources: expansion of input use (extension), and increased application of inputs (intensification); and efficiency improvements resulting from the adoption of efficient technologies and farming practices without the augmenting resources, which is termed as total factor productivity (TFP). Productivity growth comes from technical progress, which consists of two key components: technical change; and technical progress. The first component arises from improvements in production practices and the latter comes from a movement of production practices close to the existing good practices. For a comprehensive review of methodology, refer to Headey, Alauddin and Rao (2010), and for a description of estimation procedure with a guide to data, see United States Department of Agriculture (2017). Total factor productivity (TFP) is measured either by its level or its growth. The level of TFP is measured by dividing an index of agricultural outputs (index of gross crop and livestock output) by an index of inputs comprising of land, fertilizer, machinery, livestock and feed. TFP growth, on the other hand, is measured by taking the difference between growth rates of the index of agricultural outputs and the index of inputs. Growth in TFP can come from various sources: improvements in using existing resources more efficiently; the use of high-yielding, disease-resistant and drought tolerant varieties; the implementation of efficient and timely cultivation and harvesting practices; and the application of agricultural practices that control the use of water, fertilizer and other inputs more precisely (precision agriculture); providing better rural education that enhances community understanding of modern agricultural practices; institutional innovation; or improved quality of resources. TFP growth can be positive when output growth is higher than input growth, which indicates an improvement in the sources mentioned above. It can be negative when input growth surpasses that of output growth.

low per capita GDP. In Japan and the Republic of Korea, almost all of agricultural output expansion comes from TFP growth, and land and other resources are being reallocated to other sectors. Similarly, a higher percentage of agricultural output has also come from TFP growth in China, Malaysia and the Republic of Korea. Developing countries with relatively low per capita incomes, such as Bangladesh, Nepal and Pakistan, continue to rely more on area expansion and input intensification.

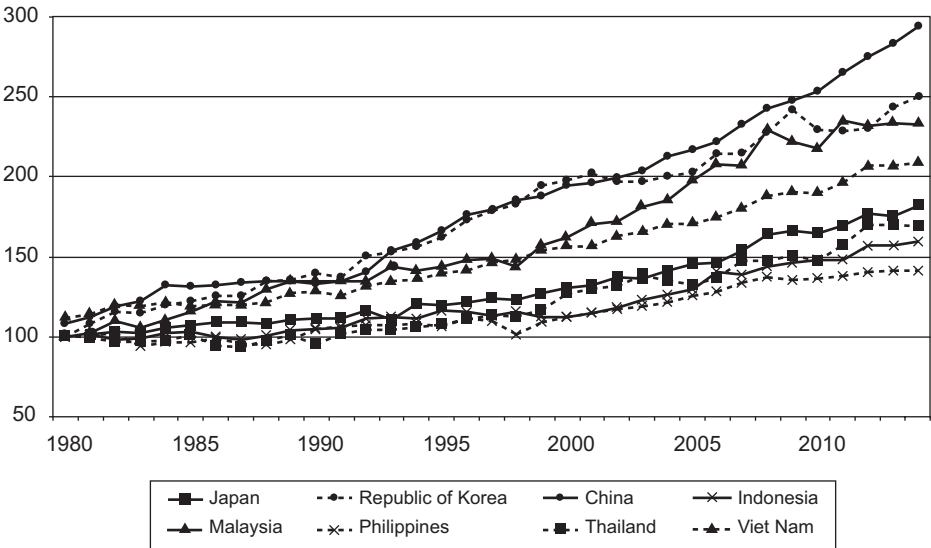
Figure 1. Sources of agricultural output growth (1980-2014)



Source: Author, based on United States Department of Agriculture (2017).

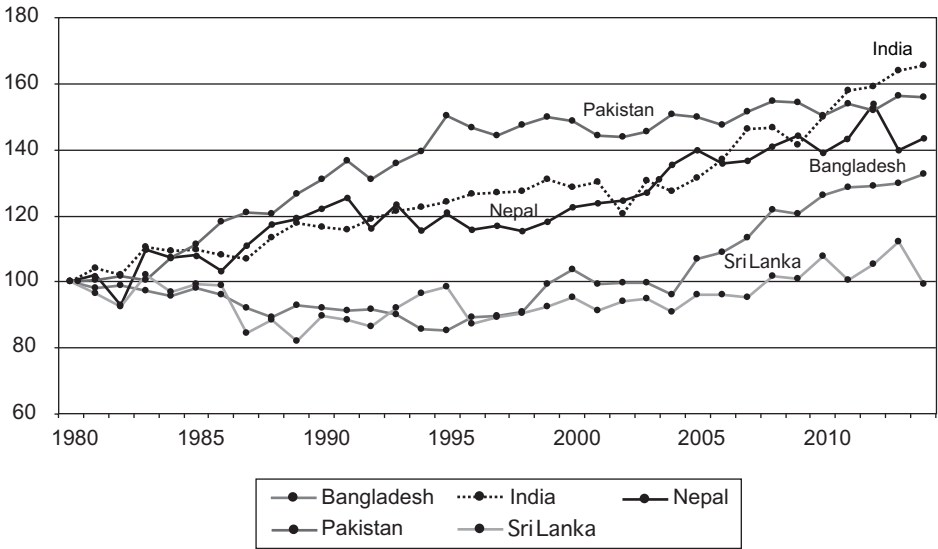
While the above figure is useful in gaining an overall view of agricultural productivity growth, it does not indicate how the change actually happened over time. Figure 2 presents annual TFP indices for East and South-East Asia for the period 1980-2014. It shows that some countries, such as China, Malaysia and the Republic of Korea, have been able to experience a transition to higher levels of output generated through TFP. Other countries in East Asia, including among them, Japan, have maintained a consistently high TFP, but not at the high levels experienced by the countries mentioned above. In South Asia, TFP growth rates have hardly reached the levels realized by East Asian countries, except for India, in the last few years (figure 3). Within the subregional group, three countries, namely India, Nepal and Pakistan, have realized higher TFP growth, whereas Bangladesh and Sri Lanka have fallen below the other countries. Sri Lanka is an exception, as TFP growth has fallen way below the other countries with significant fluctuations, perhaps indicating erratic changes of policies related to agricultural development.

Figure 2. Total factor productivity in agriculture in East Asia Index (1980 = 100)



Source: Author, based on United States Department of Agriculture (2017).

Figure 3. Total factor productivity in South Asia Index (1980 = 100)



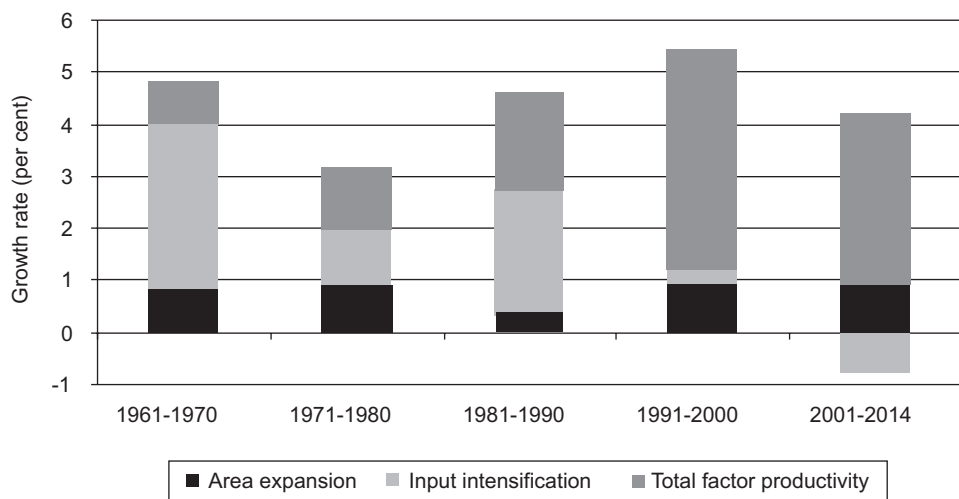
Source: Author, based on United States Department of Agriculture (2017).

IV. AGRICULTURAL POLICY REFORMS IN SELECTED COUNTRIES

Agricultural policy reforms implemented by four countries, namely China, India, Indonesia and Thailand, with the objective to spur agricultural productivity growth are discussed below. It aims to identify policies that may have specifically targeted to stimulate agricultural productivity.

China

In China, agricultural output expansion originating from TFP has been rising consistently over time, driven largely by investment in agricultural technology, the construction of rural infrastructure and the introduction of innovative institutional arrangements. In the late 1980s, role of agricultural intensification in output expansion had virtually come to an end. In subsequent periods, the use of inputs per area has been dominant, and in more recent years TFP growth has begun to play a dominant role in agricultural development.

Figure 4. Agricultural output growth and its decomposition in China

Source: Author, based on United States Department of Agriculture (2017).

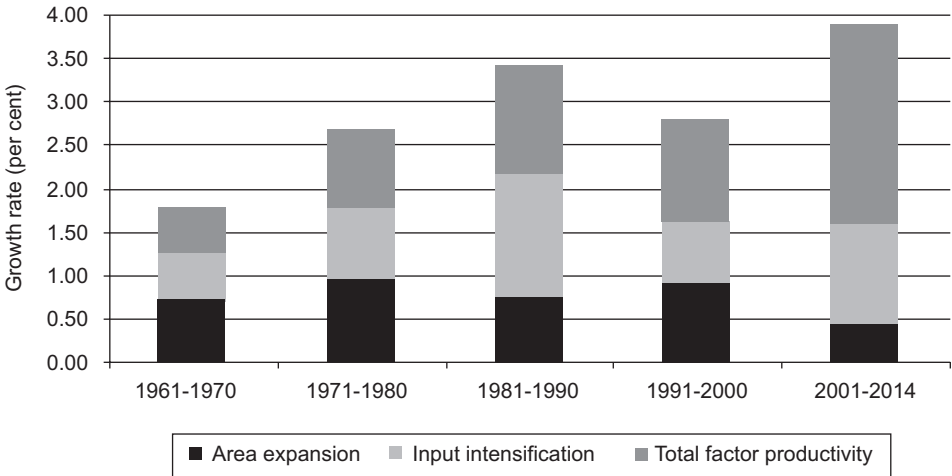
Production decentralization introduced in 1978 was a key part of the reform package to revive agricultural development. Liberalization of the agricultural pricing system and reforming agricultural procurement (Fan, Zhang and Zhang, 2002) have contributed to growth in agricultural output in subsequent periods. However, it appears that those reforms exposed farmers to market vagaries, prompting policymakers to address market adjustment issues in the 1990s. A critical step in the transition was the way China began to manage excess supply and the rising gap between urban and rural areas, for which it launched several measures in early 2000. With a focus on raising farmers' incomes, the Government (a) began to provide input subsidies to purchase improved seeds, (b) made direct payments to farmers who engaged in grain production, and (c) reduced and later abolished agricultural taxes (Zhang and Brummer, 2011).

India

India's agricultural output has been rising since the Green Revolution, spurred by the use of intensive agricultural practices (Chand, Kumar and Kumar, 2011; Joshi and others, 2000), infrastructure and irrigation development, area expansion and technical progress. In the process, some sector such as dairy have grown much more rapidly, partly supported rising demand from the growing urban population. In India during the period 2001-2014, TFP became the dominant factor in agricultural output

growth although area expansion and input intensification has continued to play significant roles (figure 5).

Figure 5. Agricultural output growth and its decomposition in India



Source: Author, based on United States Department of Agriculture (2017).

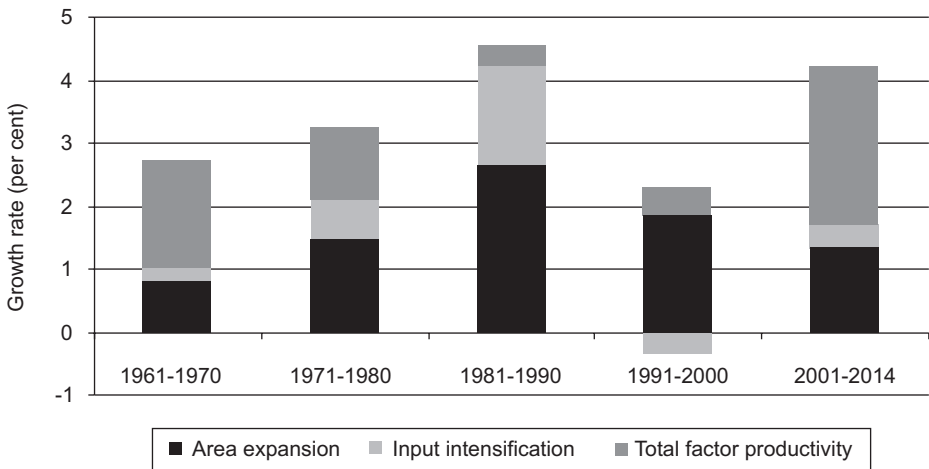
Policies implemented to support agricultural development in India include: input subsidies; incentives to encourage crop diversification with a target on encouraging farmers to move from grains and pulses to high-value food commodities, such as vegetables, fruits, spices and livestock (Gulati, 2009; Chand, Kumar and Kumar, 2011); establishing agricultural research institutes and agricultural universities to generate and disseminate new technologies; and food price stabilization schemes (Chand, Kumar and Kumar, 2011). Notwithstanding, agricultural development and improving farmers' incomes have been impeded by several factors, namely scarcity and fragmentation of land (India, Ministry of Agriculture, 2014); small farm size that is largely efficient but lacking economies of scale; weak market access; soil degradation (Indian Council for Agricultural Research, 2010); inefficiencies in water use; and vulnerability to climate change.

Indonesia

In Indonesia, agricultural output grew consistently over the past five decades (figure 6). The contribution of land expansion to output growth was a significant factor throughout the entire period covered by the study. Agricultural intensification contributed to growth through the 1990s, but, since then, it has not been a consistent

source of growth. Growth in TFP had been limited in earlier years, but became more significant in the 1990s, with its contribution rising to 60 per cent of agricultural output growth in the period 2001-2014. The gradual shift from food staples to higher-value perennial, horticultural and livestock commodities such as palm oil, and away from food staples in the main factor supporting this growth in TFP (Fuglie, 2012).

Figure 6. Agricultural output growth and its decomposition in Indonesia



Source: Author, based on United States Department of Agriculture (2017).

In Indonesia, efforts towards realizing food self-sufficiency and price stability stand out as government priorities. The rice sector has been regulated using food production and a marketing system, supplemented by export and import controls and high tariffs. The Government has been providing subsidies to agricultural inputs to incentivize the production of five specifically identified food commodities, namely rice, soybean, maize, sugar and beef. A fertilizer subsidy scheme, which accounts for nearly 10 per cent of the national development budget, was reintroduced in 2009, pushing the share of fertilizer subsidy to 30 per cent of the agriculture budget (Cervantes-Gody and Dewbre, 2010). The Government also promoted the adoption of high-yielding varieties in rice and other crops; invested in irrigation schemes; agricultural research and development and the dissemination of their findings; and provided credit at subsidized rates to stimulate agricultural output growth. In recent years a shift in policy focus to food diversification has taken place with a target to promote the consumption of food derived from secondary crops, such as cassava, banana and maize. In addition, the Government has pursued a policy to promote the

expansion of palm oil cultivation to reduce reliance on traditional crops such as rubber, coffee and cocoa. Indonesia also used border control measures (export bans, export tariffs and variable levies) to manage its agricultural markets for encouraging domestic value addition.

Thailand

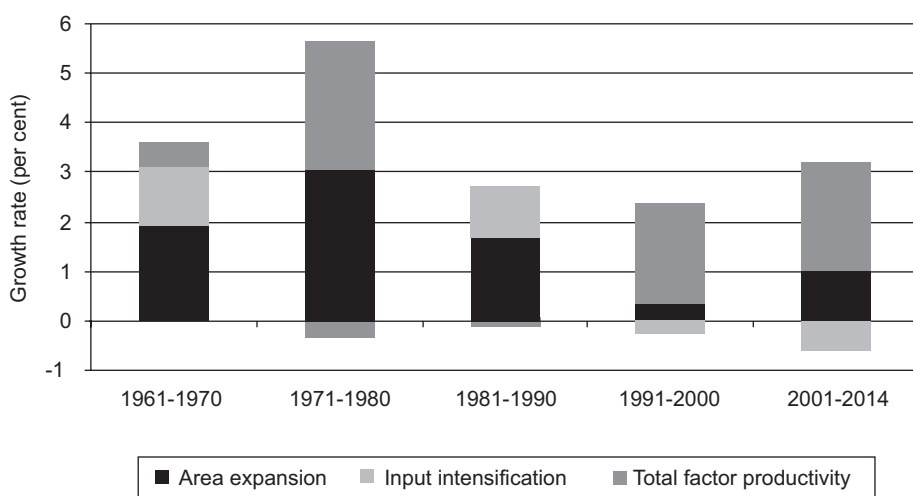
Agricultural output has been rising in Thailand for several decades. For almost three decades since the 1960s, area expansion was the dominant source of agricultural output growth while input intensification was not used consistently. Since about the beginning of the 1990s, agricultural output growth has been largely driven by factor productivity.

Agricultural development in Thailand has gone through three phases: (a) area expansion-led strategy in the 1960s and 1970s; (b) private investment-led strategy in the 1980s to contain an exodus of young workers from agriculture (Poapongsakorn, 2006); and (c) efficiency-driven growth with a decline in the use of external inputs. The first phase began when the Government established a land tenure system under which farmers were allowed to clear forests and gain secure property rights by paying taxes. Once farmers cleared land, the Government invested in roads and large irrigation systems, later complemented by spending on rural education, electrification and telecommunication (Poapongsakorn and others, 1995). The Government also strengthened the agricultural education system by investing in agricultural research, and established and expanded agricultural universities and research centres throughout the country, supplemented by extension services that promoted new high-yielding varieties. The Government of Thailand ensured continuity of funding agricultural research and development, and developed improved plant varieties in cereal, food crops and secondary and commercial crops, such as corn, sorghum, rubber and cotton (Poapongsakorn and others, 1995), but the measures were not sufficient enough to compensate for the generally weak private investment in research and development (Suphannachart and Warr, 2011).

The role of the Government in this process was largely limited to establishing an enabling environment, investing in infrastructure, such as roads, irrigation, telecommunication and energy and research, expanding agricultural credit, and investing in education. In addition, the Government focused on facilitating the adoption of improved seed varieties and provided incentives for farmers to invest in agriculture, initially by instructing commercial banks to provide farmer credits, and later by establishing agricultural banks. The novelty of the new system was the implementation of a modality of extending credit to farm households through cooperatives without collateral.

Over time, the Government of Thailand has shifted its focus on strengthening agricultural markets through the promotion of food certification schemes, opening up foreign markets for Thai products through trade agreements, strengthening value chains and supporting through international marketing. In recent years, taxes have been reduced.

Figure 7. Agricultural output growth and decomposition in Thailand



Source: Author, based on United States Department of Agriculture (2017).

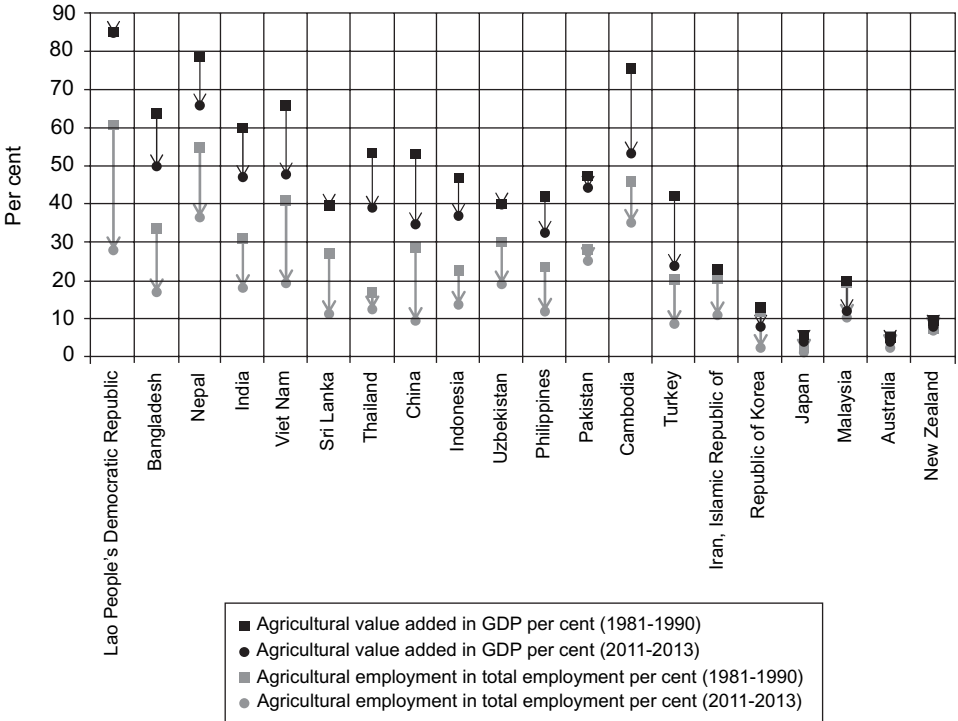
V. ECONOMIC TRANSFORMATION AND INCLUSIVE GROWTH

Following classical development theories, three variables can describe agricultural transformation: the share of agricultural value added in GDP (AVA), the share of agricultural employment in total employment (AET) and agricultural value added per worker (AVW). Figure 8 contains a summary of the movements of the first two variables for the periods 1981-1990 and 2011-2013. In all but four countries out of the 20 surveyed, the AVA share was already less than 40 per cent in the 1960s, but by 2013, it dropped to less than 20 per cent in 10 countries and to below 10 per cent in six countries. The AVA share was consistently high only in four countries – Cambodia, the Lao People's Democratic Republic, Nepal and Pakistan.

As per the classical development theory, growth in agricultural productivity releases some members of the labour force from the agricultural sector, and the growing manufacturing sector should be able to absorb them. This, while true for

industrialized and newly industrialized countries, did not happen as expected, shown in figure 8, in Asia and the Pacific. The process has been too slow for many countries.

Figure 8. Agricultural value added and agricultural employment

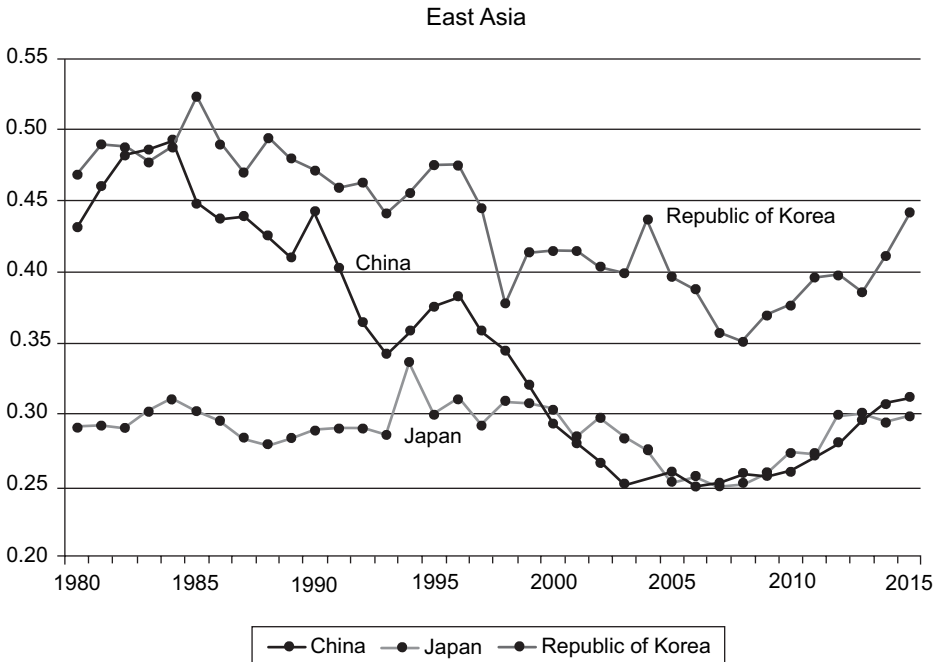


Source: Author, based on World Bank (2017).

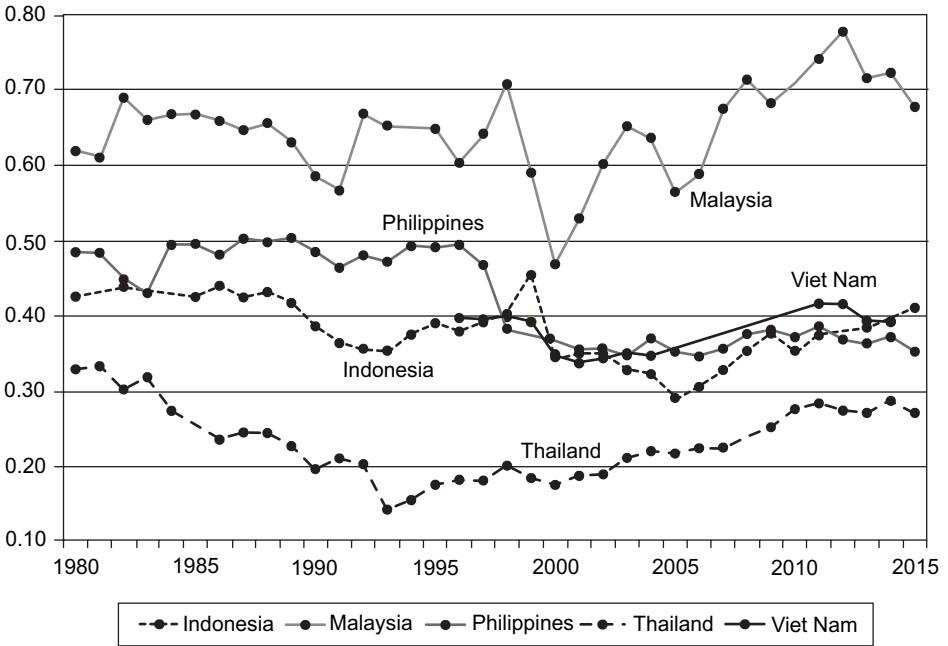
In four high-income countries in the sample, namely Australia, Japan, New Zealand and the Republic of Korea, the AVA and the AET shares declined as the classical growth model would predict. Although not declining at the same rate, total labour force in China declined by 131 million between 1990 and 2013. In India, however, the total labour force increased by 62 million during the same period. In almost all other countries, the AVA share continued to decline without a parallel decline in the AET share, effectively trapping millions in the agriculture sector and resulting in a decline in the share of agricultural GDP potentially accrued to each agricultural worker, effectively increasing their relative poverty.

To see this clearly, the AVA share is divided by the AET share, which provides an approximation to whether agricultural workers become worse off over time. Figure 9 shows the results for selected countries. The ratio has been generally high for Australia, Malaysia and New Zealand, a reflection of generally favourable economic conditions for farmers. In China, the ratio has been declining for nearly 20 years from 1986 to 2006, but in recent years the ratio has been rising, indicating improvements in farmers' relative incomes. In South Asia, farmers continue to be marginalized compared to workers in the industrial and services sectors. In India, it was observed that relative farmers' incomes have been declining since the 1980s, while some signs of recovery can be observed in recent years.

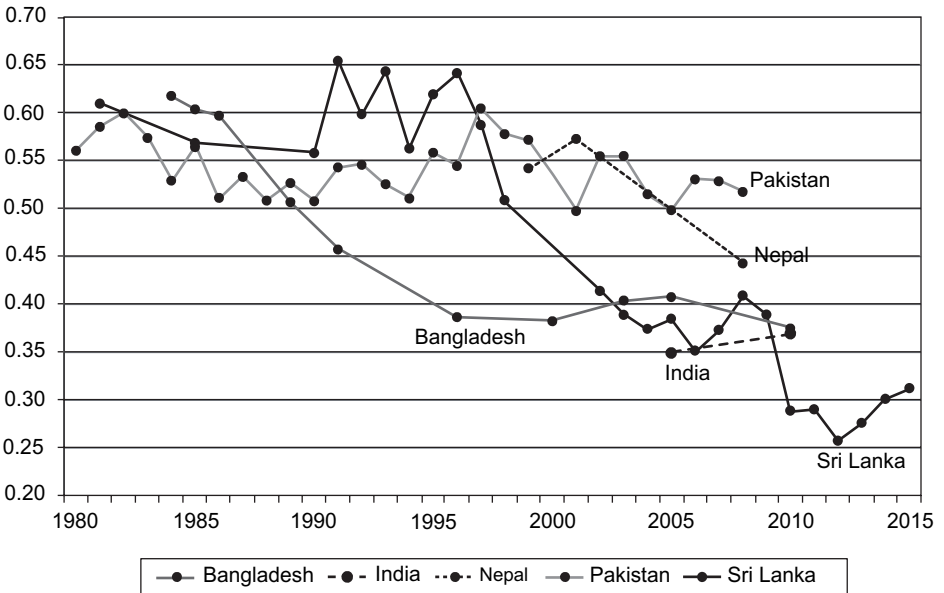
Figure 9. Ratio of the share of agricultural value added in gross domestic product and the share of agricultural employment in total employment

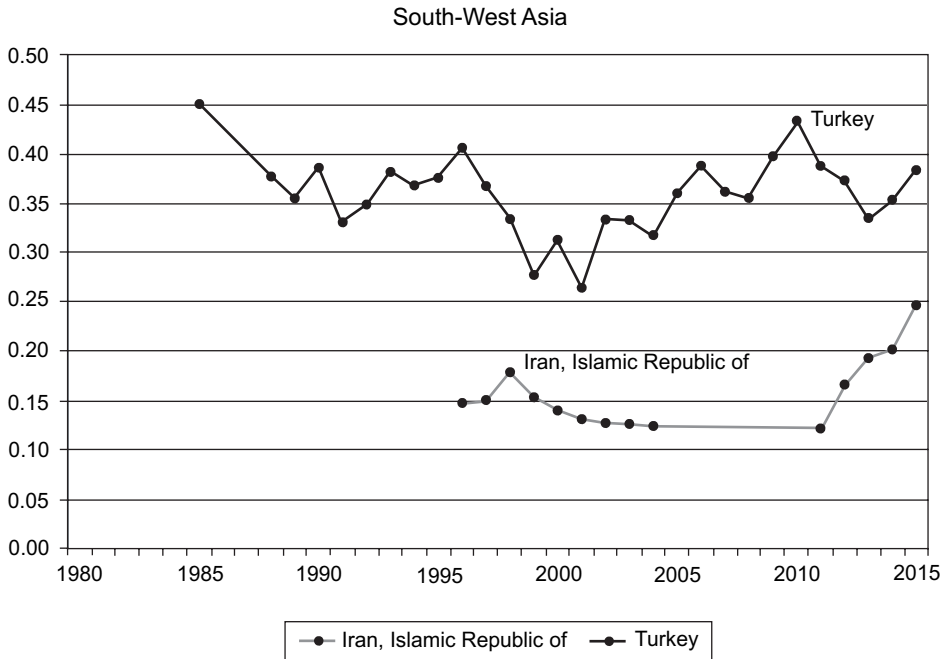


South-East Asia



South Asia

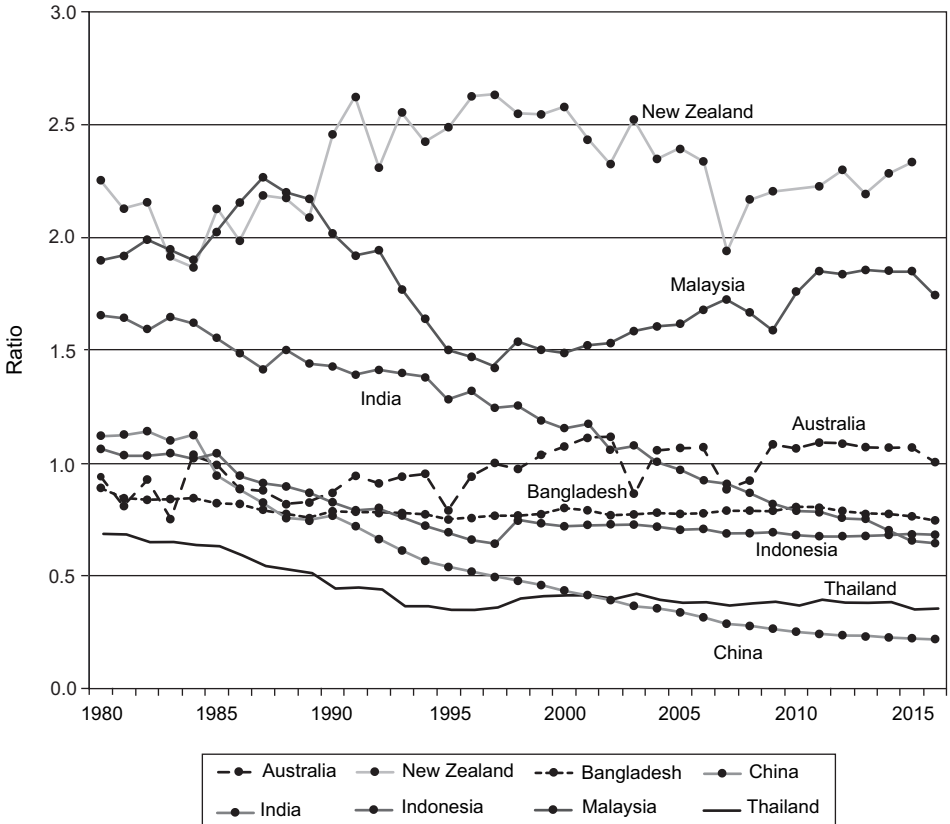




Source: Author, based on World Bank (2017).

Agricultural value added per worker (AVW) is the third important variable that explains changes to relative farmers' income over time. To put it in the perspective of national income, AVW is divided by per capita GDP (figure 10). The ratio that is closer to 1 indicates that agricultural workers could expect to receive just about the value of per capita GDP. In other words, agricultural workers are neither worse off nor better off than an average citizen. Figure 10 presents the results. In New Zealand and Malaysia, a farm worker could expect to have higher income than the per capita GDP in respective countries; and in Australia, the average income of an agricultural worker is equivalent to per capita GDP. In several other countries, including in China, India and Indonesia, farmers' relative incomes have been declining. Those results largely confirm previous findings that farmers' relative incomes have been deteriorating across many countries in Asia and the Pacific.

Figure 10. Ratio between agricultural value added per worker and per capita gross domestic product



Source: Author, based on World Bank (2017).

VI. CONCLUSIONS

Income poverty has declined steadily in Asia and the Pacific in recent years. However, poverty rates in rural areas continue to be high and widespread. Agriculture remains an important source of livelihood of a large proportion of people in the region, although by no means it is the only or the most important livelihood in rural areas. Classical economic development theories and recent empirical evidence suggest that agricultural productivity growth is a key condition for rural economic transformation and poverty alleviation. In the present paper, agricultural productivity developments were reviewed, the evolution of some key variables that would explain the nature of

structural transformation were analysed and policies implemented by selected countries to foster agricultural development were studied.

In summary, agricultural outputs across many of the countries surveyed have been rising, with agricultural productivity being a factor behind much of the agricultural expansion. However, the transformation process predicted by the classical development model in which the modern sector absorbs the labour leaving the agriculture sector has not occurred in much of Asia. Although economic growth associated with policy reforms launched in many countries in the 1980s, including in China and in India, have increased average farm incomes, the most vulnerable segments have not been able to benefit from those transformations. This confirms an earlier finding that economic growth processes in Asia have become progressively less successful in integrating low-productive agricultural labour into the rest of the economy. In some Asian countries, policy regimes have dampened the movement of labour out of agriculture deliberately and, in the process, halted economic transformation midstream. This has been done with the belief that a large movement of labour out of agriculture is politically untenable because of its potential impact on food production and unsustainable urbanization.

The experience of China in recent years is highly relevant for the discussion, where strong intersectoral linkages and higher productivity growth in the manufacturing sector enabled it to absorb a significant number of agricultural workers from agriculture into non-agriculture sectors. Whether other countries are able to emulate this experience depends on their capacity to foster stronger growth in non-agricultural sectors or movement towards agriculture-based processing industries, if such an effort can be sustained with the use of current agricultural produce. Given that the structural transformation is unlikely to happen spontaneously, efforts are needed to boost jobs outside of agriculture in parallel with agricultural productivity growth in order for agricultural productivity to have a meaningful impact on the alleviation of poverty.

REFERENCES

- Baumol, William J. (1967). Macroeconomics of unbalanced growth: the anatomy of urban crisis. *American Economic Review*, vol. 57, No. 3, pp. 415-426.
- Bustos, Paulo, Bruno Caprettini, and Jacopo Ponticelli (2016). Agricultural productivity and structural transformation. *American Economic Review*, vol. 106, No. 6, pp. 1320-1365.
- Brooks, Jonathan (2012). A strategic framework for strengthening rural incomes in developing countries. In *Agricultural Policies for Poverty Reduction*, Jonathan Brooks, ed. Paris: OECD Publishing.
- Cervantes-Gody, Dalilia, and Joe Dewbre (2010). Economic importance of agriculture for sustainable development and poverty reduction: findings from a case study of Indonesia. Paper presented to the Working Party on Agriculture Policy and Markets. Organization of Economic Cooperation and Development, Paris, 15-17 November.
- Chand, Ramesh, Praduman Kumar, and Sant Kumar (2011). *Total Factor Productivity and Contribution of Research Investment to Agricultural Growth in India*. Policy Paper, No. 25. New Delhi: National Centre for Agricultural Economics and Policy Research.
- Chenery, Hollis B., and Moises Syrquin (1975). *Patterns of Development: 1950-1970*. New York: Oxford University Press for the World Bank.
- Clark, Colin (1940). *The Conditions of Economic Progress*. London: MacMillan.
- De Haan, Arjan, and Ben Rogaly, eds. (2002). *Labour Mobility and Rural Society*. London: Frank Cass.
- Fan, Shengen, Linxiu Zhang, and Xiaobo Zhang (2002). Growth, inequality, and poverty in rural China: the role of public investments. IFPRI Research Report, 125. Washington, D.C.: International Food Policy Research Institute.
- Fuglie, Keith (2012). Sources of growth in Indonesian agriculture. *Journal of Productivity Analysis*, vol. 33, No. 3, pp. 225-240.
- Gulati, A. (2009). Indian agriculture: changing landscape. Paper prepared for the IAAE Conference. Beijing, China, 17 August.
- Haggblade, Steven, Peter Hazell, and Thomas Reardon, eds. (2007). *Transforming the Rural Nonfarm Economy: Opportunities and Threats in the Developing World*. Baltimore, Maryland: Johns Hopkins University Press.
- Headey, Derek, Mohammad Alauddin, and D.S. Prasada Rao (2010). Explaining agricultural productivity growth: an international perspective. *Agricultural Economics*, vol. 41, No. 1, pp. 1-14.
- India, Ministry of Agriculture (2014). Agriculture Census 2010-11 (Phase-I). Agriculture Census Division, Department of Agriculture & Co-Operation. Available from <http://agcensus.nic.in/document/agcensus2010/completereport.pdf>.
- Indian Council for Agricultural Research (2010). Degraded and wastelands of India: status and spatial distribution. New Delhi.
- International Fund for Agricultural Development (IFAD) (2016). *Rural Development Report, 2016: Fostering Inclusive Rural Transformation*. Washington, D.C.

- Joshi, P.K., and others (2000). Socioeconomic constraints to legumes production in rice-wheat cropping systems of India. In *Legumes in Rice Wheat Cropping Systems of the Indo-Gangetic Plain — Constraints and Opportunities*, C. Johansen and others, eds. Patancheru, India: International Crop Research Institute for the Semi-Arid Tropics; New York: Cornell University.
- Kuznets, Simon (1957). Quantitative aspects of the economic growth of nations: II. industrial distribution of national products and labour force. *Economic Development and Cultural Change*, vol. 5, No. 4, pp. 1-111.
- Matsuyama, Kiminori (1992). Agricultural productivity, comparative advantage, and economic growth. *Journal of Economic Theory*, vol. 58, No. 2, pp. 317-334.
- Murphy, Kevin M., Andrei Shleifer, and Robert Vishny (1989). Income distribution, market size and industrialization. *Quarterly Journal of Economics*, vol. 104, No. 3, pp. 537-564.
- Naylor, Rosamond, and Richard Manning (2005). Unleashing the genius of the genome to feed the developing world. *Proceedings of the American Philosophical Society*, vol. 149, No. 4, pp. 515-528.
- Poapongsakorn, Nipon (2006). The decline and recovery of Thai agriculture: causes, responses, prospects and challenges. In *Rapid Growth of Selected Asian Economies: Lessons and Implications for Agriculture and Food Security*. Policy Assistance Series 1/3, 2006/06. Bangkok: FAO Regional Office for Asia and the Pacific.
- Poapongsakorn, Nipon, and others (1995). Agricultural diversification: restructuring of agricultural production systems in Thailand. A paper prepared for the Food and Agriculture Organization of the United Nations, Bangkok.
- Ravallion, Martin, Shahua Chen, and Prem Sangraula (2007). New evidence on the urbanization of global poverty. *Population and Development Review*, vol. 33, No. 4, pp. 667-701.
- Ravallion, Martin, and Guarav Datt (1996). How important to India's poor is the sectoral composition of growth? *World Bank Economic Review*, vol. 10, No. 1, pp. 1-25.
- Reardon, Thomas, and C. Peter Timmer (2007). Transformation of markets for agricultural output in developing countries since 1950: How has thinking changed? In *Handbook of Agricultural Economics*, vol. 3, Robert Evenson and Prabhu Pingali, eds. Amsterdam: Elsevier.
- Reardon, Thomas, and others (2003). The rise of supermarkets in Africa, Asia, and Latin America. *American Journal of Agricultural Economics*, vol. 85, No. 5, pp. 1140-1146.
- Suphannachart, Waleerat, and Peter Warr (2011). Research and productivity in Thai agriculture. *Journal of Agricultural and Resource Economics*, vol. 55, No. 1, pp. 35-52.
- Timmer, C. Peter (1988). The agricultural transformation. In *Handbook of Development Economic*, vol. 1, Hollis Chenery and T.N. Srinivasan, eds. Amsterdam: North Holland.
- _____ (2007). The structural transformation and the changing role of agriculture in economic development: empirics and implications. Wendt Lecture, 30 October. American Enterprise Institute, Washington, D.C.
- United States Department of Agriculture (2017). Agricultural Productivity Database, 2017 update. Available from www.ers.usda.gov/data-products/international-agricultural-productivity/. Accessed 1 December 2017.
- Wickramasinghe, Upali, and Katinka Weinberger (2013). Smallholder market participation and production specialization. Working Paper, No. 107. Bogor, Indonesia: Centre for Alleviation of Poverty through Sustainable Agriculture.

World Bank (2008). *World Development Report: Agriculture for Development*. Washington, D.C.

_____ (2017). World Development Indicators. Available from <https://data.worldbank.org/data-catalog/world-development-indicators>. Accessed 1 December 2017.

Wright, Gavin (1979). Cheap labour and Southern textiles before 1880. *Journal of Economic History*, vol. 39, No. 3, pp. 655-680.

Zhang, Yanjie, and Bernhard Brummer (2011). Productivity change and the effects of policy reforms in China's agriculture since 1979. *Asia-Pacific Economic Literature*, vol. 25, Issue 2, pp. 131-150.

STRESS TESTING THE HOUSEHOLD SECTOR IN MONGOLIA

*Gan-Ochir Doojav and Ariun-Erdene Bayarjargal**

The present paper contains an outline of a simulation-model for stress testing the household sector in Mongolia. The model uses data from the Household Socio-Economic Survey to assess the financial resilience of the household sector to macroeconomic shocks. The results suggest that the household sector of Mongolia is vulnerable to shocks associated with interest rates, cost of basic consumption, asset prices and unemployment. In particular, impacts of interest and consumer price shocks on household's debt at risk (or expected loan losses) are considerable. Furthermore, it has been found that a substantial increase in household indebtedness has boosted the financial fragility of the household sector. Those results have important policy implications in mitigating the increasing financial fragility of the household sector and risks to financial stability.

JEL classification: C15, D14, D31, E17.

Keywords: Stress testing, household indebtedness, household surveys, Mongolia.

I. INTRODUCTION

The recent global economic crisis has resulted in increased focus on the risk that vulnerabilities in the household sector can lead to financial instability, and consequently to a deeper and longer economic recession. High levels of household

* Gan-Ochir Doojav, corresponding author, Research and Statistics Department, Bank of Mongolia, Baga toiruu-3, 15160, Ulaanbaatar 46, Mongolia (telephone: 976-318304; facsimile: 976-11-311471, email: doojav_ganochir@mongolbank.mn); and Ariun-Erdene Bayarjargal, Ardnt-Corden Department of Economics, Australian National University, 132 Lennox Crossing ACT 2601, Australia (email: ariun-erdene.bayarjargal@anu.edu.au). This research was supported by the Economic Research Institute of Mongolia grant (ERI201603). The authors would like to thank Tuvshintugs Batdelger (Economic Research Institute), Undral Batmunkh (Bank of Mongolia), the editor and two anonymous reviewers for their constructive comments. The opinions expressed herein are those of the authors and do not necessarily reflect the official views of Bank of Mongolia.

debt raise the vulnerability of household balance sheets to macroeconomic shocks, namely shocks related to income, asset prices, and interest rate. Adverse shocks deteriorate households' ability (or willingness) to pay their debts, and thereby may have a strong negative impact on the financial health of lenders. As a result, household debt may amplify cyclical downturns and weaken economic recoveries (IMF, 2012). Recent studies show that an increase in household debt boosts growth in the short term, but increases macroeconomic and financial stability risks in the medium term (IMF, 2017).

The recent surge of household indebtedness has created concerns about the vulnerability of households to macroeconomic shocks and their impact on macrofinancial stability in Mongolia. Lending to households in the financial system accounts for a sizeable share of its total lending, averaging 40 per cent annually over the period 2010-2015. As the share of household indebtedness increases, stress in this sector – triggered by a rapid increase in interest rates and unemployment, a high level of inflation and a sharp decline in housing prices, or a combination thereof – may significantly weaken the banking sector.

Therefore, it is important to continuously assess (a) the banking sector's exposure to the household sector and (b) the household sector's financial resilience, which plays a critical role in the financial system, as mortgage loans dominate financial institutions' balance sheet. Stress testing is a useful tool for assessing the resilience of the financial system to various shocks, including those that result in more borrowers unable to pay their debts, such as adverse economic shocks to households. While the Bank of Mongolia and the International Monetary Fund (IMF) have conducted some formal stress tests on the Mongolian banking sector, a stress-testing framework for the Mongolian financial system has not yet been systematically developed by the authorities.

The objective of this present paper is to develop a simulation-based household stress-testing model that evaluates the financial resilience of the household sector to macroeconomic shocks using data from the Household Socio-Economic Survey of Mongolia. The model is characterized by specific features of Mongolian households and the country's banking sector, and fits with major components of the Household Socio-Economic Survey data. Though it is different from the formal stress testing; the model is able to (a) quantify household financial resilience and its exposure to shocks, and (b) estimate the banking sector's exposure to households that are more likely to default. With regard to the model, household survey data are preferred over aggregate data, namely the household debt-to-income ratio. This is because household surveys contain information on the distributions of household debt, assets, and income, and as a result, provide more insights into households' ability to pay. As shown by Bilston, Johnson and Read (2015), aggregate measures of household

indebtedness can be misleading indicators of the household sector's financial fragility. For instance, it is possible that even with rising levels of household indebtedness in aggregate, the distribution of household debt can be concentrated among those who are well placed to service their debts. In addition, aggregate data are of limited use in differentiating households who hold debt from those who do not, and do not identify households with riskier forms of debt or those who hold enough assets to cover their debts. The stress-testing model is based on a "financial margin approach". Each household is assigned a financial margin that is usually the difference between each household's income and estimated minimum expenses. The model also shares many features with the existing models for several countries, such Karasulu (2008) for the Republic of Korea, Albacete and Fessler (2010) for Austria, Sugawara and Zaldondo (2011) for Croatia, Djoudad (2012) for Canada, Galuščák, Hlaváč and Jakubík (2014) for the Czech Republic and Bilston and Rodgers (2013) and Bilston, Johnson and Read (2015) for Australia.

The authors believe that the present paper is the first attempt to test the financial soundness of the Mongolian household sector using the micro-simulation model, a popular tool for stress testing the household sector and assessing financial stability risks resulting from the household indebtedness. Accordingly, it contributes towards the development of a comprehensive stress-testing framework for the banking system even in a data-limited environment.

The remainder of the paper is structured as follows. In section II, the household and financial sector nexus in Mongolia are presented. Section III includes a description of the stress-testing model and section IV is centred on a discussion of the pre-stress and post-stress test results. Section V concludes.

II. HOUSEHOLD AND FINANCIAL SECTOR LINKAGES IN MONGOLIA

Mongolia has an extensive amount of mineral resource wealth, which includes, among other minerals, coal, copper, and gold. Real gross domestic product (GDP) growth in Mongolia averaged 9 per cent annually over the period 2006-2015 supported by a large stock of resources and a large amount of foreign direct investment (FDI) inflows to the mining sector. Mongolia has 10 per cent of the world's known coal reserves; the Tavan Tolgoi coal mine is one of the world's largest untapped coking and thermal coal deposits. In 2009, the Government established a joint venture with Turquoise Hill Resources (a majority owned subsidiary of Rio Tinto) to develop the Oyu Tolgoi copper and gold deposit, which is the largest foreign-investment project ever in Mongolia and has attracted more than \$6 billion (50 per cent of GDP) in FDI for the first phase of the project. As a result, in 2015 Mongolia

graduated from lower-middle-income status to upper-middle-income, a group with yearly income levels of \$4,126 to \$12,735 per person (World Bank, 2015). The mining sector accounts for 20 per cent of the economy, and mineral exports account for up to 90 per cent of total exports. As a result of the country's narrow economic base, it is highly vulnerable to external shocks, namely commodity price fluctuations and volatility in FDI, and the lack of diversification has made the economy prone to repeated boom-bust cycles.

Mongolian financial system is dominated by commercial banks. Currently, 14 registered commercial banks account for 96 per cent of the total financial system assets. The ratio of total bank loans to GDP is 52 per cent. Hence banks play a vital role in the creation of money supply and in the transmission of monetary policy. Banking sector lending is concentrated (in mining, construction, trading, and household sectors) as there are few investment opportunities available domestically. In recent years, the household sector's indebtedness has sharply increased, and the bank household loans have accounted for 45 per cent of the total bank loans. As a result, the ratio of bank household loans to GDP reached 24 per cent in 2016. Mortgage loans account for more than one third of total bank household loans. Under the current regulation set by the Bank of Mongolia, the maximum loan to value ratio is 70 per cent, and maximum debt to income ratio is 45 per cent for household mortgage loans.

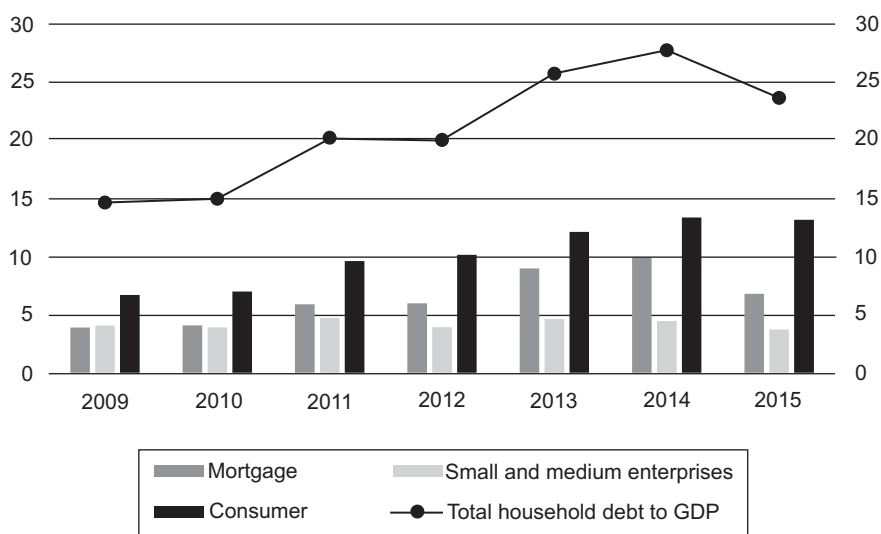
The Mongolian household sector's aggregate level of indebtedness has increased from 14 per cent to 25 per cent of GDP between 2009 and 2015. The ratio of household financial debt to disposable income has risen significantly, reaching as high as 28.2 per cent in 2014. This is close to the average of new European Union member countries and higher than the average of middle-income countries among the members of the Commonwealth of Independent States (Tiongson and others, 2010). In addition, more than one third of the Mongolian household debt consists of mortgage loans. The ratio of mortgage loan outstanding to GDP ratio peaked at 10.1 per cent in 2014, rising from 4.4 per cent in 2009.

As a result of the FDI flows for the first phase development of the Oyu Tolgoi project and high commodity prices, loan growth was rapid between 2011 and 2012. During that period, central bank policy was not tight enough to control the growth of loans. Since capital flows are free and the central bank does not use macroprudential tools, a rise in the policy rate to tighten monetary policy brought in short-term investments, such as government debt securities and non-resident deposits, which, in turn, led to higher growth of loans. Due to favourable economic condition, namely rising wages, housing price appreciation and excess liquidity in the banking sector, during that period, household credit rapidly increased, which resulted in an increase in

the share of household loans in total loans of the banking sector (reaching 45 per cent).

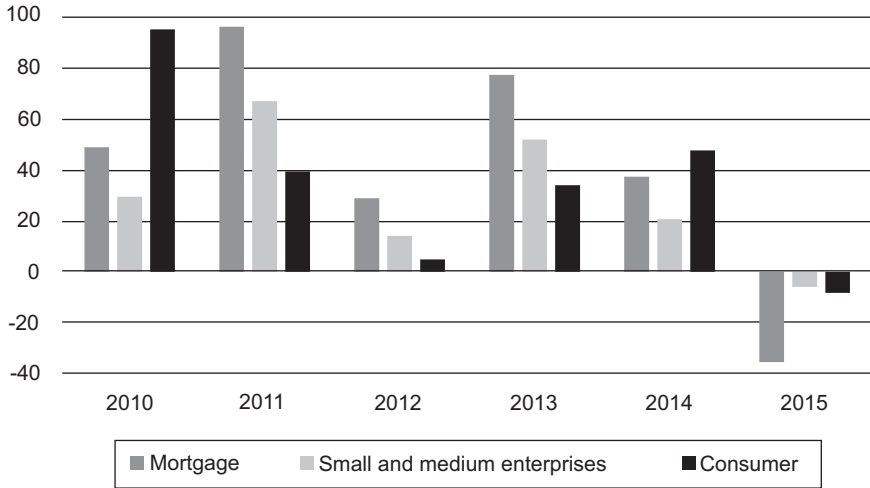
The year 2013 is of particular significance, as household mortgage loans increased substantially following the introduction of a subsidized “mortgage programme” by the Government. As a result of the programme to establish sustainable mortgage financing, the outstanding level of households’ mortgage debt has tripled to 3.4 trillion Mongolian tögrög (\$1.39 billion), approximately half of the total household loans. Mongolia has also experienced a boom-bust cycle in the housing market. The annual growth of housing prices was 24 per cent in 2014, and since June 2014 the housing prices have dropped by about 30 per cent. Figure 1 shows household debt, proxied by banks’ loan to households, to GDP ratio.

Figure 1. Household debt to gross domestic product ratio, by different types of loans



Sources: Bank of Mongolia, Reports on individual and SME loans issued by banks, 2010-2015. Available from www.mongolbank.mn/eng/dbliststatistic.aspx?id=02; and National Statistical Office of Mongolia, *Statistical Yearbook*, 2010-2015. Available from www.1212.mn/BookLibrary.aspx?category=00.

As a result of the programme, the household mortgage grew more rapidly than any other type of loan between 2010 and 2014 (figure 2), and the average growth rate of household debt surpassed GDP growth during the period. However, growth rates of bank household loans were negative in 2015 because (a) as a part of the mortgage

Figure 2. Household debt (year-on-year per cent change)

Source: Bank of Mongolia, Reports on individual and SME loans issued by banks, 2010-2015. Available from www.mongolbank.mn/eng/dbliststatistic.aspx?id=02.

programme, banks issued and sold their mortgage-backed securities to the Mongolian Iptek Corporation, which reduced mortgage loans on banks' balance sheet,¹ and (b) banks' non-performing loans started to increase significantly because of an economic recession driven by both domestic and external factors. The main external shocks were falling commodity prices and the sudden halt of FDI once the first phase of Oyu Tolgoi copper and gold mining was completed. Government stimulus policies, namely expansionary fiscal and monetary policies based on external borrowings, in response to the adverse external shocks, led to macroeconomic and financial instabilities, including a decline in foreign reserves, high level of government debt and deterioration of banks' asset quality. In particular, household consumption growth has been deteriorating since 2015 because (a) real income of households is declining and (b) households that borrowed from banks limit their consumption as they are obliged to make interest payments. In response to the economic recession, banks also have tightened their overall credit conditions, which have resulted in negative growth of small and medium enterprises and consumer loans.

¹ It should be noted that total amount of household debt/loans has not changed because of the issuance of mortgage-backed securities, and only mortgage loans at banks' balance sheet is reduced by the amount of the mortgage-backed securities. The mortgage-backed securities issuance process began in 2015. Under the programme, Mongolian Iptek Corporation must purchase the mortgage-backed securities from banks.

With the problems becoming noticeable in 2015, the rapid increases in household indebtedness raises concerns of mortgage loan risk and financial instability. Before setting the necessary policies, policymakers need to understand the depth of the household indebtedness problem, which entails conducting a formal assessment on household sector vulnerability to evolving changes in the economy.

III. THE STRESS-TESTING MODEL

The model is based on the financial margin approach employed by Albacete and Fessler (2010), and closely follows models formulated by Bilston and Rodgers (2013) and Bilston, Johnson and Read (2015). In this approach, households with negative financial margins are assumed to default on their debts. Household-level data are used to estimate loss given default and “debt at risk” (or expected loan losses) when combined with information on which households are assumed to default. In the stress testing, shocks to macroeconomic variables, such as asset prices, exchange rates, interest rates and the unemployment rate, are considered. Impacts of those shocks can be estimated by comparing pre- and post-shock default rates and loan losses. The steps of the model are detailed below.

Household-level data

In a preliminary step in developing the model, the household-level data are needed. In the model, data from the Household Socio-Economic Survey for Mongolia – a nationally representative household-based survey, are collected annually by the National Statistical Office since 2008. The surveyed households are randomly selected every year from a specified region. The survey contains information about households and individuals’ characteristics, consumption behaviour, financial condition, employment and well-being. Though the Household Socio-Economic Survey has been collected annually since 2007/08, only Household Socio-Economic Survey data for 2012 and 2014 are used in the analysis (a) because the Mongolian Household Socio-Economic Survey includes some questions, mainly about the household loans and deposits, only for even years, such as 2010, 2012 and 2014, and (b) in order to assess financial resilience of the household sector before and after the implementation of the Government mortgage programme.

The sample sizes are 12,811 and 16,174 households in 2012 and 2014, respectively, from the country’s 21 provinces and Ulaanbaatar. Data on individual characteristics are used to estimate probabilities of unemployment, and the model of unemployment is based on a sample of more than 50,000 individuals (all members of surveyed households, including children under 16 years of age and people above

60 years of age) participated in the survey each year. The descriptive statistics of variables are detailed in table 1.

Table 1. Descriptive statistics

	2012		2014	
	Mean	Standard deviation	Mean	Standard deviation
Household characteristics				
Household size	3.60	1.60	3.50	1.60
Number of children	1.11	1.10	1.12	1.10
Household income and expenditures (in millions of Mongolian tögrög)^a				
Total income	8.99	2.63	11.77	9.89
Out of which: wage	7.28	6.01	9.27	6.83
Remittance	1.31	2.27	2.19	3.99
Basic consumption expenditure	4.22	2.51	5.70	2.85
Out of which: food expenditure	2.48	1.47	3.31	1.67
Debt servicing cost	0.84	2.35	1.27	3.04
Number of observations	12 811		16 174	

Sources: National Statistical Office, Household Socio-Economic Survey 2012 and 2014. Available from www.mongolbank.mn/eng/dbliststatistic.aspx?id=02.

Note: ^aAn exchange rate was \$1 = 1,888.95 Mongolian tögrög in 2014 and \$1 = 1,397.28 Mongolian tögrög in 2012.

The majority of households' income comes from wages. The second largest component is remittances. The basic consumption expenditure is for food, transportation, energy, health and clothing. Share of food expenditures in total basic consumption is 58 per cent, on average. Data used in the present paper (including household income, debt and financial data) are reliable as they are open source, official statistics published by the National Statistical Office and the Bank of Mongolia.

As the Mongolian Household Socio-Economic Survey does not include all the required information, namely household balance sheet items, for building the model, a number of extra assumptions are used to overcome the data limitations. They are discussed in more detail below.

Estimating households' financial margin

The first step is to establish a pre-stress baseline. To this end, the financial margin, FM_i , of a household i is estimated as

$$FM_i = Y_i - BC_i - DS_i - R_i \quad (1)$$

where $Y_i = I_i - T_i$ is the i -th household disposable income, I_i is household total income before tax, T_i is tax amount paid by the household, BC_i is basic consumption expenditure, DS_i is minimum debt servicing cost (if any) and R_i is rental payment (if any). All measures are in annual basis or annualized before estimation. While Y_i and R_i are reported in the Household Socio-Economic Survey, BC_i is not directly available from the survey. In a scenario of financial distress, basic consumption is of greater relevance than actual consumption, as households can reduce discretionary spending to meet their debt obligations.

The basic consumption expenses are approximated by sum of expenses on food ($C_{F,i}$), transportation ($C_{T,i}$), energy ($C_{E,i}$), health ($C_{H,i}$) and clothing ($C_{C,i}$):

$$BC_i = C_{F,i} + C_{T,i} + C_{E,i} + C_{H,i} + C_{C,i} \quad (2)$$

The Household Socio-Economic Survey only contains information about annual payments on existing loans. Accordingly, minimum debt-servicing costs are estimated as:

$$DS_i = PM_i + PC_i + PO_i \quad (3)$$

where PM_i is the annual mortgage payment, PC_i and PO_i are the annual payments on consumer debt, namely the sum of salary loan, pension loan, household consumption loan and herder loan and other debts, namely the sum of business loan, leasing loan, car loan and other loan, respectively.

To estimate household's total debt, households' outstanding loan balances are required. Accordingly, the Household Socio-Economic Survey does not include information about households' outstanding loan balances. Fortunately, the Household Socio-Economic Survey consists of the original loan balance if the loan is taken within the past 12 months. For the loans taken within past 12 months, the end-of-period outstanding loan balances, $J_{12,i}$ are calculated as follows:²

² The calculation is based on the given information, namely monthly payment, interest rate and the original loan balance, and a credit-foncier model, namely a standard financial formula to calculate mortgage payments on amortizing loans.

$$J_{12,i} = \frac{((1+r_J)^{T_{Ji}} - (1+r_J)^0 + 12)}{((1+r_J)^{T_{Ji}} - 1)} J_{0i}, \quad \text{for } J \in \{M, C, O\} \quad (4)$$

where M , P and O , respectively, represent mortgage, consumer and other loans, r_J is the (monthly) interest rate for J -type loan at the period, J_{0i} is original balance for J -type loan of the household, and T_{Ji} is the loan's term (in months) for J -type loan of the household calculated as follows:

$$T_{Ji} = \frac{\ln(pj_i / (pj_i - r_J J_{0i}))}{\ln(1+r_J)} \quad (5)$$

where $pj_i = PJ_i/12$ is the monthly payment for the J -type loan. If T_{Ji} cannot be calculated due to the inconsistency among answers of the household, then the outstanding loan balance of the household is calculated as the loans which are not taken within past 12 months.

For the loans which are not taken within the past 12 months, the end-of-period outstanding loan which is k years old (in months) at the period, $J_{k,i}$, are approximated as follows (if the interest rate remains constant over time):

$$J_{k,i} = \frac{((1+r_J)^{T_{Ji}} - (1+r_J)^{k_J} + 12)}{((1+r_J)^{T_{Ji}} - 1)} J_{0i}^e, \quad \text{for } J \in \{M, C, O\} \quad (6)$$

where T_J is the loan's average term (in months) for the J -type loan, k_J is the average age (in months) of the J -type loan, and J_{0i}^e is the estimated original balance for J -type loan calculated from the monthly mortgage payments using a credit-foncier model as follows:

$$J_{0i}^e = \frac{((1+r_J)^{T_J} - 1)}{r_J(1+r_J)^{T_J}} pj_i \quad (7)$$

If $J_{12,i}$ and $J_{k,i}$ give negative values due to the inconsistency among the answers of the household, the household's original loan balance is used for the outstanding loan balance.

After the outstanding balance for the J -type loan is attained, then each household's total debt, D_i at the period is estimated as

$$D_i = M_{k,i} + C_{0i} + O_{0i} \quad (8)$$

Calculating probabilities of default, exposure at default and loss given default

The percentage of vulnerable households is the key measure to monitor the resilience of households under different shocks. Accordingly, in the second step, the financial margin is used to calculate each household's probability of default (PD_i) as follows:

$$PD_i = \begin{cases} 1 & \text{if } FM_i < 0 \\ 0 & \text{if } FM_i \geq 0 \end{cases} \quad (9)$$

In the model, households with negative financial margins (those not able to cover all their spending from income) are in financial distress and are considered as vulnerable households. It is important to note that only households who are in distress and unable to pay its debts are considered. Given the available data, it is not possible to consider households that are able, but unwilling to service their debt. Issues, such as strategic defaults, are beyond the scope of the present paper. Thus, households with $PD = 1$ are assumed to default with certainty. This is a simplification as some households could sell liquid assets or property to avoid default. A case without such an assumption is discussed and carried out by Ampudia, Vlokhoven and Żochowski and others (2014). This exercise is being left for future studies as there are currently no reliable data on the household liquid asset.

To measure the losses under different stress scenarios, the share of total debt held by vulnerable households along with those households' assets are taken into account. In the third step, the following is calculated, the household sector's weighted average probability of default (WPD), measuring the percentage share of total debt held by vulnerable households and loss given default. WPD is calculated as

$$WPD = \frac{\sum_i^N PD_i D_i}{\sum_i^N D_i} \quad (10)$$

where N is the total number of households.

The weighted average loss given default as a percentage of household debt in default (LGD) is the amount that lenders are unable to recover on defaulted loans:

$$LGD = \frac{\sum_i^N PD_i L_i}{\sum_i^N PD_i D_i} \quad (11)$$

where $L_i = \max(D_i - W_i, 0)$ is the value that is lost as a result of a household default, and W_i is the value of a household's "eligible" collateral, which is the collateral that lenders would be able to make a claim on in the event of default. In the model it is assumed that eligible collateral consists of real estate, namely apartment and house, only.

In step four, the *WPD* and *LGD* are combined to estimate the weighted average debt at risk as a share of total household debt (*DAR*). In other words, it is the expected loss on household debts in terms of per cent:

$$DAR = WPD \times LGD = \frac{\sum_i^N PD_i L_i}{\sum_i^N D_i} \times 100 \quad (12)$$

Once the pre-stress results are established, macroeconomic shocks are applied separately or in combination to obtain post-stress results. The difference between the pre-stress and post-stress results quantifies the impact of the shock in the model. The process is repeated for 2012 and 2014.

IV. CALIBRATION AND RESULTS

Calibration

A small number of parameters in the model are calibrated based on the statistics of the Mongolian banking sector. As the Household Socio-Economic Survey for 2014 is used, the annual mortgage interest rate is calibrated as 8.0 per cent, which is the fixed rate set in July 2013 under the government programme to establish sustainable mortgage financing. The annual interest rates for consumer (r_c) and other (r_o) loans are calibrated equally at 19.0 per cent, which is the average lending rate for 2014. The mortgage loan's term, T_M , is calibrated as 16 years (192 months), which is the weighted average term of mortgage loan calculated from the Mortgage Loan Report, the Bank of Mongolia (as of February 2016). That calibration is also consistent with the sample average estimation of the mortgage loan's term, T_{Mi} , calculated from the Household Socio-Economic Survey for 2014. The average age of the mortgage loan, k_M , is calibrated as 3.5 years (42 months), which is an approximation using the mortgage loans outstanding and the starting year of mortgage loan. The loan term for consumer (T_C) and other (T_O) loans are calibrated respectively as 45 months and 50 months, which are the sample average of loan terms, T_{Ci} and T_{Oi} , calculated using the Household Socio-Economic Survey for 2014. The average age for consumer (k_C) and other (k_O) loans are calibrated as nine months, approximated as 25 per cent (3.5/16 for the mortgage loan) of the longest term for consumer and business loans (36 months).

Pre-stress results

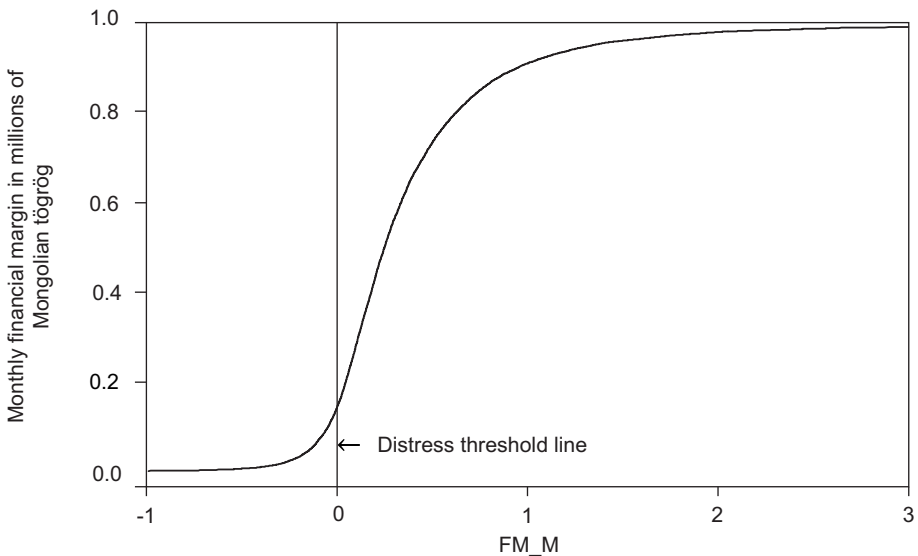
Prior to applying shocks, the pre-stress results are reviewed and compared with those of other studies. The models used in pre-stress and post-stress scenarios are programmed in Stata software.

Financial margins

A cumulative distribution function of the household's financial margin is shown in figure 3. Households with a financial margin within the range of [-0.5, 0.5] million of Mongolian tögrög per month account for about 80 per cent of total households.

According to the model, the share of households with negative financial margins, namely below the threshold line, was 14.4 per cent in 2014. The result is similar to that of other countries. For instance, Herrala and Kauko (2007) estimate 13-19 per cent for Finland; Burke, Stone and Ralston (2011) at least 14 per cent for Australia; Andersen and others (2008) 19 per cent for Norway; and Albacete and Fessler (2010) 9.2-16.5 per cent for Austria. It should be noted, however, that the estimate is sensitive to the definition of basic consumption expenditures.³

Figure 3. Cumulative distribution function of financial margin



Sources: Household Socio-Economic Survey 2014 calculation.

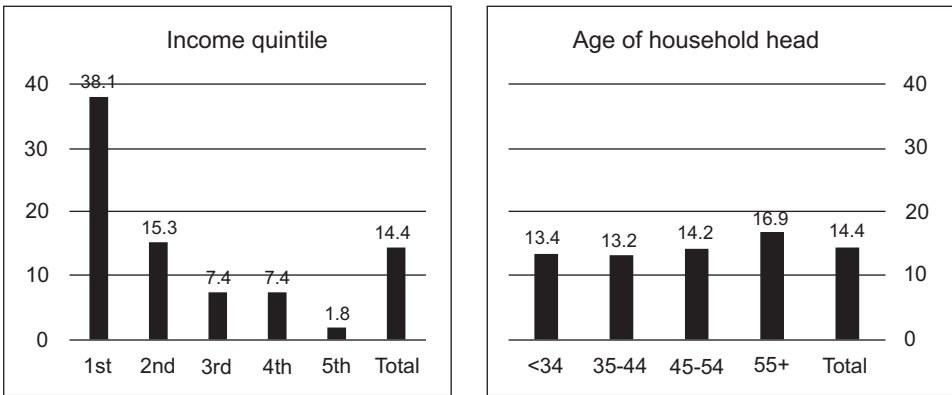
Note: Only includes households with debt. Outliers are excluded.

³ When the clothing expenditure, similar to some other studies, is excluded, this share declines to 8.3 per cent. In this study, clothing expenditures is included.

As noted in the literature, low-income households are more likely to have negative financial margins than higher-income households. In contrast to other countries, households with older heads are more likely to have negative financial margins than households with younger heads (figure 4). This may imply that younger households in Mongolia have less ability or appetite to borrow compared to other countries (Austria and Australia).

Figure 4. Pre-stress: household with negative financial margin

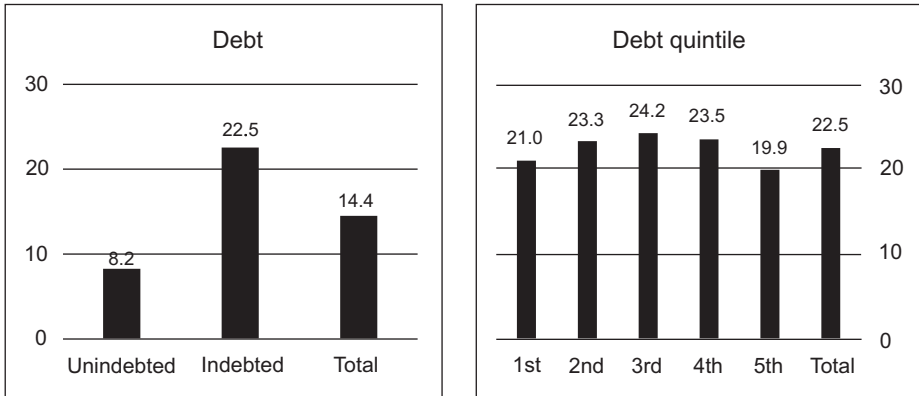
Share of households by characteristics



Source: Household Socio-Economic Survey 2014; authors' calculation.

Indebted households are more likely to have negative financial margins than those who are not. Interestingly, for the first three debt quantiles, the share of households with a negative financial margin tends to increase as debt increases. The share decreases for the highest two debt quintiles (figure 5). In addition, regardless of the debt quintile, the share of indebted households is considerably higher than that of the whole households. These results suggest that the probability of having negative financial margins is particularly high for households with debts. Moreover, this finding may indicate that loan applications assessment is less effective as lenders are able to predict whether potential borrowers would be able to pay back the loan comfortably given their income and other expenses.

It should be noted that households with negative financial margins in the model would not necessarily default in reality as households often have assets that they can draw; therefore, they may be in a sound financial position instead of having a negative financial margin. For example, 30 per cent of households with negative financial margins have assets – defined here as real estate – to avoid default.

Figure 5. Pre-stress: households with negative financial margins*Share of households by characteristic*

Sources: Household Socio-Economic Survey 2014; authors' calculation.

Debt at risk

As discussed in equations (11) and (12), debt at risk depends on the collateral that is assumed to be recoverable by the lender in the event of default. In the present paper it is assumed that this collateral consists of real estate only. According to the model, pre-stress debt at risk was 7.2 per cent in 2014. This estimate is quite high compared to those for other countries where similar studies were conducted. For example, Bilston, Johnson and Read (2015) estimated debt at risk to be 1.5 per cent in 2010 for Australia, while for Austria the debt at risk is estimated to be 2.1-4.1 per cent by Albacete and Fessler (2010). Accordingly, lenders' exposure to households with negative financial margins appears significantly large in Mongolia.

The high estimate of debt at risk is also broadly consistent with reality. For example, the interest rate on banks' household loans, excluding mortgage loans, has been high (more than 18 per cent per annum) because of high deposit rate and non-performing loan ratio.

Stress-testing scenarios

To assess the impact of macroeconomic shocks on the financial resilience of households, stress testing is conducted using various types of scenarios. First, the effects of shocks in interest rates, the unemployment rate, cost of basic consumption and housing price are assessed individually. Then, the above shocks are applied in

combination to examine household resilience. In this section, we explain how each of those shocks is operated and household credit risk is assessed under different scenarios in the model.

Increase in interest rate

A household's debt service consists of amortization and interest payments. The interest payments are the part affected by rising interest rates.⁴ The simulation of the interest rate shock (an increase in r_J) is conducted using the following formulas:

For the loans taken within past 12 months:

$$pj_i = \frac{r_J(1+r_J)^{T_{Ji}}}{((1+r_J)^{T_{Ji}} - 1)} J_{0i} \quad \text{for } J \in \{M, C, O\} \quad (13)$$

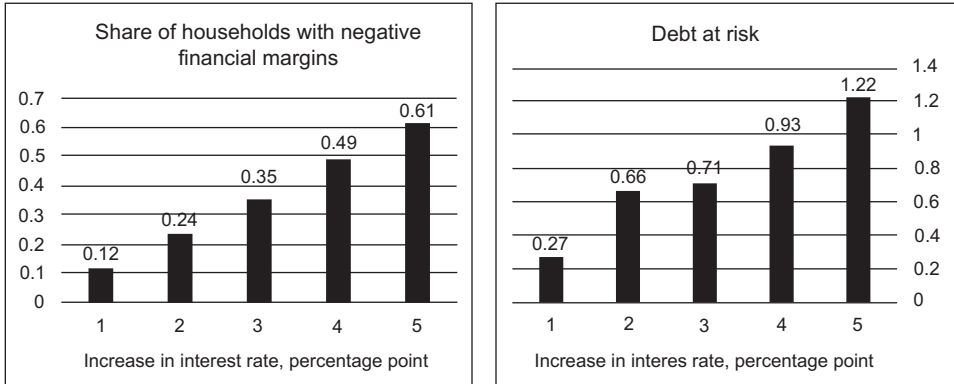
For the loans taken more than 12 months ago:

$$pj_i = \frac{r_J(1+r_J)^{T_J}}{((1+r_J)^{T_J} - 1)} J_{0i}^e \quad (14)$$

Annual payment for the J -type loan is calculated as $PJ_i = 12 \cdot pj_i$. Thus, an increase in the interest rate is a shock to the households' debt service, DS_i , and lowers their financial margins. Interest rate shocks lead to an increase in the share of households with negative financial margins and are assumed to default. The shock is assumed to pass through to all household loans equally. The debt service is increased in line with the rising interest rate shock; it is assumed that the loan (and interest) is still paid according to schedule (without expanding the maturity of the loan).

The result indicates that a one percentage point increase in the interest rate causes the share of households with negative financial margins to increase by 0.12 percentage points and the debt at risk to rise by 0.27 percentage points (figure 6). Changes in debt at risk increase non-linearly, with interest rate shocks depending on the probability of default and collateral value of the defaulted household loans. The debt at risk is relatively more responsive to the change in interest rate from one to two percentage points than further increases.

⁴ In the short term, the shock affects indebted households with variable interest rate loans. In the long run, fixed interest rate loans are also affected by such shock, as interest rates are renegotiated.

Figure 6. Effect of increasing interest rates*Changes relative to pre-stress results, 2014*

Sources: Household Socio-Economic Survey 2014; authors' calculation.

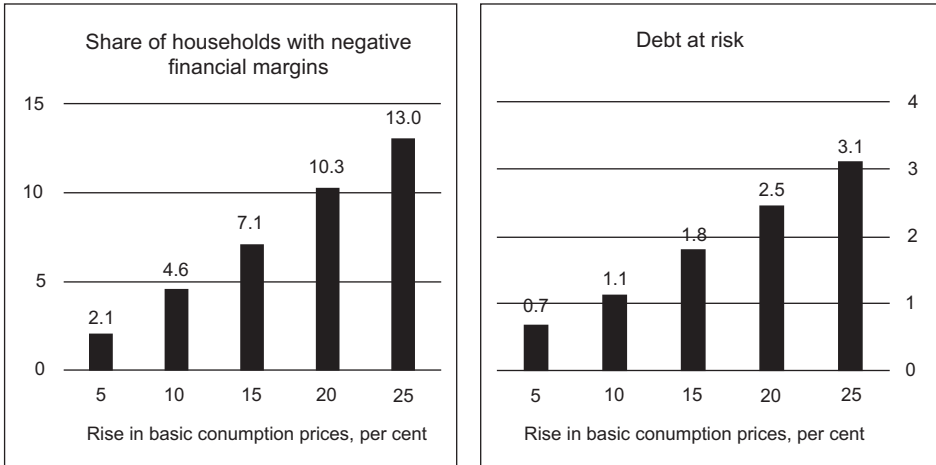
Changes in cost of basic consumption

Changes in prices of the basic consumer goods basket items are shocks to households' spending on basic consumption items, C_j , for $j = F, T, E, H, C$. The demand for basic consumption items are assumed to be price inelastic. Though this assumption is realistic for the essential goods, this is a sort of simplification, as some households could change their basic consumption basket when prices of essential goods change. For this version of the model, the inelasticity assumption is applied, as there are no preliminary studies on the price elasticities of essential goods in the case of Mongolia. It is also important to note that in this version of the model the effect of inflation on the value of nominal assets and liabilities are ignored. Thus, a higher price of the basic consumption item leads to an increase in BC_j , lowering the financial margins of the households.

A 5 per cent rise in prices of all basic consumption items causes the share of households with negative financial margins to increase by 2.1 percentage points and debt at risk to increase by 0.7 percentage points (figure 7). For larger changes in prices, the share of households with negative financial margins rises approximately linearly (increases by 2.5 percentage points for each extra increase of 5 per cent increase in prices), however, the effect on debt at risk is not linear.

Figure 7. Effect of rise in basis consumption prices

Changes relative to pre-stress results, 2014



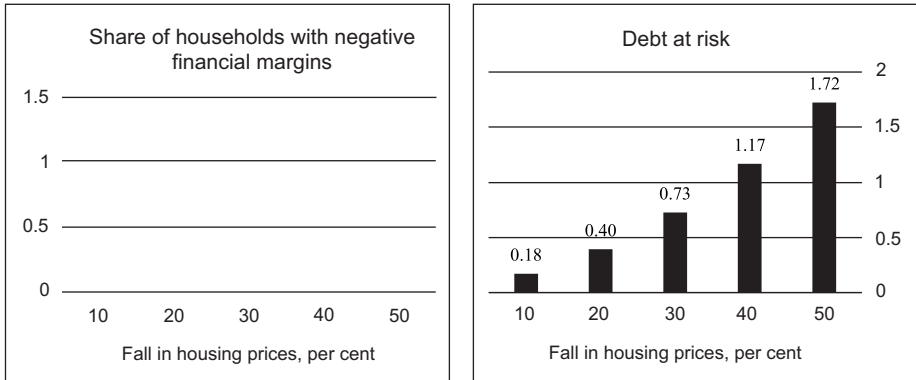
Sources: Household Socio-Economic Survey 2014; authors' calculation.

Changes in housing prices

Changes in housing prices are shocks to households' real estate wealth, W_i . For instance, falling housing prices increases LGD , however, there is no impact on the share of households with negative financial margins. It is assumed that a given asset price shock applies to all households equally and that mortgagers are the most affected by this shock. A 30 per cent fall in housing prices causes debt at risk to increase by 0.73 percentage points. The impact is relatively small compared to other countries (Australia, Austria and Croatia) as the initial debt at risk is already too high in Mongolia, which can be partially explained by the possibility that banks may already consider such shock in setting terms for their loans. However, a significant drop in housing price leads to even higher debt at risk, suggesting non-linearity.

Rising unemployment

There is a shock to the household's income Y_i , when an employed household member loses his or her job. For instance, rising unemployment reduces the income of individuals to an estimate of the unemployment benefits, thus lowers the financial margins of the affected households.

Figure 8. Effect of fall in housing prices*Changes relative to pre-stress results, 2014*

Sources: Household Socio-Economic Survey 2014; authors' calculation.

For the purpose of identifying unemployment shock, the adults in the survey are divided into three categories by economic activity: employed, unemployed and economically inactive. People outside the labour market, such as students, women on maternity leave and people suffering from a long-term sickness, are assumed to remain economically inactive over the time period considered. Thus, those individuals are not included in the sample for the simulation analysis.

Various approaches have been used to simulate unemployment shocks in the literature. Albacete and Fessler (2010) allow only homeowners (other persons in the same household do not enter in the analysis) to enter unemployment, where the probability that each homeowner becomes unemployed is estimated using a logit model. Fuenzalida and Ruiz-Tagle (2009) consider individuals to become unemployed with probabilities estimated using survival analysis. Bilston, Johnson and Read (2015) use a logit model to estimate the probability of unemployment for each individual. However, Holló and Papp (2007) and Sveriges Riksbank (2009) use the assumption that each individual has an equal probability of becoming unemployed.

Following Bilston, Johnson and Read (2015), a logit model is used to estimate the probability of individuals becoming unemployed. As not every employed person in an economy has the same probability of becoming unemployed, the probability of becoming unemployed for each employed individual in the sample must be defined. The following logit model is estimated to get probabilities of unemployment for all individuals, pu_j :

$$pU_j = Pr(U_j = 1 | \mathbf{x}_j \boldsymbol{\beta}) = F(\mathbf{x}_j \boldsymbol{\beta}) = \frac{1}{1 + e^{-\mathbf{x}_j \boldsymbol{\beta}}} \quad (15)$$

where U_j is an indicator variable equal to one if individual j is unemployed and equal to zero otherwise, \mathbf{x}_j is a vector of independent variables, including age, age squared, gender, educational attainment (completed high school, diploma and university), family structure (number of children, number of adults), household income, marital status, long-term health condition, and history of unemployment for at least one year, $\boldsymbol{\beta}$ is a vector of coefficients, and $F(\cdot)$ is the cumulative distribution function of the logistic distribution. To select the independent variables, a general-to-specific modelling approach is used, removing insignificant variables to arrive at a parsimonious model. The results are shown in table 2.

All remaining variables are significant, or for categorical variables, jointly significant at the 5 per cent level. In general, the signs of each marginal effect are in line with expectations. Characteristics, such as being male, not married, not in poor health condition, less educated, younger than 45, a member of large household, living in ger, being in an aimag centre, and or living in the eastern region increase the probability of being unemployed. Furthermore, married men are more likely to be unemployed compared to married women. A man with bachelor's degree or is older than 45 is more likely to be unemployed compared to women with the same characteristics.

Examining the size of each marginal effect gives the possibility of which variables have the greatest power of predicting unemployment. A baseline case, in which all categorical and dummy variables are set to the sample mode and continuous variables to the sample mean, shows that many variables in the regression have a sizeable effect on unemployment. For instance, under the baseline case an individual who lives in an aimag centre has 1.5 to 2.4 percentage points greater probability of being unemployed, compared to its counterpart. Conversely, a master's or PhD degree education reduces such probability by 10.4 percentage points.

Using the logit model, the probability of individuals becoming unemployed is estimated. This means that unemployment shocks in the model will most likely affect individuals with characteristics that have historically been associated with a greater likelihood of being unemployed. The unemployment probabilities are used to yield unemployment rate shocks. The constant of the model is increased until the rate of unemployment matches the required level. The simulation of changes in unemployment assumes transitions from employment to unemployment and vice versa.

Table 2. Logit model – unemployment*Individuals in the labour force*

Variable	Marginal effects at sample mean		
	Persons	Men	Women
Man	-0.126***		
Married	-0.211***	-0.085***	0.034***
Health condition	0.068***	0.074**	0.065*
Educational attainment			
Completed year 10/12	0.089***	0.067***	0.12***
Diploma/certificate	0.014**	0.024***	0.007
Bachelor's	-0.003	0.026**	-0.022*
Master's and PhD degrees	-0.104***	-0.078***	-0.140***
Demographic characteristics			
Age	-0.049***	-0.036***	-0.063***
Age squared	0.0007***	0.0005***	0.0009***
Age 21-24	0.062***	0.022*	0.118***
Age 25-34	0.077***	0.040**	0.122***
Age 35-44	0.028	0.058***	0.004
Age 45-54	-0.027**	0.003	-0.070***
Family structure			
Household size	0.018***	0.010***	0.027***
Single with dependent Children (or member)	-0.024**	-0.017	-0.006
Housing type			
Ger	0.010***	0.004	0.018**
Apartment	-0.031***	-0.025***	-0.037***
Administrative units			
Ulaanbaatar	0.012*	-0.026***	0.056***
Aimag centre	0.019***	0.015**	0.024***
Rural	-0.143***	-0.098***	-0.197***
Geographical regions			
Western	-0.025***	-0.016**	-0.034***
Highlands	-0.026***	-0.018***	-0.033***
Eastern	0.004	0.014*	-0.009
Predicted probability at means	0.16	0.11	0.22
Pseudo- R^2	0.12	0.12	0.11
Number of observations ^a	28 895	14 466	14 429
Kog-likelihood	-12 609.1	-5 142.8	-7 315.6

Sources: Household Socio-Economic Survey 2014; authors' calculation.

Notes: *, **, *** denote significance at the 10, 5 and 1 per cent levels, respectively, for the test of underlying coefficient being zero. Marginal effects calculated for dummy variables as a discrete change from 0 to 1 and for continuous variables as a one unit change.

^a Total number of observations in the estimated model is 28,895, which is the number of all adults who are eligible to work, meaning that people outside the labour market, such as students, women on maternity leave and people with long-term sickness, are not included in the sample.

After a probability of unemployment is assigned to each individual (pu_j), a random real number, $\eta_j \in [0; 1]$ for each single individual⁵ is drawn from a uniform distribution. If $pu_j \geq \eta_j$, the individual is selected as unemployed. In the case of becoming unemployed, it assumed that the individual's income is replaced by unemployment benefit while the income of other household members remain constant. Under the Mongolian law on distributing unemployment benefits from social insurance fund, the amount of unemployment benefit is determined by previous work income and years of employment. For instance, the amount of unemployment benefit is 45 per cent, 50 per cent, 60 per cent and 70 per cent of the monthly salary for the person who has worked for less than 5 years, 5-10 years, 10-15 years, and more than 15 years, respectively. The unemployment shock changes the household total income before tax, $I_{ub,i}$. However, we need the household disposable income, $Y_{ub,i}$ after the shock and it cannot be assumed that the tax amount paid by the household is the same, as the tax amount changes following the income levels. Thus, $Y_{ub,i}$ is estimated as

$$Y_{ub,i} = ETR_i I_{ub,i} \quad (16)$$

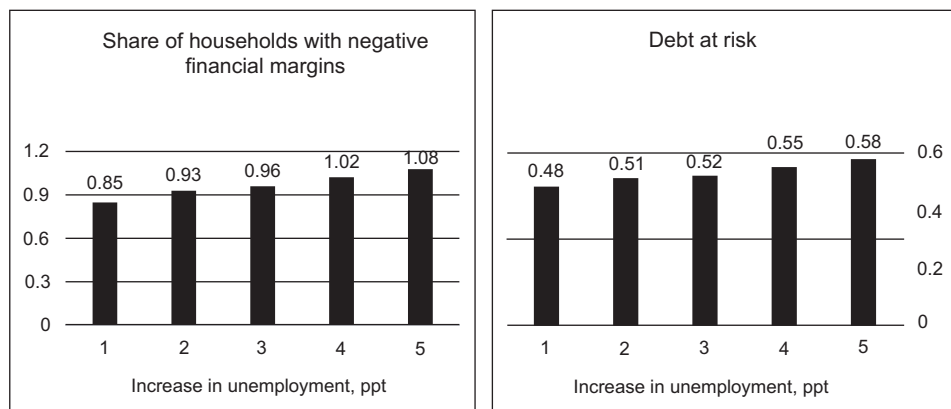
where $ETR_i = T_i/I_i$ is the effective tax rate. These steps are repeated 1,000 times using Monte Carlo simulation. Each time the vulnerability indicators is calculated and finally the mean of each indicator is taken over all simulated draws.

Base rate of unemployment for the simulation is 16 per cent, which is the predicted probability from the estimated logit model at means. A one percentage point increment in unemployment rate (from 16 per cent to 17 per cent) increases the share of households with negative financial margins by 0.85 percentage points, and a five percentage points shock in unemployment increases the share by 1.08 percentage points (figure 9). The impact of a one percentage point increase in unemployment rate on debt at risk is 0.48 percentage points. The marginal impacts of a change in unemployment on the share of households with negative financial margins and debt at risk are relatively small compared to other shocks.

Combined scenarios

This section contains a discussion of the findings to examine households' resilience under two scenarios, labelled "historical" and "hypothetical". The magnitudes of the shocks under each of the scenarios are shown in table 3.

⁵ The draws from the [0,1] uniform distribution for each single individual are not same for all the simulated levels of unemployment in order to ensure the randomized simulation.

Figure 9. Effect of rising unemployment*Changes relative to pre-stress results, 2014*

Sources: Household Socio-Economic Survey 2014; authors' calculation.

Table 3. "Historical" and "hypothetical" Scenarios

	Historical	Hypothetical
Change in housing prices (per cent)	-11.5 (2014-2015)	-20.0
Change in interest rate (percentage points)	2.25 (2009-2011)	4.0
Change in basic consumption prices (per cent)	11.6 (2009-2011)	10.0

The "historical" scenario is designed to replicate the changes in macroeconomic conditions that occurred in Mongolia during the 2009-2011 economic recession, except for the fall in housing prices. This scenario includes a significant rise in inflation, a decrease in housing prices and an increase in short-term interest rates. The "hypothetical" scenario is much more severe than the historical scenario and calibrated by taking recent macroeconomic changes into account.

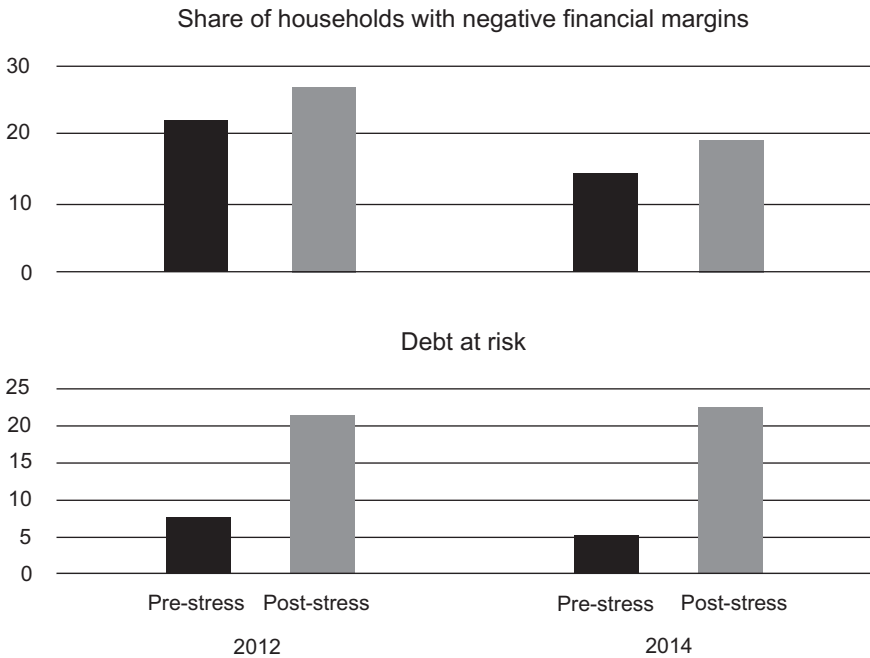
Under the historical scenario, share of households with negative financial margins increased by 4.79 and 4.80 percentage points in 2012 and 2014 relative to the pre-stress baseline, respectively (figure 10). Compared to other countries, Australia in this case, the historical scenario leads to a significantly greater share of households with negative financial margins. This is mainly the result of higher interest rate, as the monetary policy was tightened in response to the rapid exchange rate

depreciation during the economic recession (or to the high inflation before the recession). In other countries, interest rates declined as the exchange rate risk is managed using hedging instruments, and there is room for expansionary monetary policy to offset the effects of other shocks on household loan losses by reducing debt-servicing costs. In terms of debt at risk, increase in the share of households with debt at risk is greater, as all the shocks work to that decrease households' financial margins. The effect of macroeconomic shocks on debt at risk appears to have increased over the period between 2012-2014.

The rise in the share of households with negative financial margins is the largest for less indebted and/or low-income households.

Under the "hypothetical" scenario, the share of households with negative financial margins rose by about five percentage points each year, to a total of 27.1 per cent in 2012 and 19.5 per cent in 2014. At the end of 2014, debt at risk is expected to reach 25 per cent if the hypothetical shocks occur simultaneously (figure 12).

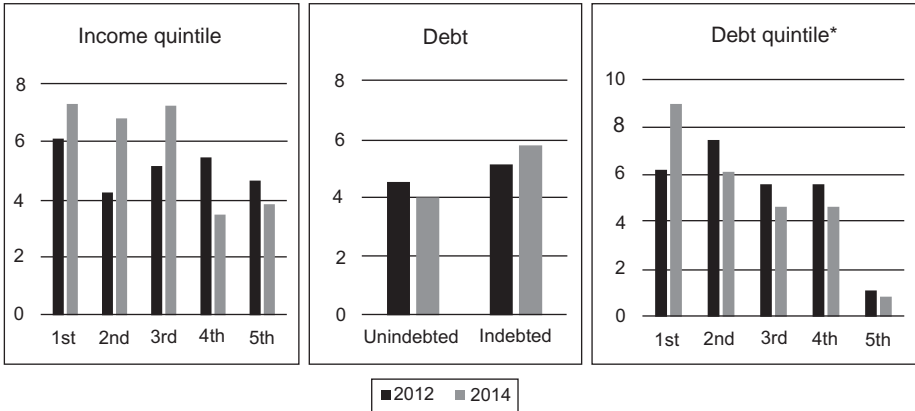
Figure 10. "Historical" scenario



Sources: Household Socio-Economic Survey 2012 and 2014; authors' calculation.

Figure 11. “Historical” scenario: share of households with negative financial margins

Change relative to pre-stress

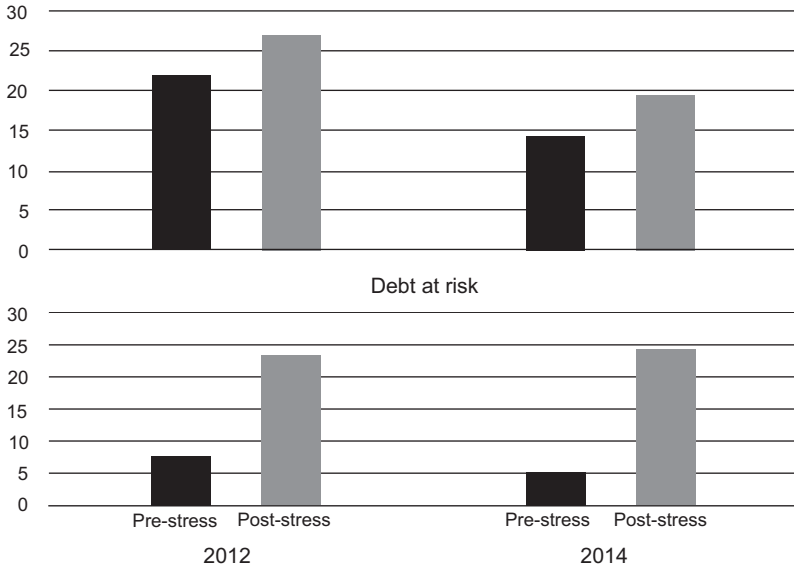


Source: Authors' calculation.

Note: * Indebted households only.

Figure 12. “Hypothetical” scenario

Share of households with negative financial margins



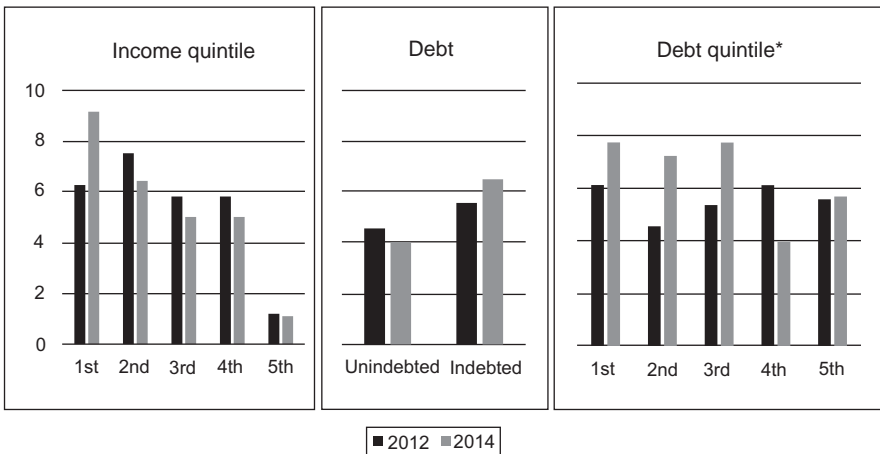
Source: Authors' calculation.

The rise in the share of households with negative financial margins is greatest for the most indebted households (figure 13). The indebted households were severely affected by the shocks in 2014 compared to 2012.

Under the “hypothetical” scenario, the share of households with negative financial margins increased each year. Households with herder and pension loans were the most vulnerable groups to financial risk compared to other groups. The share of mortgagers with negative financial margins declined from 2012 to 2014 as the annual mortgage interest rate fell to 8 per cent (figure 14). The results from the hypothetical scenario suggest that the household sector had been extremely vulnerable to macroeconomic shocks. In particular, the households who held the bulk of the debt tended to face debt-servicing problems in times of macroeconomic shocks.

Figure 13. “Hypothetical” scenario: share of households with negative financial margins

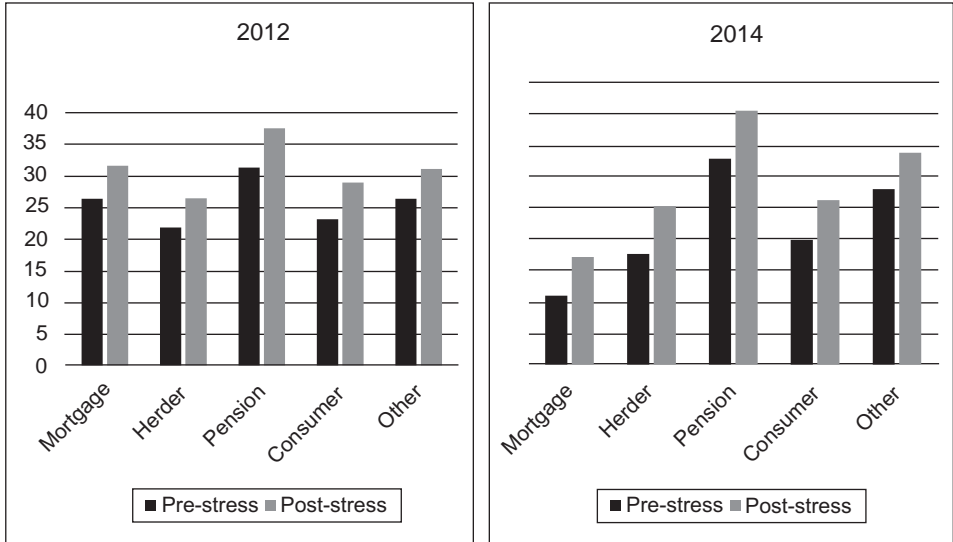
Change relative to pre-stress



Sources: Household Socio-Economic Survey, 2012 and 2014; authors' calculation.

Note: * Indebted households only.

Figure 14. “Hypothetical” scenario: share of households with negative financial margins (by type of loans)



Sources: Household Socio-Economic Survey, 2012 and 2014; authors' calculation.

V. CONCLUSION

The indebtedness of the Mongolian household sector has increased substantially in recent years. The sharp increase in household debt has raised concerns about the sustainability of this debt and possible risks for the banking sector. For the present paper, a simulation-based model for stress testing the household sector in Mongolia was developed, and the resilience of the household sector using micro data from Household Socio-Economic Survey and the simulation model was analysed. This paper also provides a useful starting point for developing a more holistic stress-testing framework for the Mongolian banking system.

Results shown in the paper have yielded significant insights about financial fragility of indebted households in Mongolia. Lenders' exposure to households with negative financial margins appears to be large in Mongolia despite a declining share of households with negative financial margins over the 2012-2014 period. For instance, pre-stress debt at risk is 7.2 per cent in 2014, which is quite high compared to other countries (Australia, Austria and Croatia). The shares of households with negative financial margin declined from 22.1 per cent in 2012 to 14.4 per cent in 2014. Indebted households are more likely to have negative financial margins than those

who are not. Households with older heads are more likely to have negative financial margins than households with younger heads. Shocks to interest rate and costs of basic consumption have harmful effects on financial wellness of households. A 5 per cent rise in prices of all basic consumption goods leads to a 0.7 percentage point increase in debt at risk, while a 5 percentage point increase in interest rate causes debt at risk to rise by 1.22 percentage points. Under both the “historical” and “hypothetical” scenarios, effect of macroeconomic shocks on debt at risk appears to be amplified over the 2012-2014 period. This suggests that a substantial increase in aggregate household indebtedness has led to the financial fragility of the household sector.

These results have important policy implications in mitigating the increasing financial fragility of the household sector and risks to financial stability. The increase in the financial fragility of the household sector adds risks to the banking sector, which is already experiencing high non-performing loans driven by the economic recession. The Government should consider a combination of ensuring sound institutions, regulations, and policies to avoid risks of financial instability associated with rising household debt. As indebted households are financially more vulnerable to adverse shocks, such as inflation or interest rate increases, macroeconomic policy authorities should focus on keeping inflation low, stable and predictable, which would provide an environment that is more favourable to low bank lending rates, job creation and real household income growth. In addition, better financial regulation and supervision, rising household income and lower income inequality would mitigate the impact of rising household debt on risks to financial stability. A response to mitigate financial risks in the household sector may rely on macroprudential tools that target credit demand, such as restrictions on debt-to-income ratio, loan-to-value ratio and risk weight in loan classification. The policy response lowers the financial and economic risks related to household over-indebtedness, but may also lead to a rise in lending rates and a contraction in supply for household loans, which in turn may increase non-performing household loans in the short term. Accordingly, policymakers should carefully weigh the benefits and adverse consequences of alternative measures before taking actions. In addition, policymakers may consider focusing on preventive and alleviative measures, including financial education and debt advisory services, namely improving communication on financial literacy and debt management strategies. Households should take on debts that are necessary and that they can pay back.

As with all stress-testing models, the one used in this paper has some limitations that are critical to its interpretation. First, the existing household survey in Mongolia may not adequately identify households with negative financial margins as households may tend to understate their debt and income. In addition, higher-income

households who possibly hold higher debts are less likely to be included in the survey, and do not disclose their financial positions. Accordingly, to build up the database for this type of modelling, it is more constructive to add new questions about household balance sheets and financial statements to the existing Household Socio-Economic Survey questionnaire. Second, as emphasized in many other papers, such as Bilston, Johnson and Read (2015), the predictive ability of household microsimulation has not been adequately tested. Thus, the stress-testing results should be frequently updated and compared with actual changes in the banking sector equity. Third, the one-period nature of the model may not be realistic in the real world as the assumptions leads to a strong and instantaneous response of loan losses to macroeconomics shocks, namely “jump to default” in a single period because of negative financial margin. In reality, the economic downturn involving a multi-period of shocks leads to loan losses that would be spread over time. The model can be further extended to relax assumptions about the probability of default and include a multiple-period nature, which could potentially improve the model fit. Finally, the model needs to be further developed to assess the effect of exchange rate risk on household debt repayment as the share of foreign currency loans is relatively high in Mongolia.

REFERENCES

- Albacete, Nicolas, and Pirmin Fessler (2010). Stress testing Austrian households. *Financial Stability Report*, No. 19, pp. 72-91.
- Ampudia, Miguel, Has van Vlokhoven, and Dawid Żochowski (2014). Financial fragility of Euro area households. Working Paper Series, No. 1737. Frankfurt: European Central Bank.
- Andersen, Henrik, and others (2008). A suite-of-models approach to stress-testing financial stability. Staff Memo, No. 2008/2. Oslo: Norges Bank.
- Bilston, Tom, and David Rodgers (2013). A model for stress testing household lending in Australia. *Reserve Bank of Australia Bulletin*, December, pp. 27-38.
- Bilston, Tom, Robert Johnson, and Matthew Read (2015). Stress testing the Australian household sector using the HILDA survey. Research Discussion Paper, No. RDP 2015-01. Sydney: Reserve Bank of Australia.
- Burke, Terry, Michael Stone, and Liss Ralston (2011). The residual income method: a new lens on housing affordability and market behaviour. AHURI Final Report, No. 176. Melbourne: Australian Housing and Urban Research Institute.
- Djoudad, Ramdane (2012). A framework to assess vulnerabilities arising from household indebtedness using microdata. Staff Discussion Paper, 2012-03. Ottawa: Bank of Canada.
- Fuenzalida, Marcelo, and Jaime Ruiz-Tagle (2009). Households' financial vulnerability. Working Papers, No. 540. Santiago: Central Bank of Chile.
- Galušćák, Kamil, Petr Hlaváč, and Petr Jakubík (2014). Stress testing the private household sector using microdata. Working Paper Series, 2. Prague: Czech National Bank.
- Herrala, Risto, and Karlo Kauko (2007). Household loan loss risk in Finland estimations and simulations with micro data. Research Discussion Papers, No. 5. Helsinki: Bank of Finland.
- Holló, Dániel, and Mónika Papp (2007). Assessing household credit risk: evidence from a household survey. Occasional Papers, No. 70. Budapest: Magyar Nemzeti Bank.
- International Monetary Fund (IMF) (2012). *World Economic Outlook: Growth Resuming, Dangers Remain*. Washington, D.C.
- _____ (2017). *Global Financial Stability Report: Is growth at Risk?* Washington, D.C.
- Karasulu, Meral (2008). Stress testing household debt in Korea. IMF Working Paper, No. 08/255. Washington, D.C.: IMF.
- Sveriges Riksbank (2009). Stress test of households' debt servicing ability. *Financial Stability Report*, vol. 1, pp. 51-52. Stockholm.
- Sugawara, Naotaka, and Juan Zaldueño (2011). Stress-testing Croatian household with debt: implications for financial stability. Policy Research Working Paper, No. WPS5906. Washington, D.C.: World Bank.
- Tiongson, Erwin, and others (2010). *The Crisis Hits Home: Stress-testing Households in Europe and Central Asia*. Washington, D.C.: World Bank.
- World Bank (2015). WB say 10 countries move up in income bracket. Press release, 1 July. Available from www.worldbank.org/en/news/press-release/2015/07/01/new-world-bank-update-shows-bangladesh-kenya-myanmar-and-tajikistan-as-middle-income-while-south-sudan-falls-back-to-low-income.

PATHWAYS FOR ADAPTING THE SUSTAINABLE DEVELOPMENT GOALS TO THE NATIONAL CONTEXT: THE CASE OF PAKISTAN

*Jaebeum Cho, Alberto Isgut and Yusuke Tateno**

Because of the ambition, comprehensiveness and complexity of the 17 goals and 169 targets of the 2030 Agenda for Sustainable Development, the implementation of it is very difficult, especially for developing countries such as Pakistan. The present paper introduces an analytical framework based on a subset of the Global SDG Indicators Database to identify an optimal pathway for the implementation of the 2030 Agenda in Pakistan. The analysis suggests that the optimal pathway would enable the country to progress towards higher income levels and human development. It also suggests that the country's national development plan, Vision 2025, is expected to contribute towards achieving inclusive and sustainable development provided that the implementation of it is prioritized and sequenced in an optimal manner.

JEL classification: O10, O21, C60.

Keywords: Sustainable Development Goals, national planning, network analysis, method of reflections.

I. INTRODUCTION

The 2030 Agenda for Sustainable Development, adopted by more than 150 world leaders on 25 September 2015, is an ambitious agenda of unprecedented scope and significance. Its 17 goals and 169 associated targets are aimed at ending poverty and hunger, protecting the planet from degradation, ensuring that all human

* This article was prepared by Jaebeum Cho, Cornell University, Alberto Isgut and Yusuke Tateno, Economic and Social Commission for Asia and the Pacific (ESCAP). Part of the article was written while Jaebeum Cho was working for ESCAP. The view expressed herein are those of the authors and do not necessarily reflect the views of the United Nations. All errors and omissions are the authors' responsibility.

beings can enjoy prosperous and fulfilling lives, and fostering peaceful, just and inclusive societies. Recognizing that countries are characterized by different levels of development and capacities, the agenda states that each government will decide how its aspirational and global targets should be incorporated in their national planning process, policies and strategies. This flexibility, while highly desirable, leads to the question of what is the best way for countries to adapt the 2030 Agenda to their unique circumstances. The objective of the present paper is to provide an answer to this difficult question.

To provide an answer, this paper starts from the premise that the Sustainable Development Goals comprise a complex system. A complex system is in essence a nexus of diverse, multiple and interconnected elements in which the whole is not necessarily equal to the sum of its parts. This view of the Goals – or any other set of relevant global issues for that matter – is not new. At the United Nations Conference on Human Environment, later called the Stockholm Conference, in 1972, the former Prime Minister of India, Indira Gandhi advocated such a view: “The population explosion, poverty; ignorance and disease, the pollution of our surroundings, the stockpiling of nuclear weapons and biological and chemical agents of destruction are all parts of a vicious circle. Each is important and urgent but dealing with them one by one would be wasted effort” (United Nations, 2015). A similar integrated view provided the basis for the 27 Rio Principles agreed at the United Nations Conference on Environment and Development, or the Earth Summit, in 1992, and was reconfirmed for the United Nations Conference on Sustainable Development, commonly known as Rio+20.

The analytical approach for this paper is based on the assumption that all goals and associated targets in the 2030 Agenda are, to a greater or lesser extent, interdependent. For example, eradicating poverty (Sustainable Development Goal 1) and promoting healthy lives (Sustainable Development Goal 3) are closely linked with each other, and cannot be viewed separately as individual targets. Such interdependencies need to be taken into account when considering alternative paths for the implementation of the Goals because achieving one goal will help in achieving other closely linked goals. In addition, the lack of attainment of some goals may create bottlenecks for attaining other goals, and such obstacles need to be considered in national frameworks for the implementation of 2030 Agenda.

To capture such interdependencies and bottlenecks, the present paper conceptualizes the Sustainable Development Goals as a system represented by a network of 75 indicators, selected from the Global SDG Indicators Database, and 170 countries. This system is referred to hereafter as the SDG system. The paper also computes a country-specific measure, termed SDG capacity, which quantifies the

capacity of each country to implement the Goals, and it proposes optimal strategies of implementation of the Goals, including specific recommendations for their prioritization and sequencing, for the case of Pakistan.¹ While the focus of the paper is on the attainment of the Goals in Pakistan, also considered is the attainment of the goals of the Pakistan national development plan, Vision 2025. The analysis used in this paper is complementary to previous work on the interlinkages between the Sustainable Development Goals.²

The rest of the paper is organized as follows. Section II contains a description of the data set employed for the analysis and a review of the degree of attainment of the Sustainable Development Goals in Pakistan. Section III includes a description of the SDG system from the perspective of Pakistan. In section IV, the implementation capacity of Pakistan with regard to the 2030 Agenda is discussed, and in section V optimal pathways for progress in Pakistan are reviewed. Section VI consists of an analysis of the scenarios comparing the optimal implementation of the 2030 Agenda and Vision 2025, and section VII concludes.

II. DATA

The analysis conducted in the present paper uses a subset of the official indicators developed by the Inter-agency and Expert Group on Sustainable Development Goal Indicators and agreed upon at the forty-eighth session of the United Nations Statistical Commission, held in March 2017. The indicators were obtained from the United Nations Global SDG Indicators Database.³ It is important to note that the analysis of the Sustainable Development Goals as a complex system, in particular the interlinkages between countries and indicators, requires as much information of the “system” as possible, in terms of both the number of countries and the number of indicators. However, important gaps remain in the availability of data, especially for developing countries.

In building the data set for the analysis, it is possible to prioritize completeness in the number of indicators at the expense of leaving out a large number of developing countries, or covering as many developing countries as possible but with fewer indicators available for each country. The criteria for the selection of indicators included in the analysis, described below, are aimed at covering the 17 Sustainable

¹ See ESCAP (2016) and Cho, Isgut and Tateno (2016) for an overview of the methods used.

² See, for example, International Council for Science and International Social Science Council (2015) and Le Blanc (2015).

³ The database is available from <https://unstats.un.org/sdgs/indicators/database/> (accessed 8 September 2017).

Development Goals, while still providing a comprehensive coverage of developing countries. In the majority of cases, the observations are for 2014 or later years.

The selection of indicators is based on the following criteria. First, the indicators are categorized as official Sustainable Development Goals indicator series in the Global SDG Indicators Database – supplementary indicator series are excluded.⁴ Second, the indicators are available for at least 50 per cent of the Asia-Pacific countries and at least 50 per cent of the world's countries. Third, the chosen indicators cover the 17 Sustainable Development Goals. Fourth, to ensure that a single target is not overrepresented in the system, not more than two indicator series have been selected for each Sustainable Development Goal target. Fifth, a single observation has been selected for each country, with the latest available being from 2010 onwards. Using those criteria, a total of 75 indicators representing the 17 Goals have been obtained.

For the chosen set of 75 indicators, however, there are still many missing observations for developing countries. To increase the representativeness of the analysis to developing countries, the multiple imputation technique developed by Rubin (1987) is used to impute missing observations.⁵ The use of imputation is limited to countries that have data for more than 75 per cent of the 75 indicators (56 or more). The imputation technique uses information regarding the relationships between the 75 indicators to predict missing values. After the imputation, the number of countries is 170, covering a large number of developing countries.⁶ In the data set, the indicators are normalized between 0 and 100, with higher values representing higher attainment.⁷ See the annex for the final list of indicators and countries included for the analysis.

Based on the list of indicators described above, the Sustainable Development Goal attainment of Pakistan is reviewed to reveal areas of strength and weakness by comparing the country with averages for the world and selected country groups. The attainment for each Goal is calculated as the average of the indicators that represent it.

⁴ Because the analysis requires continuous variables, indicators based on binary or non-scale variables are excluded from the indicator list. In addition, the total number of indicators available for each country in the Global SDG Indicators Database is used as a measure of a country's statistical capability (Sustainable Development Goal target 17.18).

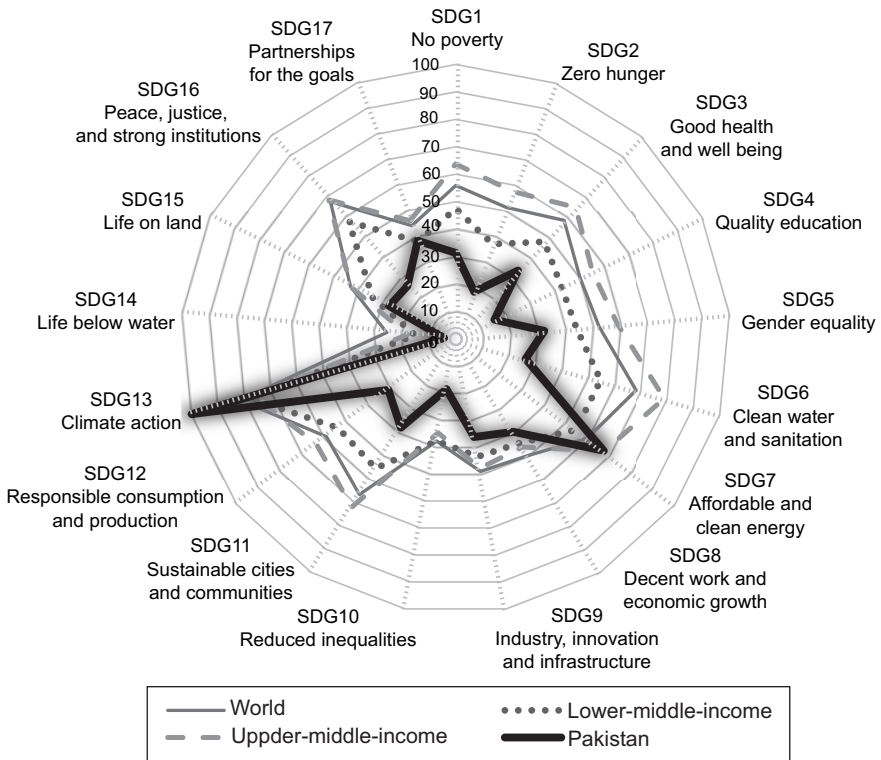
⁵ Without using imputation, the subset of countries with full information for the 75 indicators would provide a biased sample, as it would exclude those with less institutional capacities to collect statistical information.

⁶ Pakistan has data for 68 of the 75 indicators.

⁷ See Cho, Isgut and Tateno (2016) for details.

Figure 1 shows that Pakistan is doing relatively well with regard to Sustainable Development Goal 7 on affordable and clean energy and Sustainable Development Goal 13 on climate action, compared to other lower-middle-income countries, and is on par with the upper-middle-income countries.⁸ Pakistan is on par with the lower-middle-income countries with regard to Sustainable Development Goal 17 on partnerships for the Goals and Sustainable Development Goal 15 on life on land.

Figure 1. Attainment of Pakistan across the Sustainable Development Goals



Source: Authors' calculation.

Note: The figure reports the attainment of Pakistan compared with averages for the world and selected country groups. The scores are normalized between 0 and 100, with higher values representing higher attainment.

⁸ The information on Sustainable Development Goal 13 on climate action is still very incomplete in the Global SDG Indicators Database. The only indicator available for a large number of countries for this goal at the time of writing was people affected by disasters per 1,000 of the population. The latest observation for this indicator for Pakistan was 0.1, which was among the lowest globally.

However, the country is lagging other lower-middle-income countries in, for example, Sustainable Development Goal 2 on zero hunger, Sustainable Development Goal 4 on quality education, Sustainable Development Goal 6 on clean water and sanitation, and Sustainable Development Goal 10 on reduced inequalities.

III. THE SDG SYSTEM FROM THE PERSPECTIVE OF PAKISTAN

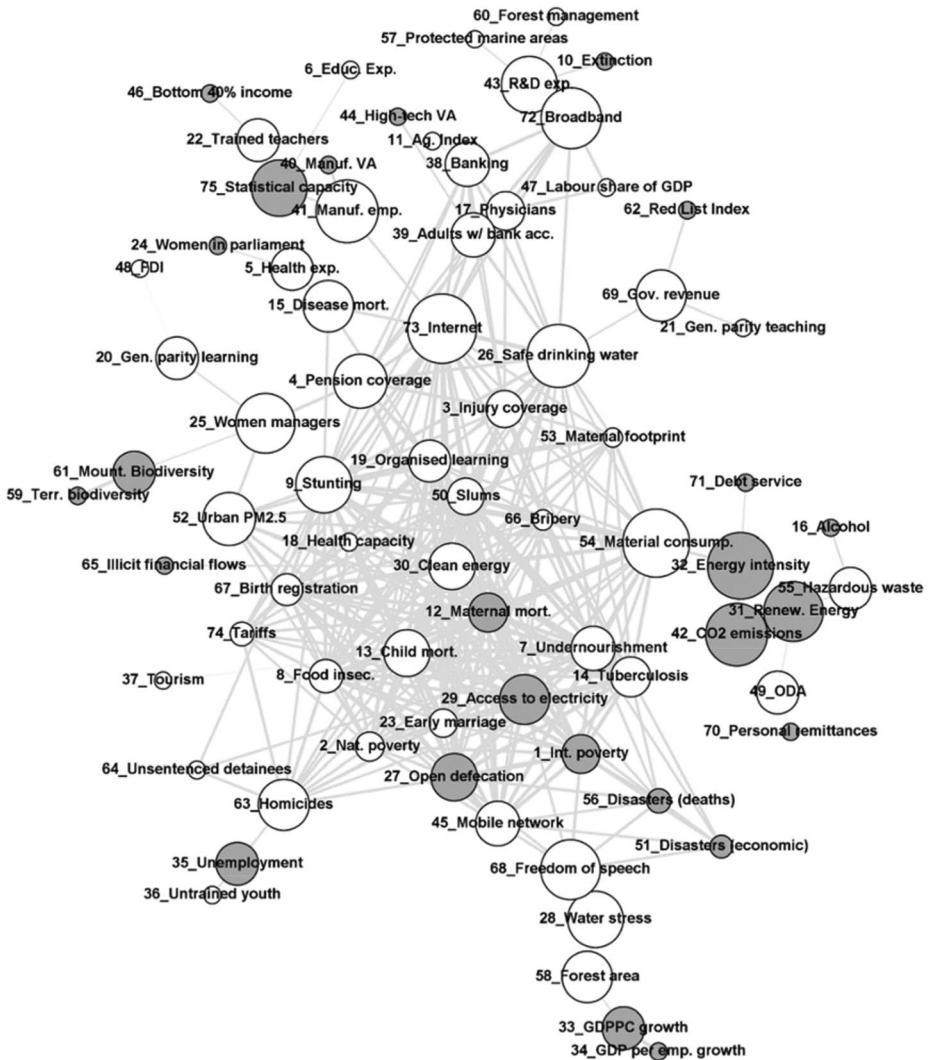
The function of the Sustainable Development Goal indicators described above is to measure the degree of attainment of the Sustainable Development Goal by individual countries. As mentioned in the introduction, the Goals and associated targets in the 2030 Agenda are, to a greater or lesser extent, interdependent, and the same should be the case for the indicators chosen to measure the Goals and targets. The objective of this section is to graph the interdependencies among the 75 available Sustainable Development Goal indicators as a network – the SDG system.

The construction of the network involves the calculation of proximity scores that capture how related one indicator is with another in terms of the levels of attainment. More specifically, for all pairs of Sustainable Development Goal indicators and for the entire sample of 170 countries, the probability of other countries having a higher level of attainment in one indicator conditional on having a higher level of attainment in another indicator is computed for each country. This probability measure is used as a proxy to the proximity, or the relatedness, of one indicator to another within the SDG system, with a higher probability suggesting that the two indicators move closely together. Once the proximity scores are calculated for all pairs of Sustainable Development Goal indicators, the network is constructed using the concept of a “maximum spanning tree”, which consists in connecting all the nodes in the network by the highest probability link for each pair of Sustainable Development Goal indicators.⁹

Figure 2 shows the network of Sustainable Development Goal indicators or SDG system for Pakistan. The light grey nodes represent indicators in which Pakistan is doing better than the average of lower-middle-income countries. The thickness of the lines connecting two nodes represents the proximity of those two indicators. The

⁹ For instance, if indicator A is linked to indicator B with a probability of 0.9 and to indicator C with probability 0.7, only the link between A and B is included in the network. After this step, all other links that represent probabilities greater than 0.85 are added to the tree. Following with the example, if indicator A is linked to indicator D with a probability of 0.87, the link between A and D is also included in the network. For more details on this methodology, see Hidalgo and others (2007).

Figure 2. The SDG system from the perspective of Pakistan



Source: Authors' calculation.

Notes: (a) The dark nodes represent indicators in which Pakistan is doing better than the lower-middle-income country average. (b) The size of the nodes represents their importance as gatekeepers, namely, how important they are as middle links for Pakistan to progress towards better attainment in other indicators. (c) Acronyms used: R&D, research and development; GDP, gross domestic product; GDPPC, GDP per capita; CO2, carbon dioxide; and ODA, official development assistance.

size of the nodes represents the number of shortest paths from all nodes to all others that pass through that node, which can be referred to as “gatekeeper nodes”.¹⁰

It can be seen clearly that the SDG system facing Pakistan has a densely connected core area, representing indicators that are highly related to each other. This area of the network contains mostly social indicators, such as child and maternal mortality, undernourishment, tuberculosis and slums, but it also includes access to electricity and clean energy. In addition, there are several peripheral areas that represent indicators that are less connected to both the core of the system and the other peripheral areas. Representative indicators in some of those peripheral areas include: per capita gross domestic product (GDP) growth, unemployment, biodiversity, women in parliament, statistical capacity, research and development expenditure, government revenue and carbon dioxide (CO₂) emissions.

The figure shows that Pakistan is doing better than the lower-middle-income countries in such indicators as maternal mortality, access to electricity, open defecation, per capita gross domestic product growth, unemployment, biodiversity, statistical capacity and CO₂ emissions. Indicators in which Pakistan is doing worse than lower-middle-income countries include undernourishment, stunting, tuberculosis, child mortality, slums, clean energy, safe drinking water, women managers, government revenue and pension coverage.

IV. THE SUSTAINABLE DEVELOPMENT GOAL IMPLEMENTATION CAPACITY OF PAKISTAN

As mentioned in the introduction, countries are characterized by different levels of capacity to achieve the Sustainable Development Goals. It is important to measure such capacities as they provide an indication of how much progress individual countries can make towards the attainment of the Goals by 2030. The purpose of this section is to explain how the SDG system described in the previous section can be used to measure such capacities in each of the countries included in the analysis.

The capacities of countries to achieve the Sustainable Development Goals can be thought of as building blocks or Lego pieces, with the attainment of a specific Sustainable Development Goal indicator being analogous to a Lego model and a country being analogous to a bucket of Legos (Hidalgo and Hausmann, 2009).

¹⁰ The shortest path between two nodes in a network is the minimum number of nodes that connect those two nodes. The number of shortest paths that pass through a particular node in the network is called its betweenness centrality. In the SDG system, nodes with a high degree of betweenness centrality represent Sustainable Development Goal indicators that are strongly connected with other Sustainable Development Goal indicators.

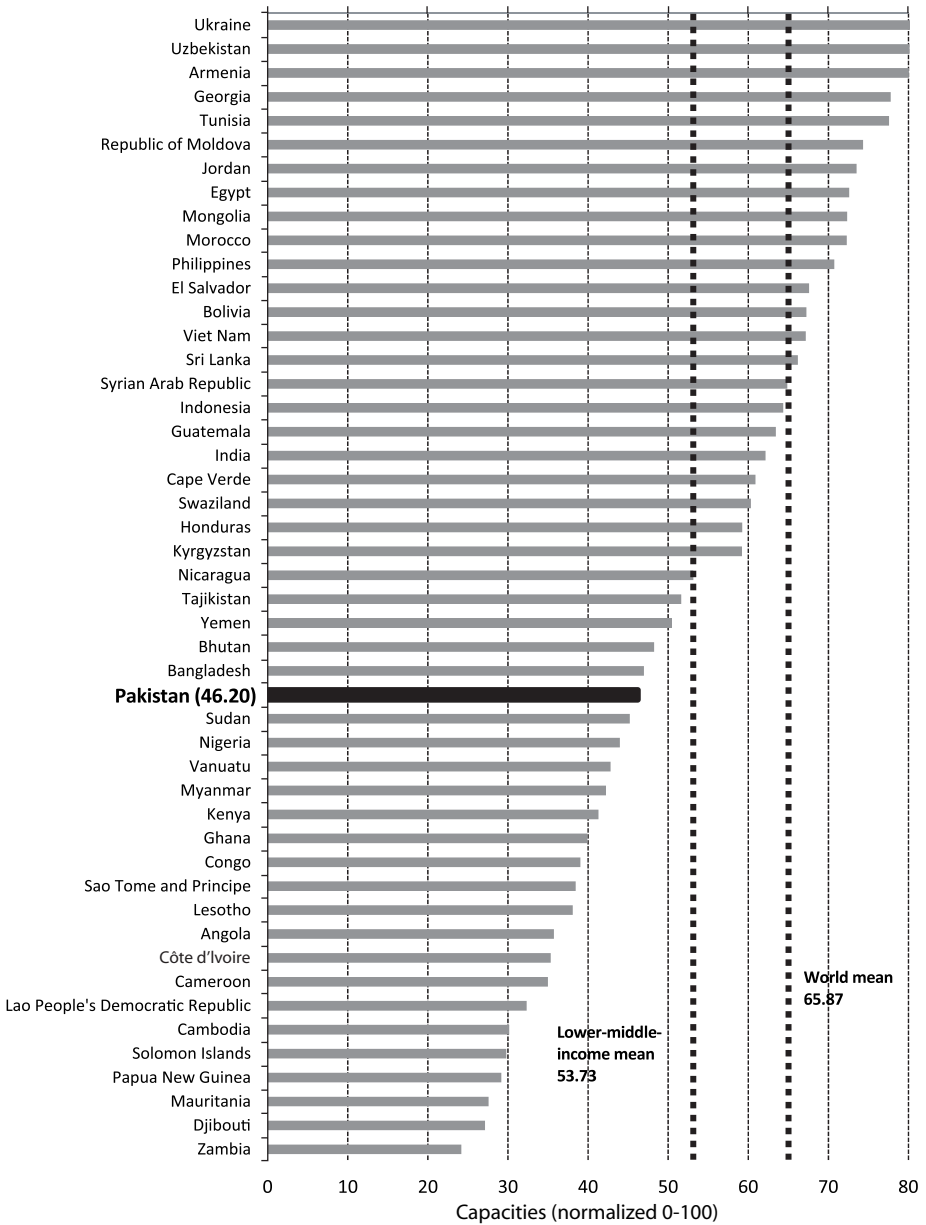
Countries are able to achieve higher attainment in a particular Sustainable Development Goal indicator (a more complex Lego model) only if the relevant capacities (Lego blocks) needed to increase attainment in an indicator are available within the country's set of capacities (the Lego bucket). However, those capacities – which include all aspects within the spectrum of socioeconomic capacities and natural resources relevant in achieving progress – are difficult if not impossible to observe directly.

It is possible, however, to indirectly measure the unobservable capacities that Pakistan possesses using the information of all countries and their attainment across all indicators. This is done by analysing the relative attainment of Pakistan across Sustainable Development Goal indicators, compared to all the other countries used in our sample. If Pakistan is achieving higher attainment in a particular indicator relative to the other countries, then Pakistan is considered to have the capacities to build that more complex “Lego model.” If Pakistan is struggling in a particular indicator, this suggests that it does not yet have the required capacities needed to make progress towards better attainment in that indicator.

In essence, the capacity measure – calculated using the “Method of Reflections”¹¹ – awards a higher capacity value if a country is doing well in indicators that other countries are struggling with, as this is suggestive of the country possessing unique capacities that others do not have. Figure 3 shows a comparison of the calculated capacity values for Pakistan with the group of lower-middle-income countries. On a scale of 0 to 100, the country's capacity is about 46, slightly below the average for the lower-middle-income countries (53.7). Countries in proximity to Pakistan, such as Bangladesh, Myanmar, Sri Lanka and Viet Nam, are seen to possess roughly the same level of capacities as Pakistan. Compared to the rest of the world, the capacity level of Pakistan is about 70 per cent of the world average.

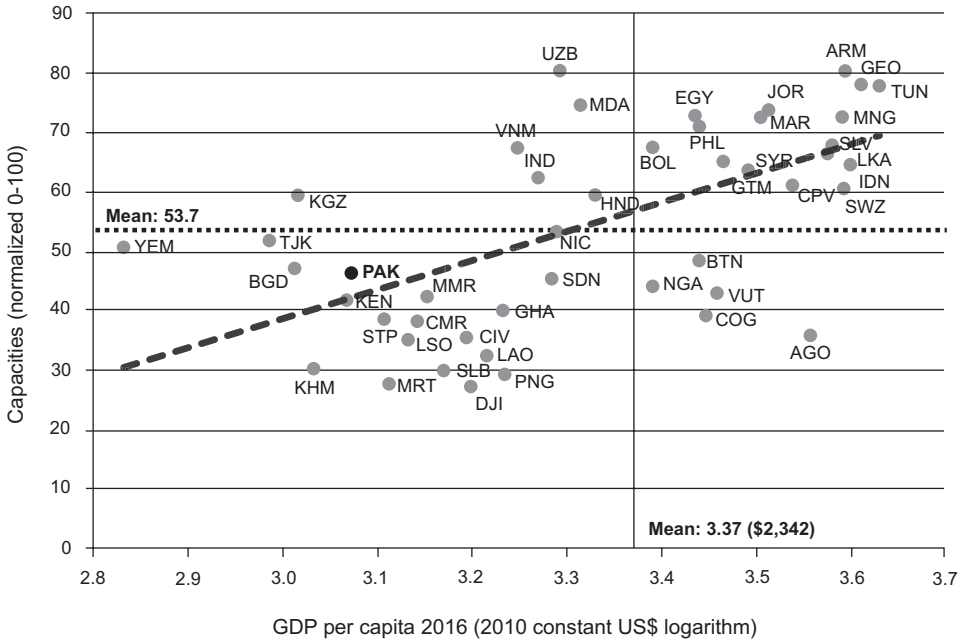
¹¹ See the annex for a brief overview of the Method of Reflections. For a more in-depth description of the method used in the analysis, see Hidalgo and Hausmann (2009) and Cho, Isgut and Tateno (2016).

Figure 3. SDG capacities of lower-middle-income countries



Source: Authors' calculation.

Figure 4. SDG capacities versus gross domestic product per capita (lower-middle-income countries)



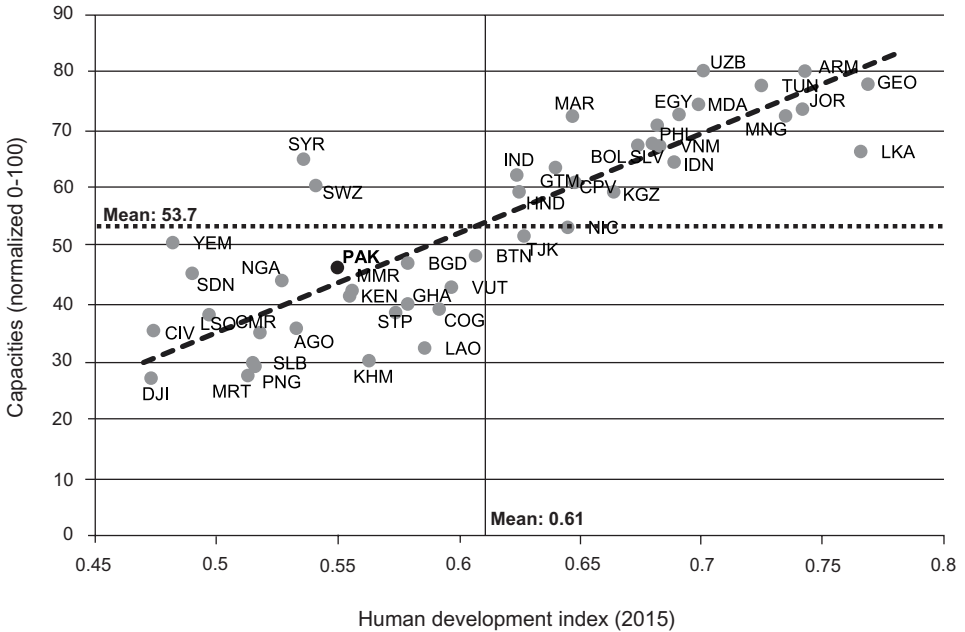
Source: Authors' calculation.

Note: AGO, Angola; ARM, Armenia; BGD, Bangladesh; BOL, Bolivia (Plurinational State of); BTN, Bhutan; CIV, Côte d'Ivoire; CMR, Cameroon; COG, Congo; DJI, Djibouti; EGY, Egypt; GEO, Georgia; GHA, Ghana; CPV, Cabo Verde; GTM, Guatemala; HND, Honduras; IND, India; JOR, Jordan; KEN, Kenya; KGZ, Kyrgyzstan; KHM, Cambodia; LAO, Lao People's Democratic Republic; LKA, Sri Lanka; LSO, Lesotho; MAR, Morocco; MDA, Republic of Moldova; MMR, Myanmar; MNG, Mongolia; MRT, Mauritania; NGA, Nigeria; NIC, Nicaragua; PAK, Pakistan; PHL, Philippines; PNG, Papua New Guinea; SLB, Solomon Islands; SLV, El Salvador; STP, Sao Tome and Principe; SWZ, Swaziland; SDN, Sudan; SYR, Syrian Arab Republic; TJK, Tajikistan; TUN, Tunisia; UZB, Uzbekistan; VNM, Viet Nam; VUT, Vanuatu; and YEM, Yemen.

V. OPTIMAL PATHWAYS FOR PROGRESS

Based on the SDG system described in section III and the measure of SDG capacity explained in section IV, it is possible to set up an optimization problem to identify the optimal pathway for Pakistan to progress towards achieving the Sustainable Development Goals. The first step is to identify a group of countries with similar levels of attainment of the Sustainable Development Goals as Pakistan. This group of "peers" is defined as 10 countries with SDG capacities higher than Pakistan and 10 countries with SDG capacities lower than Pakistan, and it includes

Figure 5. SDG capacities versus the human development index (lower-middle-income countries)



Source: Authors' calculation.

Note: AGO, Angola; ARM, Armenia; BGD, Bangladesh; BOL, Bolivia (Plurinational State of); BTN, Bhutan; CIV, Côte D'Ivoire; CMR, Cameroon; COG, Congo; DJI, Djibouti; EGY, Egypt; GEO, Georgia; GHA, Ghana; CPV, Cabo Verde; GTM, Guatemala; HND, Honduras; IDN, Indonesia; IND, India; JOR, Jordan; KEN, Kenya; KGZ, Kyrgyzstan; KHM, Cambodia; LAO, Lao People's Democratic Republic; LKA, Sri Lanka; LSO, Lesotho; MAR, Morocco; MDA, Republic of Moldova; MMR, Myanmar; MNG, Mongolia; MRT, Mauritania; NGA, Nigeria; NIC, Nicaragua; PAK, Pakistan; PHL, Philippines; PNG, Papua New Guinea; SLB, Solomon Islands; SLV, El Salvador; STP, Sao Tome and Principe; SWZ, Swaziland; SDN, Sudan; SYR, Syrian Arab Republic; TJK, Tajikistan; TUN, Tunisia; UZB, Uzbekistan; VNM, Viet Nam; VUT, Vanuatu; and YEM, Yemen.

Bangladesh, Bhutan, Cabo Verde, Congo, Ghana, Honduras, Kenya, Kyrgyzstan, Myanmar, Nicaragua, Nigeria, Samoa, Sao Tome and Principe, Senegal, Sudan, Swaziland, Tajikistan, Timor-Leste, Vanuatu and Yemen.

The optimization problem uses the SDG capacities estimated in the previous section as a planning tool to guide Pakistan on the prioritization and sequencing of the attainment of indicators over time. For that purpose, the value of the capacities measured can be calculated for a small increase in the value of a number of indicators, one at a time, selecting the indicator that yields the largest increase in

SDG capacities. Iterating this calculation many times can produce an “optimal” pathway for progress towards the achievement of the Sustainable Development Goals.

To reduce the computational burden, the optimization algorithm limits the number of indicators that Pakistan can improve upon. The set of indicators eligible for improvement is identified by the SDG system and the position of Pakistan within it, based on: (a) the degree of complexity of indicators; (b) current attainment level compared to peers; and (c) potential synergies across indicators. The selection of those characteristics is based on three assumptions.

The first assumption is that it is less costly to make progress in indicators that are less complex. The level of complexity of each indicator is obtained as a part of the calculation of the measure of SDG capacity with the method of reflections. Thus, the selection of indicators to be considered for improvement in the optimization algorithm favours indicators that are less complex. The second assumption is that countries with similar SDG capacities should be able to attain similar levels of progress in each individual indicator. Thus, the algorithm favours indicators in which Pakistan is lagging far behind its peers – they can be considered “low hanging fruits.” The third assumption is that improvement in indicators that are connected to several other indicators in the SDG system, referred to as gatekeeper indicators, may create synergies with other indicators.¹² Thus, the algorithm favours indicators with high betweenness centrality, represented by large nodes in figure 2 above.

In table 1, the suggested priority areas for Pakistan based on the objective of maximizing SDG capacities are laid out. The results are aggregated into three five-year phases: 2016-2020, 2021-2025 and 2026-2030. The priority levels for each indicator are calculated as the percentage of steps in each phase for which the indicator is chosen as a priority, relative to the total number of steps in each phase.

In the first phase (2016-2020), the optimal pathway emphasizes improvements in information and communications technology (ICT) infrastructure and Internet users, followed by an expansion in the network of automated teller machines (ATMs), increasing the number of physicians, and the protection of forests. In the second phase (2021-2025), ICT infrastructure and Internet users continue to be important but the expansion of access to bank accounts becomes the top priority, followed by expenditure on research and development. Increasing the number of physicians and

¹² An example could be the development of rural energy, which could facilitate the expansion of business and employment opportunities, thus reducing poverty, and the operation of rural medical clinics, leading to improvements in health outcomes.

protecting the forests remains important but less than in the first phase. In the third phase (2026-2030), the top priority becomes improving access to safe drinking water, followed by investing in clean fuel technologies, two new priorities. In decreasing order of importance, expenditure in research and development, ICT investment and expansion of ATMs follow.

Table 1. Suggested areas of priority for Pakistan

Goal	Indicator	Priority level (%)
Early stage (2016-2020)		
17	Internet users	25.9
8	Number of automated teller machines (ATMs)	22.3
17	Fixed-broadband subscriptions	20.3
3	Physicians density	19.3
15	Forest certified under an independently verified certification scheme	12.2
Transition phase (2021-2025)		
8	Proportion of adults (15 years and older) with an account at a bank	40.6
17	Fixed-broadband subscriptions	16.3
17	Internet users	13.9
9	Gross domestic expenditure on research and development	11.4
3	Physicians density	8.9
8	Number of automated teller machines (ATMs)	5.9
15	Forest certified under an independently verified certification scheme	3.0
Towards maturity (2026-2030)		
6	Population using safely managed drinking water	38.3
7	Clean fuel and technologies (usage rate)	19.1
9	Gross domestic expenditure on research and development	12.9
8	Number of automated teller machines (ATMs)	8.1
17	Fixed-broadband subscriptions	6.2
17	Internet users	5.3
8	Proportion of adults (15 years and older) with an account at a bank	4.8
3	Physicians density	4.3
15	Forest certified under an independently verified certification scheme	1.0

Source: Authors' calculations.

Note: Priority levels for the indicators are calculated as the percentage of steps in each phase for which the indicator is chosen as a priority relative to the total number of steps in each phase.

Several characteristics can be drawn from these results regarding the optimal pathways for the implementation of the 2030 Agenda in Pakistan. The first one is a large concentration in a relatively small number of indicators: ICT investment, ATMs and bank accounts, drinking water, physicians, forests and expenditure in research and development. This suggests a strategic approach for the achievement of the Goals, with a heavy policy focus on selected areas of great importance to Pakistan. A second characteristic is that the results are dependent on the country's position in the SDG system, tending to emphasize "low hanging fruits" or indicators in which Pakistan is underperforming compared with other countries with similar levels of SDG capacities.

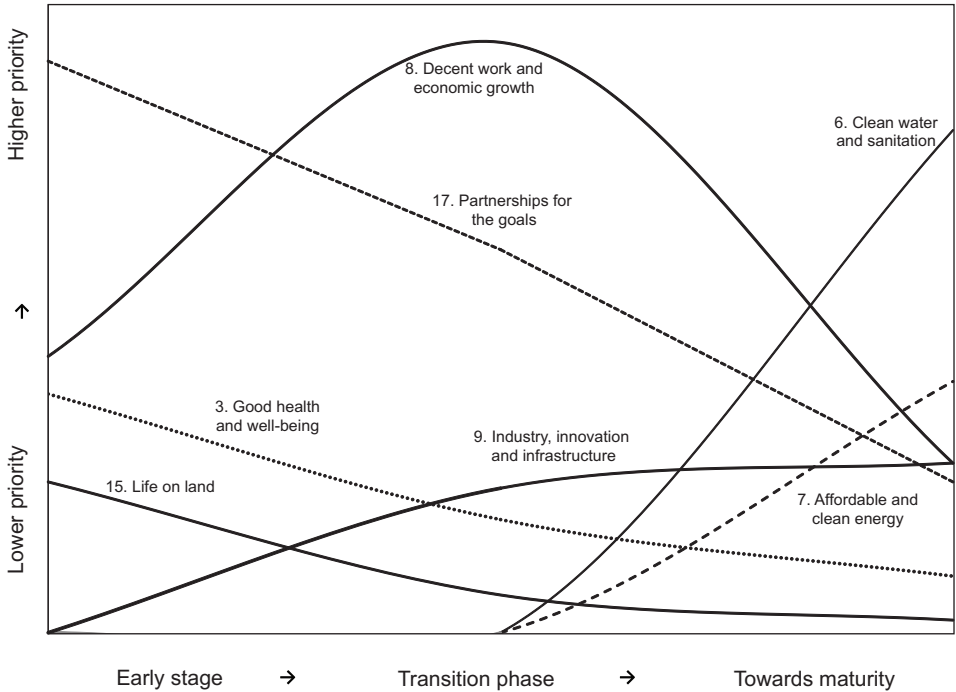
A third characteristic of the optimal pathways is sequencing, in the sense that the priorities vary from phase to phase.

Figure 6 illustrates the relative importance of each Sustainable Development Goal during subsequent phases of development for Pakistan. Goal 17 (partnerships for the Goals), followed by Goal 8 (decent work and economic growth), Goal 3 (good health and well-being), and Goal 15 (life on land) is particularly important early on. Goal 8 (decent work and economic growth) and Goal 6 (clean water and sanitation) become the most important in the second and third phases, respectively.

An interesting result is that some of the prioritized indicators, including broadband, Internet, expenditure in research and development, and safe drinking water, coincide with the core gatekeeper nodes of the preceding network analysis (see figure 2). Those findings suggest that, given the current level of capacity, Pakistan has the potential to improve on various Sustainable Development Goal indicators, even in areas where the country has been lagging relative to its peers. In fact, it would be efficient if Pakistan prioritizes those indicators because it would contribute to increasing the country's SDG capacity and accelerate progress towards the achievement of the Goals.

Figure 7 illustrates how the position of Pakistan within the SDG system would change by implementing the optimal pathway. As in figure 2 the light grey nodes represent indicators in which Pakistan is performing better than the lower-middle-income country average. The dark grey nodes represent indicators in which Pakistan is predicted to exhibit higher attainment levels relative to lower-middle-income countries in 2030 if it follows the optimal pathway. Those indicators are prioritized in the optimal pathway, indicating that improving their attainment is effective for Pakistan. Finally, the white nodes represent indicators that are expected to remain below the lower-middle-income country average by 2030.

Figure 6. Priority Sustainable Development Goals for the implementation of the 2030 Agenda

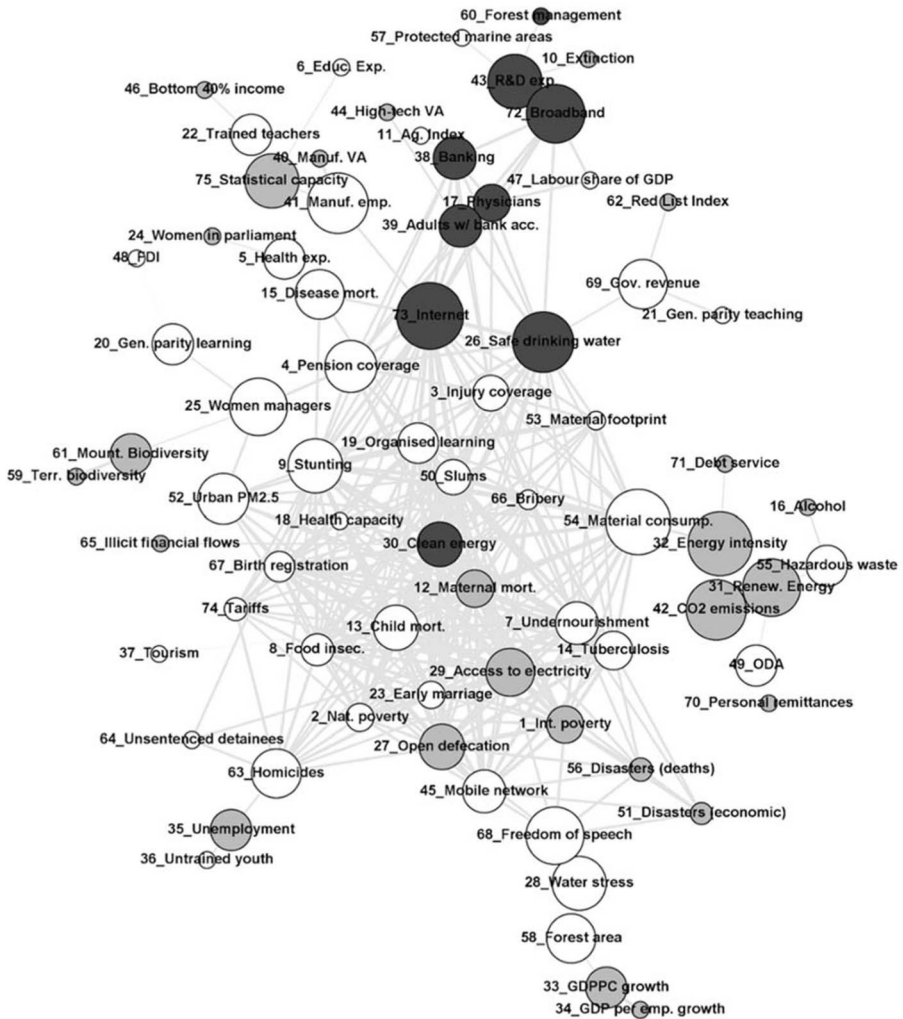


Source: Authors' calculations.

Figure 7 illustrates that Pakistan is slowly migrating from the nodes that are scattered at the upper portion of the network towards the core of the system, where indicators are densely connected. The optimal pathway projected in this figure includes improvements in indicators, such as expenditure in research and development, broadband, Internet, drinking water, physicians, and access to bank accounts, that are important gatekeeper nodes in the SDG system.

The figure, however, illustrates that most of the progress by 2030 is expected to take place only in the upper portion of the network. The core of the network contains a cluster of indicators, represented by white nodes, in which Pakistan will not be able to outperform the lower-middle-income countries even by 2030. Those indicators are represented by nodes that are densely connected. They are related to gender, health, hunger and education, such as child mortality and stunting, all of which are identified as areas of weakness in the country in section II. The analysis

Figure 7. The optimal pathway for progress in Pakistan



Source: Authors' calculation.

Notes: (a) The size of nodes represents their importance as gatekeepers, namely how important they are as middle links for Pakistan to progress towards better attainment in other indicators; and (b) nodes are coloured based on the level of attainment of Pakistan compared with lower-middle-income countries. Light grey nodes are those in which Pakistan exhibits higher attainment levels compared with lower-middle-income countries presently, while dark grey nodes are those in which Pakistan is predicted to exhibit higher attainment levels relative to lower-middle-income countries in 2030 if it follows the optimal pathway. (c) Acronyms used: R&D, research and development; GDP, gross domestic product; GDPPC, GDP per capita; CO₂, carbon dioxide; and ODA, official development assistance.

implies that Pakistan will need more time to accumulate sufficient capacities to address those challenges.

VI. SCENARIO ANALYSIS

The optimization exercise described above is further complemented by a comparative analysis of alternative scenarios, the results of which are compared in terms of the predicted levels of the human development index against the model-proposed optimal pathway. In particular, the optimal pathway described above is compared with a second scenario based on the country's development plan, Vision 2025 (box 1). This scenario is constructed by obtaining the optimal pathway in which only Sustainable Development Goal indicators that are substantially covered by Vision 2025 are selected. In the second scenario, some of the goals corresponding to gender (Sustainable Development Goal 5),¹³ cities (Sustainable Development Goal 11), sustainable consumption and production (Sustainable Development Goal 12), climate change (Sustainable Development Goal 13), oceans (Sustainable Development Goal 14) and terrestrial ecosystems (Sustainable Development Goal 15) are excluded. For a third scenario, for comparison purposes, a randomized pathway in which progress is made in arbitrary order is considered. This scenario is extreme and unrealistic, but it is an attempt to mimic the situation in which there is absolutely no focused area or policy coordination among various government institutions.

In summary, the following three scenarios are analysed:

1. The model-proposed optimal pathway;
2. The optimal pathway for progress within the focus of Vision 2025;
3. A randomized pathway for progress that does not give precedence to any indicator over another.

Future levels of the human development index for Pakistan are estimated under the different scenarios on the basis of the historical relationship between the human development index and the measure of SDG capacity shown in figure 5 above. The results of the three scenarios are shown in figure 8. For comparison purposes, the figure shows the historical trends in the human development index for Pakistan.

¹³ While gender issues are present in pillar 1, only 2 specific indicators (primary and secondary education parity and workforce participation) are included, and thus gender is considered not to be a core area of improvement.

Box 1. Vision 2025

After an extensive process of consultation with parliamentarians, federal ministries, provincial governments, business leaders, international institutions, universities, think tanks and non-governmental organizations concluded in a national conference on 22 November 2013, the Government of Pakistan compiled its Vision 2025 (Pakistan, 2014). This aspirational document includes a compilation of the consensus views of national and international stakeholders regarding the future direction of the country. It provides a conceptual platform for the achievement of sustainable and inclusive growth for the benefit of all the citizens of Pakistan, thus offering a national approach for meeting globally agreed goals and targets, including the Sustainable Development Goals. As shown in the table below Vision 2025 includes five enablers and seven pillars, with many pillars overlapping with the Sustainable Development Goals contained in the 2030 Agenda for Sustainable Development.

Pakistan Vision 2025: enablers, pillars, and corresponding Sustainable Development Goals

Pakistan Vision 2025		Sustainable Development
Enablers and pillars	Goals	Goals
Enabler I: Shared national vision Enabler II: Political stability and continuity of policies Enabler III: Peace and security Enabler IV: Rule of law Enabler V: Social justice		Goal 16: Peace, justice and strong institutions
Pillar I: Putting people first – developing human and social capital	1, 2, 3, 4, 5, 6, 7	Goal 3: Good health and well-being Goal 4: Quality education Goal 5: Gender equality Goal 6: Clean water and sanitation
Pillar II: Achieving sustained, indigenous and inclusive growth	8, 9, 10, 11	Goal 1: No poverty Goal 8: Decent work and economic growth Goal 10: Reduced inequalities Goal 17: Partnerships for the Goals

Table (continued)

Pakistan Vision 2025		Sustainable Development
Enablers and pillars	Goals	Goals
Pillar III: Governance, institutional reform and modernization of the public sector	12	Goal 16: Peace, justice and strong institutions
Pillar IV: Energy, water and food security	13, 14, 15, 16	Goal 2: Zero hunger Goal 6: Clean water and sanitation Goal 7: Affordable and clean energy
Pillar V: Private sector-led growth	17, 18, 19	Goal 8: Decent work and economic growth
Pillar VI: Developing a competitive knowledge economy through value addition	20, 21, 22, 23	Goal 8: Decent work and economic growth Goal 9: Industry, innovation and infrastructure
Pillar VII: Modernizing transportation infrastructure and greater regional connectivity	24, 25	Goal 9: Industry, Innovation and infrastructure

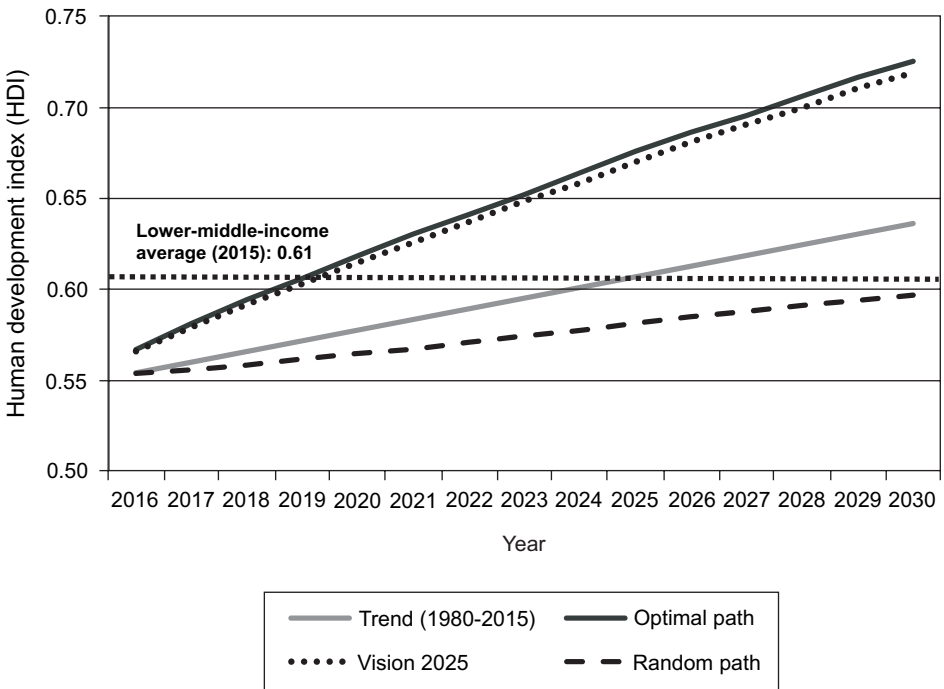
Source: Authors, based on the information from the Ministry of Planning, Development and Reform, Government of Pakistan, *Pakistan Vision 2025: One Nation – One Vision, Executive Summary*, and the 2030 Agenda for Sustainable Development.

Figure 8 shows that the optimal pathway results in the highest levels of the human development index, while the pathway defined by Vision 2025 follow a slightly lower trajectory than the optimal Sustainable Development Goals pathway. This suggests that Vision 2025 is a good match for the priorities of Pakistan for the implementation of the 2030 Agenda from the present until and 2030. Furthermore, the predicted trajectories in the human development index associated with both the optimal and the pathway defined by Vision 2025 greatly exceed the historical trend of the human development index. Finally, the random pathway would be unable to guarantee that Pakistan could keep up with or exceed past trends in annual increases.

Overall, the results suggest the following:

1. Planning and prioritization are essential for progress towards sustainable development as the expected outcome from randomized policies are strictly inferior, justifying the need for policy coordination across different state agencies and across different levels of governments.

Figure 8. Comparison of scenarios



Source: Authors' calculation.

2. Vision 2025 is expected to contribute to progress towards achieving inclusive and sustainable development provided that the implementation of it is prioritized and sequenced in an optimal manner.
3. The lack of progress expected in addressing issues related to gender, health, hunger and education, noted in the previous section, will require careful consideration by national policymakers of Pakistan and development partners.

VII. CONCLUSIONS

In the present paper, an attempt is made to understand how a country could move forward in implementing the 2030 Agenda, taking into account its level of development and unique capacities. The paper is focused on the case of Pakistan, based on the framework developed by Cho, Isgut and Tateno (2016). The analysis is

based on a data set that includes 75 indicators and 170 countries available from the Global SDG Indicators Database at the time of writing (September 2017).

The analysis of the SDG system as a network of interconnected indicators has identified an optimal pathway towards the achievement of the Sustainable Development Goals for Pakistan, given the country's current capacities. It has found that the country's national development plan, Vision 2025, is expected to contribute to progress towards achieving inclusive and sustainable development provided that the implementation of it is prioritized and sequenced in an optimal manner. However, the analysis suggests that Pakistan would need more time to accumulate sufficient capacities to address challenges in areas related to gender, health, hunger and education.

It must be noted that the analysis conducted in this paper is based on an initial set of indicators from the Global SDG Indicators Database. As the data for the Sustainable Development Goal indicators become available for more countries in coming years, the analytical framework used for this paper will be refined and improved by enhancing the coverage and representativeness of the Sustainable Development Goals.

REFERENCES

- Cho, Jaebeum, Alberto Isgut, and Yusuke Tateno (2016). An analytical framework for identifying optimal pathways towards sustainable development. MPFD Working Papers, WP/16/03. Bangkok: ESCAP.
- Hidalgo, César A., and Ricardo Hausmann (2009). The building blocks of economic complexity. *Proceedings of the National Academy of Sciences*, vol. 106, No. 26, pp. 10570-10575.
- Hidalgo, César A., and others (2007). The product space conditions the development of nations. *Science*, vol. 317, No. 5837, pp. 482-487.
- International Council for Science, and International Social Science Council (2015). *Review of Targets for the Sustainable Development Goals: The Science Perspective*. Paris: International Council for Science.
- Le Blanc, David (2015). Towards integration at last? The sustainable development goals as a network of targets. DESA Working Paper, No. 141. New York: Department of Economic and Social Affairs of the United Nations.
- Pakistan, Ministry of Planning, Development and Reform (2014). *Pakistan Vision 2025: One Nation – One Vision*. Available from <http://fics.seecs.edu.pk/Vision/Vision-2025/Pakistan-Vision-2025.pdf>.
- Rubin, Donald B. (1987). *Multiple Imputation for Nonresponse in Surveys*. New York: John Wiley & Sons.
- United Nations (2015). *Global Sustainable Development Report*. Available from <https://sustainabledevelopment.un.org/content/documents/1758GSDR%202015%20Advance%20Unedited%20Version.pdf>.
- United Nations, Economic and Social Commission for Asia and the Pacific (ESCAP) (2016). *Asia-Pacific Countries with Special Needs Development Report 2016: Adapting the 2030 Agenda for Sustainable Development at the National Level*. Sales No. E.16.II.F.11.

ANNEX

Table A. List of indicators used for analysis

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
1	1.1 By 2030, eradicate extreme poverty for all people everywhere, currently measured as people living on less than \$1.25 a day	1.1.1 Poor living on less than US\$1.90 a day in total employment, 15+ years (% of total employment)
	1.2 By 2030, reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions	1.2.1 Population living below the national poverty line (% of population)
	1.3 Implement nationally appropriate social protection systems and measures for all, including floors, and by 2030 achieve substantial coverage of the poor and the vulnerable	1.3.1 Employed population covered in the event of work injury (% of employed population) 1.3.1 Population above retirement age receiving a pension (% of population)
	1.a Ensure significant mobilization of resources from a variety of sources, including through enhanced development cooperation, in order to provide adequate and predictable means for developing countries, in particular least developed countries, to implement programmes and policies to end poverty in all its dimensions	1.a.2 General government health expenditure (% of total government expenditure) 1.a.2 Public expenditure on education (% of total government expenditure)
2	2.1 By 2030, end hunger and ensure access by all people, in particular the poor and people in vulnerable situations, including infants, to safe, nutritious and sufficient food all year round	2.1.1 Prevalence of undernourishment (percentage) 2.1.2 Moderate or severe food insecurity in the population (% of population)
	2.2 By 2030, end all forms of malnutrition, including achieving by 2025 the internationally agreed targets on stunting and wasting in children under five years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women, and older persons	2.2.1 Children moderately or severely stunted (% of children under 5)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	2.5 By 2020, maintain the genetic diversity of seeds, cultivated plants and farmed and domesticated animals and their related wild species, including through soundly managed and diversified seed and plant banks at the national, regional and international levels, and promote access to and fair and equitable sharing of benefits arising from the utilization of genetic resources and associated traditional knowledge, as internationally agreed	2.5.2 Local breeds classified as being at unknown level of risk of extinction (percentage)
	2.a Increase investment, including through enhanced international cooperation, in rural infrastructure, agricultural research and extension services, technology development and plant and livestock gene banks in order to enhance agricultural productive capacity in developing countries, in particular least developed countries	2.a.1 Agriculture orientation index (index)
3	3.1 By 2030, reduce the global maternal mortality ratio to less than 70 per 100,000 live births	3.1.1 Maternal mortality (deaths per 100,000 live births)
	3.2 By 2030, end preventable deaths of newborns and children under 5 years of age, with all countries aiming to reduce neonatal mortality to at least as low as 12 per 1,000 live births and under-5 mortality to at least as low as 25 per 1,000 live births	3.2.1 Under-five mortality rate (deaths per 1,000 live births)
	3.3 By 2030, end the epidemics of AIDS, tuberculosis, malaria and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases	3.3.2 Tuberculosis incidence rate (per 100,000 population)
	3.4 By 2030, reduce by one third premature mortality from non-communicable diseases through prevention and treatment and promote mental health and well-being	3.4.1 Mortality rate attributed to cardiovascular disease, cancer, diabetes, or chronic respiratory diseases (probability, %)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	3.5 Strengthen the prevention and treatment of substance abuse, including narcotic drug abuse and harmful use of alcohol	3.5.2 Alcohol per capita consumption (litres per annum)
	3.c Substantially increase health financing and the recruitment, development, training and retention of the health workforce in developing countries, especially in least developed countries and small island developing States	3.c.1 Physicians density (per 10,000 population)
	3.d Strengthen the capacity of all countries, in particular developing countries, for early warning, risk reduction and management of national and global health risks	3.d.1 International Health Regulations core capacity index (index)
4	4.2 By 2030, ensure that all girls and boys have access to quality early childhood development, care and pre-primary education so that they are ready for primary education	4.2.2 Participation rate in organized learning, one year before the official primary entry age (percentage)
	4.5 By 2030, eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations	4.5.1 Gender parity index for participation rate in organized learning, one year before the official primary entry age (female-to-male ratio) 4.5.1 Gender parity index of teachers in primary education who are trained (female-to-male ratio)
	4.c By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries, especially least developed countries and small island developing States	4.c.1 Trained teachers, primary education (percentage)
5	5.3 Eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation	5.3.1 Percentage of women aged 20 to 24 years who were first married or in union before age 18 (percentage)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	5.5 Ensure women's full and effective participation and equal opportunities for leadership at all levels of decision-making in political, economic and public life	5.5.1 Seats held by women in national parliament (% of seats) 5.5.2 Women in managerial position (percentage)
6	6.1 By 2030, achieve universal and equitable access to safe and affordable drinking water for all	6.1.1 Population using safely managed drinking water (% of population)
	6.2 By 2030, achieve access to adequate and equitable sanitation and hygiene for all and end open defecation, paying special attention to the needs of women and girls and those in vulnerable situations	6.2.1 Population practicing open defecation (% of population)
	6.4 By 2030, substantially increase water-use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater to address water scarcity and substantially reduce the number of people suffering from water scarcity	6.4.2 Total freshwater withdrawal (% of total renewable water per annum)
7	7.1 By 2030, ensure universal access to affordable, reliable and modern energy services	7.1.1 Access to electricity, Sustainable Energy for All (SE4All) (% of population) 7.1.2 Clean fuel and technologies (CFT) usage rate (% of population)
	7.2 By 2030, increase substantially the share of renewable energy in the global energy mix	7.2.1 Renewable energy share of total final energy consumption (% of total final energy consumption)
	7.3 By 2030, double the global rate of improvement in energy efficiency	7.3.1 Energy intensity from the Global Tracking Framework for Measuring Energy Access (in megajoules per unit of GDP in 2011 PPP)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
8	<p>8.1 Sustain per capita economic growth in accordance with national circumstances and, in particular, at least 7 per cent gross domestic product growth per annum in the least developed countries</p> <p>8.2 Achieve higher levels of economic productivity through diversification, technological upgrading and innovation, including through a focus on high-value added and labour-intensive sectors</p> <p>8.5 By 2030, achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value</p> <p>8.6 By 2020, substantially reduce the proportion of youth not in employment, education or training</p> <p>8.9 By 2030, devise and implement policies to promote sustainable tourism that creates jobs and promotes local culture and products</p> <p>8.10 Strengthen the capacity of domestic financial institutions to encourage and expand access to banking, insurance and financial services for all</p>	<p>8.1.1 Average annual GDP per capita growth rate, 2005 US dollars (% change per capita per annum)</p> <p>8.2.1 Growth rate of GDP per employed person (% change per annum)</p> <p>8.5.2 Unemployment rate, 15+ years (% of labour force)</p> <p>8.6.1 Not in education, employment or training (NEET) rates (% of population aged 15-24)</p> <p>8.9.1 Outbound tourism expenditure (% of GDP)</p> <p>8.10.1 Number of automated teller machines (ATMs) (per 100,000 adults)</p> <p>8.10.2 Proportion of adults with an account at a bank (% of population aged 15 and above)</p>
9	<p>9.2 Promote inclusive and sustainable industrialization and, by 2030, significantly raise industry's share of employment and gross domestic product, in line with national circumstances, and double its share in least developed countries</p>	<p>9.2.1 GDP by activity: manufacturing (% of GDP)</p> <p>9.2.2 Manufacturing employment (% of total employment)</p>

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	9.4 By 2030, upgrade infrastructure and retrofit industries to make them sustainable, with increased resource-use efficiency and greater adoption of clean and environmentally sound technologies and industrial processes, with all countries taking action in accordance with their respective capabilities	9.4.1 Carbon dioxide emissions (kg CO ₂ equivalent per 1 US\$ GDP, 2005 PPP)
	9.5 Enhance scientific research, upgrade the technological capabilities of industrial sectors in all countries, in particular developing countries, including, by 2030, encouraging innovation and substantially increasing the number of research and development workers per 1 million people and public and private research and development spending	9.5.1 Gross domestic expenditure on research and development (% of GDP)
	9.b Support domestic technology development, research and innovation in developing countries, including by ensuring a conducive policy environment for, inter alia, industrial diversification and value addition to commodities	9.b.1 Medium and high-tech industry value added (% of total value added)
	9.c Significantly increase access to information and communications technology and strive to provide universal and affordable access to the Internet in least developed countries by 2020	9.c.1 Population covered by a mobile-cellular network (% of population)
10	10.1 By 2030, progressively achieve and sustain income growth of the bottom 40 per cent of the population at a rate higher than the national average	10.1.1 Growth rates in per capita real survey mean consumption or income, bottom 40% (percentage)
	10.4 Adopt policies, especially fiscal, wage and social protection policies, and progressively achieve greater equality	10.4.1 Labour share of GDP (% of GDP)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	10.b Encourage official development assistance and financial flows, including foreign direct investment, to States where the need is greatest, in particular least developed countries, African countries, small island developing States and landlocked developing countries, in accordance with their national plans and programmes	10.b.1 FDI inflows (% of GDP) 10.b.1 Official development assistance (% of GDP)
11	11.1 By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums	11.1.1 Urban slum population (% of urban population)
	11.5 By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations	11.5.2 Direct disaster economic, average annual loss (per 1,000 US\$)
	11.6 By 2030, reduce the adverse per capita environmental impact of cities, including by paying special attention to air quality and municipal and other waste management	11.6.2 Annual mean concentration of PM2.5 (micrograms per m ³)
12	12.2 By 2030, achieve the sustainable management and efficient use of natural resources	12.2.1 Material footprint total by type (kg per 1 US dollar, 2005 GDP) 12.2.2 Domestic material consumption intensity (kg per 1 US dollar, 2005 GDP)
	12.4 By 2020, achieve the environmentally sound management of chemicals and all wastes throughout their life cycle, in accordance with agreed international frameworks, and significantly reduce their release to air, water and soil in order to minimize their adverse impacts on human health and the environment	12.4.1 Hazardous waste, Basel Convention compliance (percentage)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
13	13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	13.1.1 Disasters, total people affected (per 1,000 population)
14	14.5 By 2020, conserve at least 10 per cent of coastal and marine areas, consistent with national and international law and based on the best available scientific information	14.5.1 Protected areas in relation to marine area (percentage)
15	15.1 By 2020, ensure the conservation, restoration and sustainable use of terrestrial and inland freshwater ecosystems and their services, in particular forests, wetlands, mountains and drylands, in line with obligations under international agreements	15.1.1 Forest area (% of land area) 15.1.2 Proportion of important sites for terrestrial biodiversity (percentage)
	15.2 By 2020, promote the implementation of sustainable management of all types of forests, halt deforestation, restore degraded forests and substantially increase afforestation and reforestation globally	15.2.1 Forest certified under an independently verified certification scheme (percentage)
	15.4 By 2030, ensure the conservation of mountain ecosystems, including their biodiversity, in order to enhance their capacity to provide benefits that are essential for sustainable development	15.4.1 Proportion of important sites for mountain biodiversity (percentage)
	15.5 Take urgent and significant action to reduce the degradation of natural habitats, halt the loss of biodiversity and, by 2020, protect and prevent the extinction of threatened species	15.5.1 Red list index (index)
16	16.1 Significantly reduce all forms of violence and related death rates everywhere	16.1.1 Intentional homicide (per 100,000 population)
	16.3 Promote the rule of law at the national and international levels and ensure equal access to justice for all	16.3.2 Unsensenced detainees, pre-trial (% of prison population)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	16.5 Substantially reduce corruption and bribery in all their forms	16.5.2 Illicit financial flows (% of GDP) 16.5.2 Bribery incidence, business asked for bribery (percentage)
	16.9 By 2030, provide legal identity for all, including birth registration	16.9.1 Birth registration (% of children under 5)
	16.10 Ensure public access to information and protect fundamental freedoms, in accordance with national legislation and international agreements	16.10.1 Killings of journalists and associated media personnel (number)
17	17.1 Strengthen domestic resource mobilization, including through international support to developing countries, to improve domestic capacity for tax and other revenue collection	17.1.1 Total general government revenue, Global Financial Statistics (% of GDP)
	17.3 Mobilize additional financial resources for developing countries from multiple sources	17.3.2 Personal remittances received (% of GDP)
	17.4 Assist developing countries in attaining long-term debt sustainability through coordinated policies aimed at fostering debt financing, debt relief and debt restructuring, as appropriate, and address the external debt of highly indebted poor countries to reduce debt distress	17.4.1 Debt service (% of exports of goods, services and primary income)
	17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge-sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism	17.6.2 Fixed-broadband subscriptions (per 100 population)

Table A. (continued)

Sustainable Development Goals	Corresponding target	Indicator used for analysis (unit)
	17.8 Fully operationalize the technology bank and science, technology and innovation capacity-building mechanism for least developed countries by 2017 and enhance the use of enabling technology, in particular information and communications technology	17.8.1 Internet users (% of population)
	17.10 Promote a universal, rules-based, open, non-discriminatory and equitable multilateral trading system under the World Trade Organization, including through the conclusion of negotiations under its Doha Development Agenda	17.10.1 Tariff rate, under most favoured nation status (percentage)
	17.18 By 2020, enhance capacity-building support to developing countries, including for least developed countries and small island developing States, to increase significantly the availability of high-quality, timely and reliable data disaggregated by income, gender, age, race, ethnicity, migratory status, disability, geographic location and other characteristics relevant in national contexts	The total number of indicators out of the 74 used for analysis that are available for each country.

B. List of countries in the data set, after imputation

Afghanistan; Albania; Algeria; Angola; Argentina; Armenia; Australia; Austria; Azerbaijan; Bahrain; Bangladesh; Barbados; Belarus; Belgium; Belize; Benin; Bhutan; Bolivia (Plurinational State of); Bosnia and Herzegovina; Botswana; Brazil; Brunei Darussalam; Bulgaria; Burkina Faso; Burundi; Cambodia; Cameroon; Canada; Cabo Verde; Central African Republic; Chad; Chile; China; Colombia; Comoros; Congo; Costa Rica; Côte d'Ivoire; Croatia; Cuba; Cyprus; Czech Republic; Democratic Republic of the Congo; Denmark; Djibouti; Dominican Republic; Ecuador; Egypt; El Salvador; Estonia; Ethiopia; Fiji; Finland; France; Gabon; Gambia; Georgia; Germany; Ghana; Greece; Guatemala; Guinea; Guinea-Bissau; Guyana; Haiti; Honduras; Hungary; Iceland; India; Indonesia; Iran (Islamic Republic of); Iraq; Ireland; Israel; Italy; Jamaica; Japan; Jordan; Kazakhstan; Kenya; Korea, Republic of; Kuwait;

Kyrgyzstan; Lao People's Democratic Republic; Latvia; Lebanon; Lesotho; Liberia; Lithuania; Luxembourg; Madagascar; Malawi; Malaysia; Maldives; Mali; Malta; Mauritania; Mauritius; Mexico; Mongolia; Montenegro; Morocco; Mozambique; Myanmar; Namibia; Nepal; Netherlands; New Zealand; Nicaragua; Niger; Nigeria; Norway; Oman; Pakistan; Panama; Papua New Guinea; Paraguay; Peru; Philippines; Poland; Portugal; Qatar; Republic of Moldova; Romania; Russian Federation; Rwanda; Saint Lucia; Saint Vincent and the Grenadines; Samoa; Sao Tome and Principe; Saudi Arabia; Senegal; Serbia; Seychelles; Sierra Leone; Singapore; Slovakia; Slovenia; Solomon Islands; South Africa; Spain; Sri Lanka; Sudan; Suriname; Swaziland; Sweden; Switzerland; Syrian Arab Republic; Tajikistan; Thailand; the former Yugoslav Republic of Macedonia; Timor-Leste; Togo; Trinidad and Tobago; Tunisia; Turkey; Uganda; Ukraine; United Arab Emirates; United Kingdom; United Republic of Tanzania; United States; Uruguay; Uzbekistan; Vanuatu; Venezuela; Viet Nam; Yemen; Zambia; and Zimbabwe.

C. The Method of Reflections

The Method of Reflections (Hidalgo and Hausmann, 2009) uses the information of the constructed network of (a) countries and (b) indicators to calculate measures of capacity and complexity. Taking countries as a starting point, each country's attainment across all 75 indicators is summed up to produce a first order measure of a country's capacity. The same can be done for the indicators from which the sum of the links for any indicator represents the overall attainment of the indicator given the set of countries. However, this in itself is not very enlightening in that the measure is the simple sum of attainment. The Method of Reflections allows for iteration by using the information collected at the first order measure to calculate a second order measure, and so forth until higher order measures are calculated. For example, the second order measure for countries would not simply sum the links, but would weight those links based on the values for the indicators calculated in the first order. Higher reflections for countries represent generalized measures of "unobserved capacities" in that the difficulty in achieving a certain level in a particular indicator is taken into consideration, rather than simply summing up the raw attainment levels. The same applies for indicators, in which the higher order reflections generate generalized measures of "complexity" in that the unobserved capacities of countries are taken into consideration.

For this analysis 75 indicators are further disaggregated into 100 different categories, each resulting in a total of 7,500 indicators. The indicators are disaggregated by dividing the attainment of countries in any indicator into 100 groups, and dichotomizing the attainment. For example, a country that is in the bottom 1 per cent with regard to the poverty indicator will score a 1 in the first of the 100 poverty

indicator categories, and a 0 for all subsequent categories. A country that is in the top 1 per cent will record a score of 1 for all 100 of the poverty indicator categories. The reasoning behind this disaggregation is that for the bottom categories, many countries will have a score of 1, which will result in that bottom category having a low “complexity” score, while the top category will have very few countries having a score of 1, resulting in a high “complexity” score. Thus, disaggregation allows for the differentiation of countries’ attainment into separate “complexity” categories for each indicator.

PREFERENTIAL TRADE AGREEMENTS WITH LABOUR PROVISIONS AND CHILD LABOUR: EVIDENCE FROM ASIA AND THE PACIFIC

Alberto Posso*

Many argue that the benefits of trade liberalization do not equitably accrue to everyone. To counter this trend, some governments have proposed adding labour provisions in preferential trade agreements. The eradication of child labour is included in most of those agreements. Using unique new data, the present study is an assessment on whether preferential trade agreements with labour provisions have resulted in less child labour in 18 developing economies in the Asia-Pacific region over the period 1997-2014. The analysis reveals that countries with more preferential trade agreements with labour provisions have lower incidences of child labour. Robustness exercises, however, show that those trade policies are unlikely to reduce child labour and that instead, improving educational access is likely to lower this phenomenon. Accordingly, governments tend to sign those agreements after labour market conditions improve. This is useful in that it signals to other countries their concern about labour standards, which have been found to increase foreign direct investment. Alternatively, signing those preferential trade agreements can protect their own labour markets from a potential race to the bottom.

JEL classification: F13, J83, K31, N45.

Keywords: Asia-Pacific region, child labour, labour provisions, preferential trade agreements, trade policy analysis.

* The Australian APEC Study Centre, Royal Melbourne Institute of Technology, 445 Swanston Street, Melbourne, VIC, 3000, Australia (email: alberto.posso@rmit.edu.au; URL: www.albertoposso.org). This work was supported by the Economic and Social Commission for Asia Pacific (ESCAP). No financial interest or benefit has arisen from the direct application of this research. The funding body did not influence research outcomes at any stage. The author is thankful to Mia Mikic, Yann Duval, Panit Buranawijarn, and participants of the Regional Dialogue on Enhancing the Contribution of Preferential Trade Agreements to Inclusive and Equitable Trade, which was held in Bangkok on 21 and 22 June 2017.

I. INTRODUCTION

Most economists agree that international trade provides opportunities for growth and employment generation. However, a growing consensus within the discipline and many segments of society highlight that the benefits of international trade are not accruing to everyone within economies with equity. In particular, competition from abroad can often hurt a number of domestic industries, which has prompted many firms to search for ways to save costs. In turn, this can result in significant downward pressure on wages and labour conditions. Consequently, a number of governments are attempting to ensure more equitable outcomes from trade liberalization. In particular, labour provisions in trade agreements have been offered as a solution.

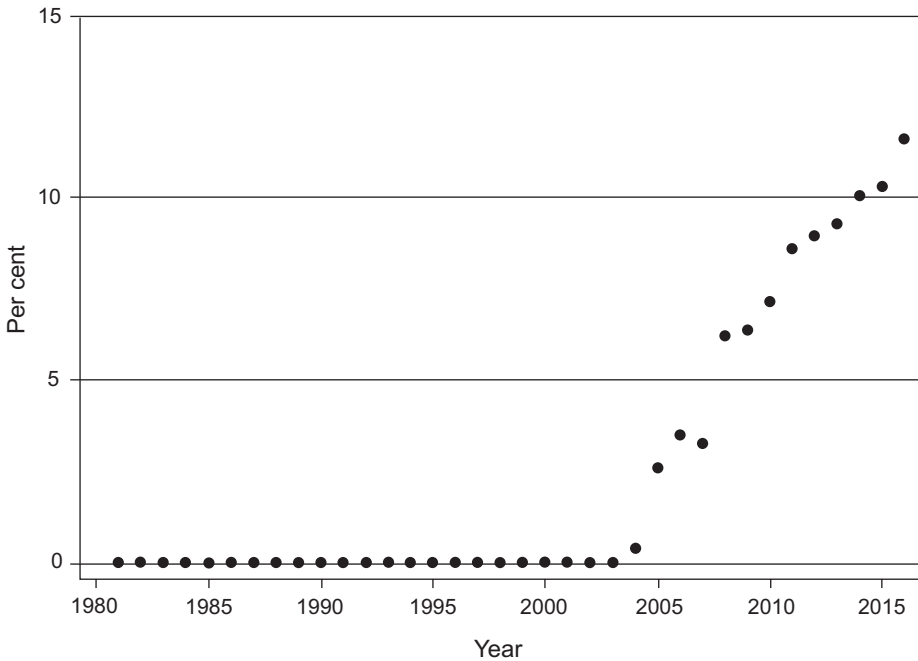
This is part of a growing trend that incorporates sustainable development into bilateral and regional trade agreements (Draper, Khumalo and Tigere, 2017). Thus, various trade agreements are now characterized by a wide scope of sustainable development provisions, many of which include measures promoting compliance with international or domestic environmental and labour laws, or regulatory commitments to advance social or environmental objectives (Draper, Khumalo and Tigere, 2017).

Efforts to introduce labour standards in trade policy have traditionally been met with opposition, particularly from developing economies, which have argued that high labour standards would erode their comparative advantage (Dolumbia-Henry and Gravel, 2006). Generally, those in favour of labour standards argue that they can help avoid a race to the bottom, while addressing growing inequality concerns (Bhagwati, 1995; Chan and Ross, 2003). However, many argue that labour provisions either do not have the desired impact, or can possibly worsen key labour market outcomes, for example, by imposing trade sanctions on labour-intensive industries (Maskus, 2002).

Nevertheless, labour provisions are now part of an increasing number of preferential trade agreements (PTAs). In figure 1, data on the percentage of all preferential trade agreements with labour provisions in both developed and developing economies in the Asia-Pacific region are plotted, as determined by Engen (2017). The data show that labour provisions in preferential trade agreements have increased from around 1 per cent in 2005 to 10 per cent a decade after. Those provisions link labour standards with trade by demanding compliance with certain agreed upon base standards. The provisions added to various preferential trade agreements vary significantly from agreement to agreement. However, in most cases they tend to include the core International Labour Organization (ILO) labour standards (Engen, 2017). These are: (a) freedom of association and the effective recognition of the right to collective bargaining (Conventions No. 87 and No. 98); (b) the elimination of all forms of forced and compulsory labour (Conventions No. 29 and No. 105);

(c) the effective abolition of child labour (Conventions No. 138 and No. 182); and (d) the elimination of discrimination in respect of employment and occupation (Conventions No. 100 and No. 111). In most cases, labour provisions in preferential trade agreements are not supported by formal enforcement mechanisms, relying instead on self-compliance (Engen, 2017). However, this does not necessarily preclude those mechanisms from having a real effect on labour market outcomes.

Figure 1. Percentage of preferential trade agreements with labour provisions, 1980-2015



Source: Authors calculations based on data from Engen (2017).

The limited empirical evidence on the nexus between preferential trade agreements with labour provisions and labour market outcomes is mixed. Bonnal (2010), for example, examines the impact of trade on frequency of strikes and lockouts as well as on cases of injury. He finds that the value of labour standards is positively associated with trade. On the other hand, Häberli, Jansen and Monteiro (2012) find that trade under preferential trade agreements lower labour standards, measured by notice periods, severance payments, and the gross replacement ratio, but only in agreements between developed economies.

For this paper, the impact of labour provisions in preferential trade agreements on child labour is empirically tested. Child labour is the focus of this study for two reasons: (a) it remains a prominent problem in most developing nations; and (b) it is the only labour standard for which there are adequate macroeconomic-level time-series data.¹ Even though child labour has been found to be a function of poverty (Krueger, 1997; Basu and Van, 1998), it is associated with worsening health outcomes (Roggero and others, 2007) and lower educational attainment (Akabayashi and Psacharopoulos, 1999; Zabaleta, 2011). As such, child labour is often perceived as having real and long-lasting effects on the economic prosperity of countries. It is, therefore, seen by many policymakers as robbing countries of their future. According to ILO, Asia and the Pacific is the region with the largest absolute number of child workers, estimated at 77 million children and amounting to more than half of the global total (ILO, 2013).

Labour provisions that aim to decrease child labour and improving other labour market outcomes are a relatively new feature in international trade. Accordingly, they remain in a phase of experimentation, lacking available information and evidence of how or if they work. For this paper, a unique new data set prepared by Engen (2017) on preferential trade agreements and preferential trade agreements with labour provisions signed in the Asia-Pacific region over the period 1997 to 2014 is used.

Insights from the Asia-Pacific region are useful to developing countries in other regions not only because preferential trade agreements with labour provisions are increasing in popularity, but also because this region is home to more than half of the global workforce. Accordingly, the quality of work in the Asia-Pacific region has implications for the state of total welfare of workers globally (Engen, 2017). Furthermore, because of its size, the region faces large labour market challenges. Indeed, while some countries have experienced significant improvements in labour regulations and conditions over the last decades, a large number of workers in this region face difficult, often hazardous, conditions and with very little protection (Engen, 2017).

Understanding the nexus between international trade policy and labour market outcomes, particularly child labour, is also of great importance given the current international policy climate. Proponents of the 2030 Agenda for Sustainable Development generally recognize that while trade promotion has been associated with higher levels of economic growth, not all segments of society have benefited from the new opportunities associated with it (ESCAP, 2017). In a world facing populist

¹ It is imperative that developing nations collect reliable statistical information on all labour standards to inform policy with more formal analyses.

backlashes against international trade and globalization, understanding the role, if any, international trade policy can have in improving the conditions of the segment of a population remaining at the margin of the economy is important.

The data of Engen (2017) are grouped with World Bank data to assess whether preferential trade agreements with labour provisions are likely to have resulted in a decline in child labour in 18 developing economies in the Asia-Pacific region. The empirical approach for determining this begins with a broad statistical analysis that focuses on existing correlations in order to reach preliminary conclusions. The results of that exercise are then tested for robustness by applying an econometric model that reviews the relationship between preferential trade agreements with labour provisions and child labour after controlling for other key factors that can influence child labour. This econometric analysis is then augmented with models that test causality between the trade policy initiative and the labour market outcomes.

The results of the correlation analysis suggest that countries that have signed preferential trade agreements with labour provisions have lower incidences of child labour. Similar findings are gathered from the simple econometric analysis. The models that aim to determine whether there is a causal linkage, however, suggest that preferential trade agreements with labour provision are unlikely to cause lower incidences of child labour. Instead, those models indicate that improving access to educational opportunities within countries is likely to significantly reduce child labour.

The remainder of the paper is structured as follows. The next section contains an introduction to the empirical approach. In section III the data are discussed, and in section IV the empirical results are presented. Section V includes policy implications, while the last section concludes.

II. EMPIRICAL APPROACH

For the present study, a two-tiered empirical approach is used to examine the data. The study begins with a simple graphical analysis that discusses the correlations between preferential trade agreements and preferential trade agreements with labour provisions with child labour in order to highlight country-level trends in the data. This analysis relies on the calculation of average child labour for boys and girls, which is compared to the average number of treaties for each country in the sample. Average child labour and the number of treaties are calculated for each economy over the entire period for which data are available. This provides a *between* country analysis of the data to simply determine if countries with preferential trade agreements and preferential trade agreements with labour provisions exhibit lower or higher incidences of child labour.

Next, an econometric approach is adopted that takes advantage of repeated observations for each economy through time to estimate how preferential trade agreements and preferential trade agreements with labour provisions correlate with child labour *within* each country, on average. This econometric approach builds on macroeconomic studies that have looked at the nexus between trade and labour market outcomes in developing countries.² Most of the previous work on the determinants of child labour relies on microeconomic data, such as household surveys (Edmonds, 2008). The conceptual framework in this study builds on micro-level studies by using macroeconomic proxies for key household characteristics, namely income and educational attainment. Taking advantage of macro-level panel data also means that country characteristics can also be included in the model. The study estimates the following model:

$$CL_{i,t} = \alpha + \beta_1 T_{i,t} + \beta_2 PTA_{i,t} + \beta_3 PTA_LP_{i,t} + \beta_4 X_{i,t} + \mu_{i,t} \quad (1)$$

where the subscripts denote country i at time t . CL is child labour (male, female or total), T is a vector of trade exposure variables (such as openness), PTA is the number of signed preferential trade agreements that country i has at time t , while PTA_LP is the number of preferential trade agreements with labour provisions that the country has at time t . The variable X is a vector of other factors that can potentially influence child labour at a macroeconomic level (discussed in the next section), while $\mu_{i,t}$ is the error term. It is important to test for the effect of PTA_LP after controlling for PTA in order to isolate the effect that PTA_LP potentially has more clearly.

Equation (1) is primarily estimated with a fixed effects model. Those models allow for the decomposition of the error term into:

$$\mu_{i,t} = \delta_i + \lambda_t + \varepsilon_{i,t} \quad (2)$$

where δ_i is a country-specific dummy variable used to control for unobserved, time-invariant characteristics. For example, δ_i controls for the legal origin in country i , which could potentially determine key labour market outcomes. Additionally, δ_i controls for geographical location and topography, which could influence the availability of opportunities for child work in an economy. The term λ_t controls for omitted time-variant characteristics that affect all countries in a particular year. For example, λ_t controls for unobserved labour market effects of the global financial crisis of 2008-2009. Finally, the term $\varepsilon_{i,t}$ is an idiosyncratic error term. Formal Hausman tests are used to ensure that fixed effects perform better than random effects estimators.

² Another strand of the literature focuses on the opposite relationship (see Kucera and Sarna, 2006).

Fixed effects regressions are useful to deal with omitted variable bias. However, the standard model does not deal well with endogeneity bias. This phenomenon is plausible here because countries with, for example, low rates of child labour may choose to adopt more stringent labour standards to show political willingness against this problem in the international arena. Developing countries with relatively stronger existing labour market outcomes may also sign a preferential free trade agreement with labour provisions to attract more international investment to the manufacturing sector. Multinational firms may then see this as a relatively safer option to do business in a world where production practices are increasingly under scrutiny from the global media and civil society. An instrumental variable (IV) approach is most often viewed as the best method to deal with endogeneity. IV regressions use a variable (or set of variables), z , that are correlated only with the dependent variable through its direct relationship with the endogenous variable. In practice, however, finding instruments that are intuitively pleasing can be difficult. Therefore, this study relies on two alternative techniques to account for endogeneity – lagged explanatory variables and generalized method of moments (GMM).

The lagged explanatory variable approach simply fits the following model:

$$CL_{i,t} = \alpha + \beta_1 LS_{i,t-n} + \beta_2 T_{i,t-n} + \beta_3 PTA_{i,t-n} + \beta_4 PTA_LP_{i,t-n} + \beta_5 X_{i,t-n} + \mu_{i,t} \quad (3)$$

In this case, for simplicity, all explanatory variables are lagged by n years. The number of lagged years can be determined by a number of criteria, however, in this situation, because of the limited availability of data, a lag of one year is employed. The intuition behind this approach is that movements in variables in period $t-1$ are unlikely to be correlated with movements in period t . In practice, however, if the endogenous variable in period t is determined to some degree by itself in period $t-1$, then the said variable will remain correlated with the error term, thus endogenous.

Accordingly, a second, more comprehensive, technique is employed to account for endogeneity – GMM. This technique relies on lags of the endogenous variables as instruments (Arellano and Bond, 1991). An advantage of GMM is that it is designed with endogenous variables being potentially correlated with both past and present errors. GMM uses first-differences to transform equation (1) into

$$\Delta CL_{i,t} = \beta_1 \Delta LS_{i,t} + \beta_2 \Delta T_{i,t} + \beta_3 \Delta PTA_{i,t} + \beta_4 \Delta PTA_LP_{i,t} + \beta_5 \Delta X_{i,t} + \Delta \mu_{i,t} \quad (4)$$

In this case, transforming the regressors by first differencing removes the fixed country-specific effect as it does not vary with time, as shown in equation (5).

$$\Delta \mu_{i,t} = \Delta \delta_i + \Delta \lambda_t + \Delta \varepsilon_{i,t} = \Delta \lambda_t + \Delta \varepsilon_{i,t} \quad (5)$$

Equation (5) fits instruments for the differenced variables that are not strictly exogenous with differenced lags of one and two years. Arellano and Bond (1991) also have developed tests for autocorrelation, which, if present, can make some lags invalid as instruments. A problem, however, is that applying GMM to small samples, as in this case, can lead to over rejection of the null hypotheses (Hansen, Heaton and Yaron, 1996). Consequently, those results must be interpreted with caution. Overall, however, using alternative techniques is important to obtain general inferences about the relationships evident from the data.

III. DATA

The list of countries in the study is given in the appendix. The principal data requirement is some degree of time-variation to apply panel data techniques that control for unobserved, time-invariant characteristics, which could potentially explain labour market outcomes.³ The data are available over the period 1997-2014 for 18 nations.

The data are obtained from internationally recognized data sources. The dependent variable, child labour (*CL*), is available from the World Bank's World Development Indicators and is measured by children in employment (male, female and total), as a proportion of children aged 7 to 14. The World Bank collates child labour data obtained from household surveys by ILO, the United Nations Children's Fund (UNICEF), the World Bank, and national statistical offices. It adheres to the definition of economic activity adopted by the 13th International Conference of Labour Statisticians, which classifies a person as employed if they have been engaged in at least one hour in any activity relating to the production of goods and services during the reference period.

Those data are generally available from 1997 for most developing countries. However, the household level surveys from which the data come from are generally conducted every five years, with gaps within some economies being larger. Standard multivariate econometric analysis generally requires a relatively large sample size. Presently, each economy has approximately two to three observations for the entire period, providing a total sample of approximately 45 observations. It is well understood that labour market outcomes move slowly within countries, therefore, linear interpolation is an acceptable technique used to maximize the number of

³ Panel data are defined by multiple cases (countries) being observed at two or more time periods. The cross-sectional information (countries) is used to capture differences between economies, while the time-series or within-subject information reflects changes within countries over time. Panel data regression techniques allow the model to take advantage of those different types of information.

observations (Blanchard and Wolfers, 2000; Bertola, Blau and Kahn, 2001; Dreher and Gaston, 2008). The child labour variables are linearly interpolated under the assumption that they follow a constant trend between missing years.⁴

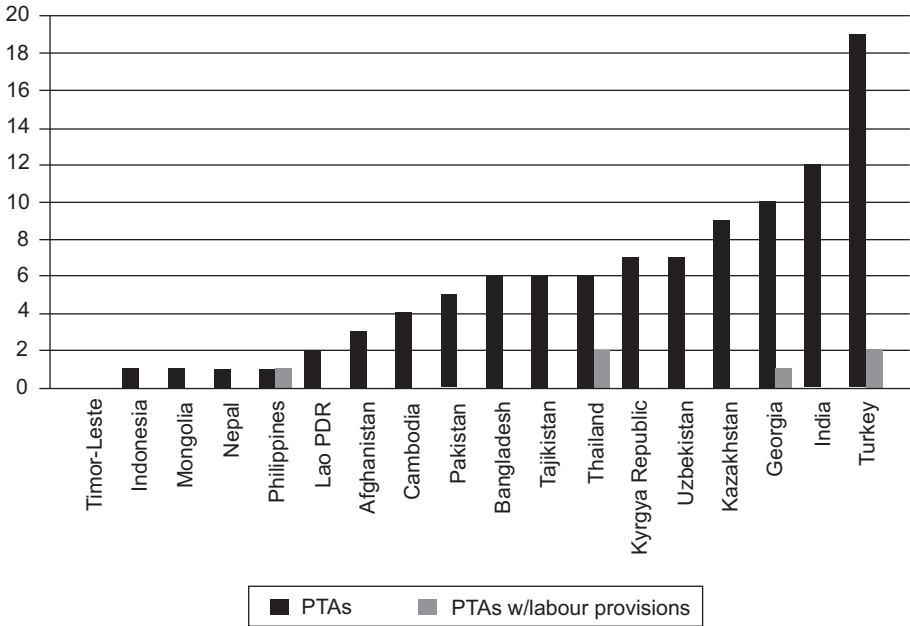
This technique allows the econometric models to capture changes in the dependent variable as shifts in overall trends between observed, rather than imputed, observations. Given that a shock in period t is only observed to affect a change in the dependent variable (and its trend) in period $t+1$, the econometric results can potentially undervalue the true relationship between the dependent and independent variables. In that regard, the results must be interpreted with caution.

Data on preferential trade agreements and preferential trade agreements with labour provisions are sourced from Engen (2017), who has created a data set containing the number of preferential trade agreements and preferential trade agreements with labour provisions for a selection of countries in the Asia-Pacific region. Out of 173 active preferential trade agreements in the region, Engen (2017) identifies that 34 have a labour provision, amounting to approximately 20 per cent of all agreements. However, Engen also notes that out of the agreements entered into force starting in 2004, the share of those having provisions is 33 per cent. Figure 2 gives a summary of the data on preferential trade agreements and preferential trade agreements with labour provisions for the countries used in the forthcoming analysis. The figure highlights that agreements with labour provisions are clustered around a number of countries. Thailand and Turkey, for example, have the most preferential trade agreements with labour provisions. The statistical analyses below use cumulative sums of each variable in year t .

The remaining macro-level explanatory variables used in the regressions build on studies focusing on the determinants of child labour (Chernichovsky, 1985; Patrinos and Psacharopoulos, 1997; Basu and Van, 1998; Ray, 2000; Edmonds, 2008; Edmonds and Pavcnik, 2005; Beegle, Dehejia and Gatti, 2006; Edmonds and Schady, 2008). As mentioned above, most previous studies on this topic find that child labour is a function of income and educational attainment. Income is proxied with gross domestic product (GDP) per capita, which is measured in thousands of 2010 United States dollars. Educational attainment is captured through primary and secondary enrolment rates. The latter variables capture the opportunity cost of child work and parent's level of education, given that higher current enrolment rates are associated with higher levels of parental educational attainment (Wilson, 2001). Enrolment rates are presented as percentages of the relevant age groups. The rule of law is also included because in most instances child labour is illegal. Accordingly, it is

⁴ Interpolation uses the standard formula, relying on the *ipolate* command in STATA.

Figure 2. Asia-Pacific countries with preferential trade agreements and preferential trade agreements with labour provisions, 2016



Source: Calculations using data from Engen (2017).

Note: PTAs, preferential trade agreements.

assumed that the problem is more likely to be observed in the absence of the rule of law. According to the World Bank, the rule of law variable captures the extent to which people perceive confidence in and abide by the rules of their society. This measure focuses on indicators, such as the quality of contract enforcement, property rights, the police and the courts, as well as on the likelihood of crime and violence (Kaufmann, Kraay and Mastruzzi, 2011). The rule of law gives a country’s score on an aggregate indicator ranging from approximately -2.5 to 2.5. Those data are available from the Worldwide Governance Indicator database. Finally, openness (trade as a share of GDP) is also included to control for trade exposure, which can potentially influence child labour opportunities (Edmonds and Pavcnik, 2005). Table 1 shows a highlight of the summary statistics.

Table 1. Summary statistics

Variable	Observations	Mean	Standard deviation	Minimum	Maximum
Child labour (male)	127	18.44	14.16	1.9	52.4
Child labour (female)	127	17.01	15.68	1.6	52.4
Child labour (total)	127	17.75	14.72	1.7	52.3
GDP per capita	127	1.79	2.02	0.39	9.72
Primary enrolment rate	127	107.69	11.89	91.97	145.41
Secondary enrolment rate	127	66.44	19.91	18.87	99.38
Rule of law	127	-0.69	0.46	-1.94	0.28
Openness	127	81.10	39.77	25.55	201.80
Total PTAs	127	3.48	3.08	0	12
Total PTAs w/ labour provisions	127	0.05	0.28	0	2

Source: Authors calculations based on data from Engen (2017) and World Development Indicators.

Notes: PTAs, preferential trade agreements. Child labour, primary and secondary enrolment rates, and openness are measured as percentages. GDP per capita is measured in thousands of 2010 United States dollars. The rule of law gives a country's score on the aggregate indicator, in units of a standard normal distribution ranging from approximately -2.5 to 2.5. PTAs and PTAs with labour provisions are cumulative sums.

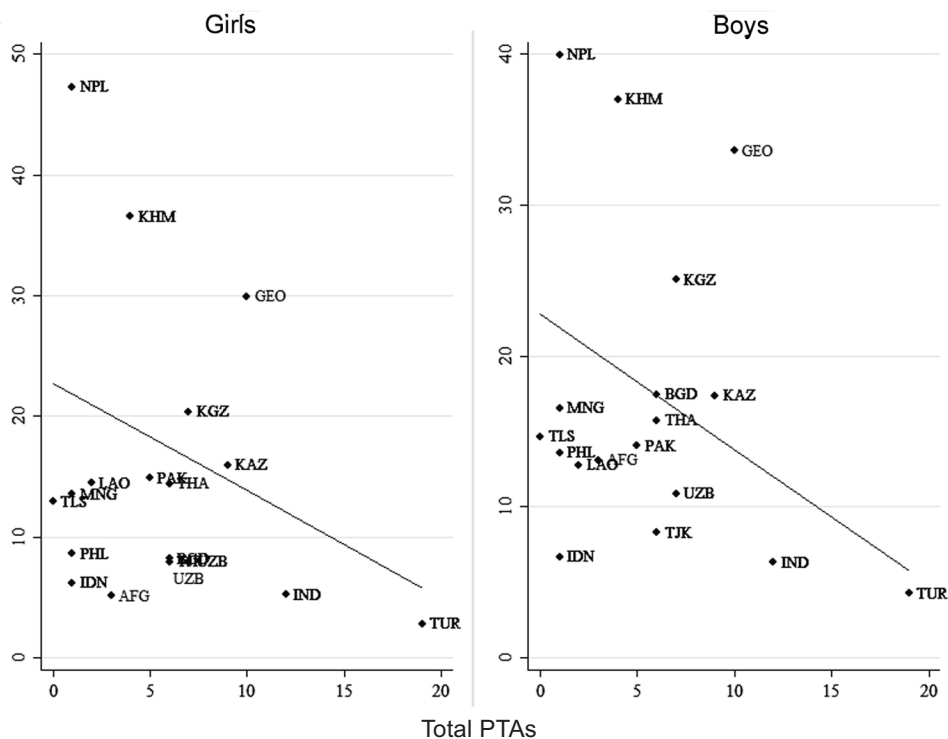
IV. RESULTS

Graphical analysis and preliminary results

In this section, the relationship between preferential trade agreements and preferential trade agreements with labour provisions with child labour are examined extensively. Figures 3 and 4 provide graphical information about the correlations between the variables of interest. The figures show encouraging results – the more preferential trade agreements and such agreements with labour provisions that an economy has, the lower its incidences of child labour for male and female children.

Nevertheless, both figures highlight that only a handful of economies have signed preferential trade agreements with labour provisions. Figure 4 shows that countries that have signed multiple preferential trade agreements with labour provisions have lower incidences of child labour. However, this may be because those provisions have a real effect on the economy or economies that have signed the provisions when child labour is already low. The remainder of the section contains a discussion of tests to determine whether this relationship is robust to the inclusion of other explanatory variables and panel data regression techniques that account for potential reverse causality.

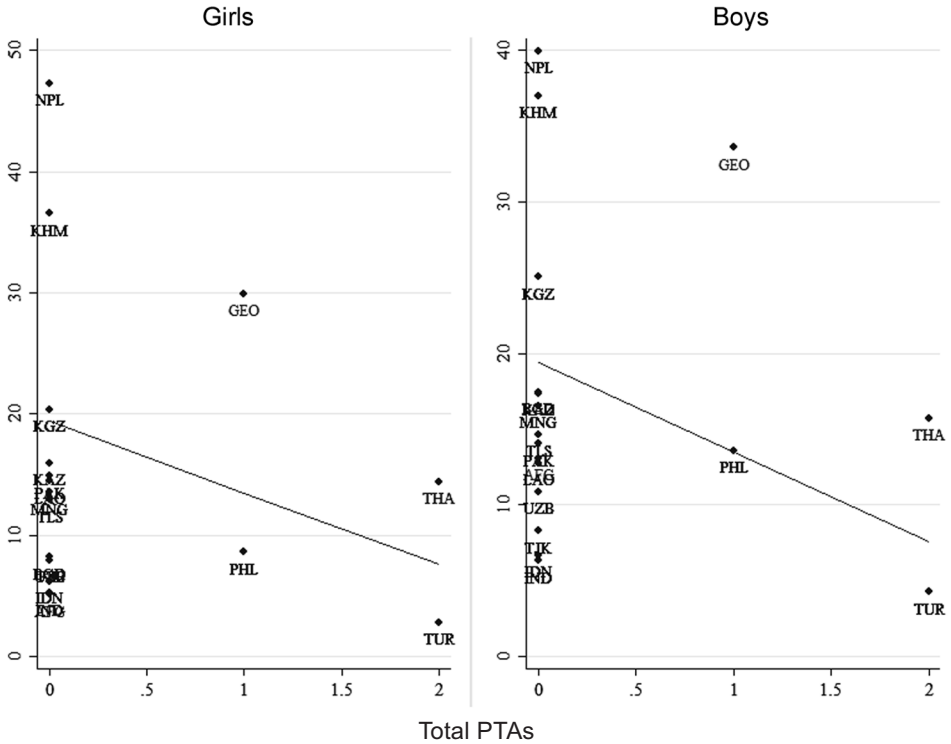
Figure 3. Preferential trade agreements versus child labour



Source: Calculations based on data from World Development Indicators and Engen (2017).

Notes: AFG, Afghanistan; BGD, Bangladesh; GEO, Georgia; IND, India; IDN, Indonesia; KAZ, Kazakhstan; KGZ, Kyrgyzstan; KHM, Cambodia; LAO, Lao People's Democratic Republic; MNG, Mongolia; NPL, Nepal; Pak, Pakistan; PHL, Philippines; TJK, Tajikistan; THA, Thailand; TLS, Timor-Leste; TUR, Turkey; and UZB, Uzbekistan.

Figure 4. Preferential Trade Agreements with labour provisions versus child labour



Source: Calculations based on data from the World Development Indicators and Engen (2017).

Notes: AFG, Afghanistan; BGD, Bangladesh; GEO, Georgia; IND, India; IDN, Indonesia; KAZ, Kazakhstan; KGZ, Kryrgyzstan; KHM, Cambodia; LAO, Lao People’s Democratic Republic; MNG, Mongolia; NPL, Nepal; Pak, Pakistan; PHL, Philippines; TJK, Tajikistan; THA, Thailand; TLS, Timor-Leste; TUR, Turkey; and UZB, Uzbekistan.

Econometric analysis and results

The results of the fixed effects regression analyses are presented in table 2. Column 1 uses female child labour as the dependent variable, column 2 focuses on its male counterpart, and column 3 uses total (female and male) child labour as the dependent variable. The findings in table 2 confirm a number of expectations. In particular, higher income is associated with lower child labour – an increase in GDP per capita by \$1,000 (2010) is associated with a decline in child labour by approximately four percentage points. This is consistent with a number of previous empirical studies that find that child labour is a function of poverty (Ray, 2000).

Additionally, higher rates of secondary enrolment rates are found to be associated with lower incidences of child labour – an increase in the secondary enrolment rate by one percentage point is associated with approximately a one percentage point decline in child labour, with all other things being equal. This is also consistent with previous findings – child labour is, unsurprisingly, most prominent among older children (Ravallion and Wodon, 2000). As a result, if children are attending secondary school, they are probably less likely to be working.

Table 2. Child labour regressions, fixed effects models

	(1)	(2)	(3)
Child labour indicator	Girls	Boys	Total
GDP per capita	-4.13 ** [-2.88]	-4.43 *** [-3.01]	-4.28 *** [-2.96]
Primary enrolment rate	-0.34 [-1.70]	-0.43 [-1.69]	-0.39 [-1.71]
Secondary enrolment rate	-0.76 *** [-4.28]	-0.80 *** [-3.44]	-0.79 *** [-3.80]
Rule of law	-2.16 [-0.55]	-4.13 [-0.79]	-3.13 [-0.70]
Openness	0.050 [0.85]	0.051 [0.76]	0.052 [0.82]
Total preferential trade agreements	-0.22 [-0.50]	-0.45 [-0.81]	-0.35 [-0.70]
Total preferential trade agreements with labour provisions	-5.74 * [-1.83]	-8.34 ** [-2.26]	-7.15 * [-2.08]
Country and year fixed effects?	Yes	Yes	Yes
Observations	127	127	127
R-squared	0.58	0.53	0.56
Number of countries	18	18	18

Source: Authors' calculations on data from World Development Indicators, Worldwide Governance Indicators and Engen (2017).

Notes: *, **, and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively. Robust t-statistics in brackets. Child labour variables are linearly interpolated to maximize the number of available observations. Child labour is defined as the per cent of girls, boys or total (girls and boys) aged between 7 and 14 in employment.

Turning to the trade related variables, while preferential trade agreements are found to have a statistically insignificant relationship with child labour, preferential trade agreements with labour provisions are found to be negatively and significantly associated with child labour. An increase in the number of signed preferential trade agreements with labour provisions by one is associated with a decline in female, male and total child labour by approximately six, eight and seven percentage points, respectively. This estimated relationship is akin to an economy doubling its GDP per capita.

This gives impetus to the notion that those policy initiatives are having a positive effect on this important phenomenon. However, it remains possible that economies with lower incidences of child labour are signing preferential trade agreements with labour provisions to signal to economic agents in other countries that they are actively engaged in fixing this problem. To begin to test whether this is the case, a Durbin-Wu-Hausman test for endogeneity is performed. The test marginally accepts the null hypothesis (p -value of 0.11) that preferential trade agreements with labour provisions can be treated as exogenous. Given the relatively low p -value, however, endogeneity remains potentially problematic.

In the rest of this section, the two techniques discussed above to address the potential endogeneity problem are adopted. Those techniques assume that all variables are potentially endogenous, with the exception of the rule of law. GDP per capita (income) is potentially endogenous if, as assumed in Basu and Van (1998), children are productive workers called upon when households want to increase total household income. Enrolment rates are endogenous if an increase in child labour pulls children out of school – a standard assumption. Finally, openness and total preferential trade agreements are potentially endogenous if developing countries are more likely to sign preferential trade agreements and engage in other trade-expanding policies when their existing labour market outcomes are healthier. The results are presented in table 3.

Overall, after accounting for endogeneity, only primary and secondary enrolment rates are found to decrease child labour. The lagged regressions show that primary enrolment rates in the previous year do not have a statistically significant relationship with child labour. However, the GMM regressions show that an increase in primary enrolment rates by one percentage point leads to a decline in child labour by approximately 0.6 percentage points, all things held equal. Similarly, both the lagged and GMM regressions show that an increase in secondary enrolment rates by one percentage point are associated with a decline in child labour by approximately 0.7 percentage points, all things held equal. This suggests that access to education at the primary and secondary levels is likely to increase the opportunity cost of child

work, leading to more households opting to send their children to school rather than work. The implications for policy are that the provision of quality education is likely to lead to the desired labour market outcomes.

Table 3. Child labour regressions, accounting for endogeneity

	(1)	(2)	(3)	(4)	(5)	(6)
Child labour indicator:	Girls	Girls	Boys	Boys	Total	Total
Model:	Lag	GMM	Lag	GMM	Lag	GMM
GDP per capita	4.42 [0.87]	7.99 [1.43]	3.38 [0.67]	7.61 [0.87]	3.90 [0.77]	7.84 [1.10]
Primary enrolment rate	-0.085 [-0.54]	0.58 *** [4.73]	-0.064 [-0.35]	0.54 *** [4.59]	-0.076 [-0.44]	0.56 *** [5.04]
Secondary enrolment rate	-0.62 ** [-2.46]	-0.73 *** [-3.72]	-0.64 ** [-2.29]	-0.66 * [-1.94]	-0.63 ** [-2.37]	-0.70 *** [-2.90]
Rule of law	-11.2 [-1.39]	-13.2 [-0.66]	-12.3 [-1.43]	-16.9 [-0.63]	-11.8 [-1.41]	-15.7 [-0.69]
Openness	-0.067 [-1.18]	-0.19 [-1.53]	-0.084 [-1.26]	-0.20 [-1.14]	-0.075 [-1.22]	-0.19 [-1.31]
Total preferential trade agreements	0.63 [1.28]	-1.06 [-0.76]	0.88 [1.67]	-1.36 [-0.81]	0.76 [1.48]	-1.21 [-0.83]
Total preferential trade agreement with labour provisions	0.24 [0.096]	-22.5 [-0.57]	-0.62 [-0.21]	-20.3 [-0.46]	-0.20 [-0.072]	-21.0 [-0.50]
Country and year controls?	Yes	Yes	Yes	Yes	Yes	Yes
Observations	93	127	93	127	93	127
R-squared	0.50		0.45		0.47	
Number of countries	18	18	18	18	18	18
AR(1) p-value		0.53		0.89		0.71
AR(2) p-value		0.44		0.53		0.48
Hansen test p-value		0.88		0.89		0.89

Source: Authors' calculations on data from World Development Indicators, Worldwide Governance Indicators and Engen (2017).

Notes: *, **, and *** denote statistical significance at the 10, 5 and 1 per cent levels, respectively. Robust t-statistics in brackets. Child labour is defined as the per cent of girls, boys, or boys and girls (total) aged between 7 and 14 in employment. Child labour variables in columns 2, 4 and 6 are linearly interpolated. Child labour variables in columns 1, 3 and 5 are five-year moving averages. The rule of law is not lagged.

Table 3 also shows that preferential trade agreements and such agreements with labour provisions have a statistically insignificant effect on child labour when accounting for endogeneity. That is, the table shows that there is no evidence of a causal relationship between signing a preferential trade agreement with labour provisions and experiencing an improvement in child labour.

V. POLICY IMPLICATIONS

The regression analyses above suggest that labour provisions in preferential trade agreements are unlikely to lead to significantly lower child labour. To many policymakers, this may not be surprising given the weak enforcement mechanisms in preferential trade agreements with labour provisions. Draper, Khumalo and Tigere (2017) discuss the heterogeneity of enforcement mechanisms of sustainable development in cooperation agreements, more generally. They highlight that while some economies or regional blocks maintain a soft approach to sustainable development provisions in agreements, others have incorporated stronger sustainable development obligations. The problem, however, is that developing economies, where child labour issues and other social problems are arguably worse, exhibit more apprehension about including sustainable development commitments in agreements.

Draper, Khumalo and Tigere (2017) suggest that one possible solution is multilateralism – the World Trade Organisation (WTO) could promote the extension of deep agreements containing sustainable development provisions. WTO members could potentially enable that process by facilitating adoption of clear accession mechanisms in preferential trade agreements and regional agreements to encourage the conversion of best endeavour provisions to mandatory provisions. This scenario is perhaps unlikely in a global setting. However, the Trans-Pacific Partnership was perhaps a good example on how regional trade agreements could be formulated to incorporate labour market and environmental provisions, as well as governance goals.

Nevertheless, even if provisions were to lead to legal changes, developing economies face significant capacity constraints that curtail their ability to implement the obligations (ILO, 1996). For a provision to be effective, developing countries need significant support to enhance existing monitoring processes. Importantly, enhanced monitoring processes must be implemented in all sectors, including the agricultural sector, where child labour is most prevalent.

The graphical correlation and simple econometric analyses reveal that countries with lower incidences of child labour are more likely to have signed preferential trade agreements with labour provisions. That is, there is a correlation between preferential trade agreements with labour provisions and less child labour,

but this relationship is unlikely to be causal. Those findings could be attributed to data quality issue; indeed, a significant degree of manipulation was undertaken prior to econometric modelling, suggesting that the results must be interpreted with caution. Intuitively, however, a hypothesis that can potentially reconcile those empirical findings may be related to governments signing preferential trade agreements with labour provisions after their labour market conditions have improved. There are two possible reasons why countries may want to do this.

The first one is to signal to other countries that their labour markets function well or are “fair”. This may be a good strategy for developing nations competing in a market where labour standards are internationally visible and increasingly important, particularly to consumers. Indeed, empirical evidence shows that countries that adopt labour standards attract greater foreign direct investment (FDI) (Aggarwal, 1995; Kucera, 2002). Kucera (2002) explains those findings by suggesting that while labour standards increase labour costs, the significance of labour costs in FDI decisions is marginally small, thus, outweighed by other positive impacts of labour standards, such as increased quality of labour or political stability. However, those findings can potentially vary within and between countries (or industries). Blanton and Blanton (2012), for example, find that higher labour standards are positively correlated with FDI in the manufacturing sector, while negatively correlated with FDI in the services sector. Nevertheless, this notion does present a viable strategy to developing nations that exhibit low incidences of child labour and/or compliance with the other ILO core labour standards. The second reason why nations may want to adopt labour standards in preferential trade agreements after their conditions have improved is to pressure other countries to improve their own labour markets. This may be an important strategy for governments concerned about the state of affairs in other countries or worried about unfair competition or a “race to the bottom” of labour standards in globalized environments. Indeed, many observers suggest that the latter is a prominent strategy employed by developed economies in order to deny developing countries the use of their comparative advantage (Bhagwati, 1995; Engen, 2017). Some developing economies may choose to also do this to mitigate against the possible negative labour market consequences of economies with lax labour market conditions entering the global economy. As argued in the introductory section, the entrance of economies with poorer labour standards into internationally competitive production networks is often perceived by political agents as putting downward pressure on existing labour market conditions.

The results also reveal that rather than using trade policy to lower child labour, improving access to educational opportunities is likely to significantly reduce this phenomenon. Increasing primary and secondary enrolment rates significantly reduces child labour. Intuitively, more and qualitative better educational opportunities should, therefore, lower incidences of child labour within countries.

VI. CONCLUDING REMARKS

The present paper is centred on whether trade policy is an efficient conduit to lower child labour in some developing countries. The results reveal that a causal relationship between preferential trade agreements with labour provisions and child labour is unlikely – current agreements are possibly too soft, lacking enforcement mechanisms, making their effect void. Instead, improving educational access is likely to cause lower child labour incidences within economies. This suggests that, in that respect, policies aiming at improving child welfare directly are a better tool to lower child labour than trade policies. Rather, the signing of labour-friendly trade agreements is potentially a mechanism that governments use to signal to the international community that they care about labour issues.

Economies can potentially benefit from signing agreements after conditions improve in at least two ways. On the one hand, some developing economies may use this approach to signal to other nations that they care about labour standards, which has been found to increase FDI. On the other hand, those countries may choose to undertake those strategies in order to protect their own labour markets from a potential race to the bottom in labour standards. In either case, signing preferential trade agreements with labour provisions is a sensible strategy for economies with relatively better labour market conditions. To understand this issue comprehensively, future studies should include labour market outcomes as potential inputs into econometric functions explaining why countries sign preferential trade agreements and preferential trade agreements with labour provisions.

It is important to note that data limitations make a comprehensive analysis of child labour difficult. The available data from most economies are sourced from household surveys conducted every five years. As a result, applying standard econometric techniques to such data requires significant data manipulation and some important assumptions – namely that labour market movements are slow. This means that the results in this paper must be interpreted with caution.

Furthermore, current data availability does not allow for a robust analysis of other core labour standards. To test the effects of globalization, particularly trade and investment, on welfare outcomes, governments must actively collect time-series information on, for example, freedom of association, incidences of forced labour, and different types of discrimination. Future work needs to focus on the nexus between globalization, international legal agreements and labour market outcomes to understand the consequences of these economic shocks and provide policy initiatives that can adequately prepare segments of the population for, at least, the most common potential negative outcomes.

REFERENCES

- Aggarwal, Mita (1995). International trade, labor standards, and labor market conditions: an evaluation of the linkages. Working Paper, 95-06-C. Washington, D.C.: United States International Trade Commission.
- Akabayashi, Hideo, and George Psacharopoulos (1999). The trade-off between child labour and human capital formation: a Tanzanian case study. *Journal of Development Studies*, vol. 35, No. 5, pp. 120-140.
- Arellano, Manuel, and Stephen Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *The Review of Economic Studies*, vol. 58, No. 2, pp. 277-297.
- Basu, Kaushik, and Pham Hoang Van (1998). The economics of child labor. *American Economic Review*, vol. 88, No. 3, pp. 412-427.
- Beegle, Kathleen, Rajeev H. Dehejia, and Roberta Gatti (2006). Child labour and agricultural shocks. *Journal of Development Economics*, vol. 81, No. 1, pp. 80-96.
- Bertola, Giuseppe, Francine D. Blau, and Lawrence M. Kahn (2001). Comparative analysis of labour market outcomes: lessons for the US from international long-run evidence. NBER Working Paper, No. w8526. Cambridge, MA: National Bureau of Economic Research.
- Bhagwati, Jagdish (1995). Trade liberalisation and 'fair trade' demands: addressing the environmental and labour standards issues. *The World Economy*, vol. 18, No. 6, pp. 745-759.
- Blanchard, Olivier, and Justin Wolfers (2000). The role of shocks and institutions in the rise of European unemployment: the aggregate evidence. *The Economic Journal*, vol. 110, No. 462, pp. 1-33.
- Blanton, Robert G., and Shannon L. Blanton (2012). Rights, institutions, and foreign direct investment: an empirical assessment. *Foreign Policy Analysis*, vol. 8, No. 4, pp. 431-452.
- Bonnal, Michaël (2010). Economic growth and labour standards: evidence from a dynamic panel data model. *Review of Development Economics*, vol. 14, No. 1, pp. 20-33.
- Chan, Anita, and Robert J.S. Ross (2003). Racing to the bottom: international trade without a social clause. *Third World Quarterly*, vol. 24, No. 6, pp. 1011-1028.
- Chernichovsky, Dov (1985). Socioeconomic and demographic aspects of school enrollment and attendance in rural Botswana. *Economic Development and Cultural Change*, vol. 33, No. 2, pp. 319-332.
- Draper, Peter, Nkululeko Khumalo, and Faith Tigere (2017). Sustainability provisions in regional trade agreements: can they be Multilateralised? RTA Exchange Overview Paper, July. Geneva: International Centre for Trade and Sustainable Development (ICTSD) and Inter-American Development Bank (IDB).
- Dreher, Axel, and Noel Gaston (2008). Has globalization increased inequality? *Review of International Economics*, vol. 16, No. 3, pp. 516-536.
- Doumbia-Henry, Cleopatra, and Eric Gravel (2006). Free trade agreements and labour rights: recent developments. *International Labour Review*, vol. 145, No. 3, pp. 185-206.
- Edmonds, Eric V. (2008). Child labour. In *Handbook of Development Economics*, vol. 4, T. Paul Schultz and John A. Strauss, eds. Amsterdam: North-Holland.

- Edmonds, Eric V., and Nina Pavcnik (2005). Child labour in the global economy. *Journal of Economic Perspectives*, vol. 19, No. 1, pp. 199-220.
- Edmonds, Eric V., and Norbert Schady (2008). Poverty alleviation and child labour. NBER Working Paper, No. 15345. Cambridge, MA: National Bureau of Economic Research.
- Engen, Lars (2017). Labour provisions in Asia Pacific Preferential trade agreements. Background Paper, No. 1/2017 prepared for the Development Account Project on Enhancing the Contribution of Preferential Trade Agreements to Inclusive and Equitable Trade. Bangkok: Economic and Social Commission for Asia and the Pacific. Available from www.unescap.org/sites/default/files/Background%20Material%20-%20Labour%20provisions%20in%20Asia-Pacific%20PTAs.pdf.
- Hansen, Lars Peter, John Heaton, and Amir Yaron (1996). Finite-sample properties of some alternative GMM estimators. *Journal of Business & Economic Statistics*, vol. 14, No. 3, pp. 262-280.
- Häberli, Christian, Marion Jansen, and José-Antonio Monteiro (2012). Regional trade agreements and domestic labour market regulation. In *Policy Priorities for International Trade and Jobs*, Douglas Lippoldt, ed. Paris: OECD.
- International Labour Organization (ILO) (1996). Child labour: What is to be done? Document for discussion at the Informal Tripartite Meeting at the Ministerial Level.
- _____ (2013). *Making Progress Against Child Labour – Global Estimates and Trends 2000-2012*. Geneva.
- Kaufmann, Daniel, Aart Kraay, and Massimo Mastruzzi (2011). The worldwide governance indicators: methodology and analytical issues. *Hague Journal on the Rule of Law*, vol. 3, No. 2, pp. 220-246.
- Krueger, Alan B. (1997). Observations on international labour standards and trade. In *Annual World Bank Conference on Development Economics*, M. Bruno and B. Pleskovic, eds. Washington, D.C.: World Bank.
- Kucera, David (2002). Core labour standards and foreign direct investment. *International Labour Review*, vol. 141, No. 1-2, pp. 31-69.
- Kucera, David, and Ratish Sarna (2006). Trade union rights, democracy, and exports: a gravity model approach. *Review of International Economics*, vol. 14, No. 5, pp. 859-882.
- Maskus, Keith E. (2002). Regulatory standards in the WTO: comparing intellectual property rights with competition policy, environmental protection, and core labour standards. *World Trade Review*, vol. 1, No. 2, pp. 135-152.
- Patrinos, Harry Anthony, and George Psacharopoulos (1997). Family size, schooling and child labor in Peru – an empirical analysis. *Journal of Population Economics*, vol. 10, No. 4, pp. 387-405.
- Ravallion, Martin, and Q. Wodon (2000). Does child labour displace schooling? Evidence on behavioural responses to an enrollment subsidy. *The Economic Journal*, vol. 110, No. 462, pp. 158-175.
- Ray, Ranjan (2000). Analysis of child labour in Peru and Pakistan: a comparative study. *Journal of Population Economics*, vol. 13, No. 1, pp. 3-19.
- Roggero, Paola, and others (2007). The health impact of child labour in developing countries: evidence from cross-country data. *American Journal of Public Health*, vol. 97, No. 2, pp. 271-275.

- United Nations, Economics and Social Commission for Asia Pacific (ESCAP) (2017). *Asia-Pacific Trade and Investment Report 2017: Channelling Trade and Investment into Sustainable Development*. Sales No. E.17.II.F.22.
- Wilson, Kathryn (2001). The determinants of educational attainment: modeling and estimating the human capital model and education production functions. *Southern Economic Journal*, vol. 67, No. 3, pp. 518-551.
- Zabaleta, Mariela Buonomo (2011). The impact of child labour on schooling outcomes in Nicaragua. *Economics of Education Review*, vol. 30, No. 6, pp. 1527-1539.

APPENDIX

Country list

Afghanistan	Mongolia
Bangladesh	Nepal
Cambodia	Pakistan
Georgia	Philippines
India	Tajikistan
Indonesia	Thailand
Kazakhstan	Timor-Leste
Kyrgyzstan	Turkey
Lao People's Democratic Republic	Uzbekistan

WHAT EXPLAINS REGIONAL IMBALANCES IN PUBLIC INFRASTRUCTURE EXPENDITURE? EVIDENCE FROM INDIAN STATES

*Biswajit Mohanty, N.R. Bhanumurthy and Ananya Ghosh Dastidar**

Literature on regional growth suggests that divergences in infrastructure is a major factor behind the wide and persistent imbalances in regional growth in India. Using a state infrastructure expenditure function, possible factors that determine infrastructure expenditure and its role in the regional imbalance in infrastructure creation across 14 major Indian states are examined in the present paper. The study indicates that such factors as lagged expenditure, resource mobilization and per capita income may cause varying amounts of infrastructure expenditure across states. It also indicates that spending by the infrastructure-deficit states, political stability and positive spatial dependence in infrastructure expenditure have a balancing effect on infrastructure creation across regions. Those results suggest the need to do the following: (a) harness the favourable factors influencing public expenditure that include improving the financial capacity of the infrastructure-deficit states; (b) strengthen the positive spatial dependence among states through the creation of interstate infrastructure networks, such as railways and national highways; and (c) enable a conducive investment climate, which could boost competition among states for improved infrastructure creation.

* Biswajit Mohanty, Lecturer, A.B. College, Bhadrak, Odisha (email: biswajitm4@gmail.com); N.R. Bhanumurthy, Professor, National Institute of Public Finance and Policy, New Delhi (email: nrbmurthy@gmail.com); and Ananya Ghosh Dastidar, Associate Professor, University of Delhi, New Delhi, (email: agdastidar@gmail.com). An earlier version of the paper was presented at the Papers in Public Economics and Policy Conference, organized by the National Institute of Public Finance and Policy, in March 2017. The authors would like to thank Arfat Ahmad Sofi, Bhartee Bhusana Dash and other participants for their comments and suggestions. Any errors and omissions in the paper are the authors' alone.

JEL classification: H54, R11, R12, C31.

Keywords: Infrastructure, regional imbalance, spatial dependence, Indian states.

I. INTRODUCTION

The role of infrastructure as a significant factor in supporting economic growth at the national and at the regional levels has been emphasized in existing literature.¹ Given that economic growth at the national level depends on growth in the regions within the country, the distribution of infrastructure facilities across different regions within an economy assumes importance in the context of achieving balanced regional growth. The issue is particularly relevant in India as a number of studies on regional development and growth in the country attribute the regional imbalance in infrastructure as being a major factor behind wide and persistent regional disparity (Shah, 1970; Das and Barua, 1996; Ghosh and De, 2005). A key question here is: Why is there such regional imbalance in infrastructure? The answer to this may have interesting implications for policies related to infrastructure set by national and subnational governments.

What drives the provision of infrastructure across different regions within an economy? As most of the infrastructure services are non-excludable, non-rival and prone to market failure, the provision of them occurs mainly through a public policy decision. The literature on this topic attributes the differences in regional infrastructure provision to several factors, including, among them, government's preferences for equity and/or efficiency and its fiscal health, economic status and the demography of the region, political factors, persistence of expenditure on infrastructure overtime, and spatial interdependence in infrastructure expenditure among regions. Those studies, however, are ambiguous regarding the relative importance of those factors in influencing infrastructure expenditure. Given that the empirical studies pertain to different countries and time periods and their findings differ, the issue of regional infrastructure provision becomes case-specific. India is a good case for exploring the factors behind regional infrastructure provision because, of late, there is growing emphasis on infrastructure investment to reduce the regional imbalance. In addition, very few studies on this issue have been undertaken in India, and the ones that have been carried out have dealt with either public expenditure in general or some specific infrastructure expenditure, such as health, but not with the determinants of infrastructure expenditure per se. Those studies have also not considered some crucial factors, such as the role of spatial interdependence in infrastructure

¹ See Romp and de Haan (2007) for a critical survey of the literature.

expenditure among regions and the relationship between infrastructure expenditure and actual infrastructure facilities.

Unlike the existing studies, in the present study, a more comprehensive list of determinants of infrastructure expenditure are considered, namely lagged infrastructure expenditure, government's preference for equity (the effect of current infrastructure stock and poverty ratio), financial capacity, economic status or per capita income, political stability and spatial interdependence in infrastructure expenditure, for a panel of 14 states over a 20-year period from 1991 to 2010. In the study, the determinants of economic and social infrastructure expenditure, capital, and revenue expenditure are examined separately and the potential endogeneity of some of the determinants, such as per capita income and infrastructure stock through a spatial dynamic system generalized method of moments (GMM) are addressed to obtain robust results.

In the following section, some stylized facts about infrastructure expenditure and actual infrastructure creation across states are put forward. Section III contains a brief review of the literature on the determinants of regional infrastructure provision. Next is a discussion of the empirical model adopted and the method used in the study. Section V gives a description of the data and variables used. The following section includes reports of the empirical results and a discussion on the findings and section VII concludes.

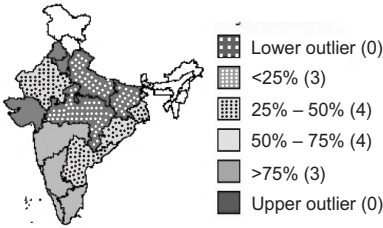
II. SPATIAL DISTRIBUTION OF INFRASTRUCTURE IN INDIA: SOME STYLIZED FACTS

In this section, the regional distribution of infrastructure index is compared with infrastructure expenditure per capita. The maps of the level of per capita infrastructure expenditure vis-à-vis that of infrastructure index for 1991 and 2010 are depicted in figure 1. In the box, group values are mapped into six categories, four quartiles (1-25 per cent, 25-50 per cent, 50-75 per cent, and 75-100 per cent), and two outlier categories at the low and high end of the distribution. Outliers are values that are more than 1.5 times higher than the inter-quartile range (IQR), namely the difference between the seventy-fifth percentile (Q3) and the twenty-fifth percentile (Q1). According to the values, the states in the two upper quartiles and the high outlier are classified as a higher status group (shading areas in the map) and the rest as a lower status group (dotted areas).

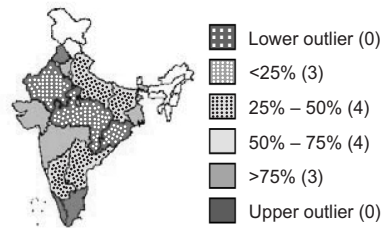
From the box maps in figure 1, the following can be inferred. First, there is a dual pattern of low-infrastructure and high-infrastructure index states, exhibiting an unequal endowment of infrastructure facilities across states. Second, this inequality in

Figure 1. Level of expenditure per capita and infrastructure index

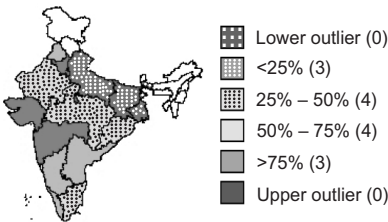
Expenditure-1991



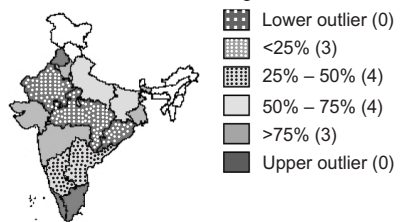
Index-1991



Expenditure-2010



Index-2010



Source: Authors' calculations and mapping using GeoDa software.

infrastructure facilities is also persistent over the years. That is, the same pattern of low-status states, namely Bihar, Madhya Pradesh, Odisha, Rajasthan, Uttar Pradesh and West Bengal, and high-status states, namely Gujarat, Haryana, Karnataka, Kerala, Maharashtra and Punjab, are observed in both 1991 and 2010. Third, the persistence in the relative position of states in the infrastructure index corresponds to their position in infrastructure expenditure. This means that the states that are not able to change their initial status in expenditure per capita are also not able to change their initial status in the index. Fourth, there is a spatial clustering of states with a similar status, with regard to both index and expenditure. The lower status states are seen lying close to each other as indicated by the dotted areas in the map and so are also the higher status states as shown by the shading areas, indicating the possibility of spatial dependence in infrastructure expenditure.

Those stylized facts suggest that the solution for regional balance in infrastructure may lie in more spending on the part of infrastructure-deficient states, given the association between inequality in infrastructure facilities and inequality in infrastructure expenditure. Hence, the unchanged relative position of states in

infrastructure expenditure prompts the need for an explanation as to what is constraining the states from spending more on infrastructure. In addition: What is the implication of the spatial clustering of states with similar status and does it have a role in influencing infrastructure expenditure? The explanations may have to do with different factors affecting the expenditure on infrastructure provision as discussed in the literature review section. In the next section, a discussion in the literature about the factors that determine infrastructure spending decisions is considered.

III. DETERMINANTS OF REGIONAL INFRASTRUCTURE PROVISION: AN OVERVIEW OF LITERATURE

Broadly, the literature identifies three groups of factors that are behind the regional infrastructure provision, namely economic, political and spatial factors. Economic factors are comprised of equity and/or efficiency considerations, resource constraints, demography and temporal persistence. It has long been recognized that efficiency and equity considerations are major elements in government's preferences behind the allocation of infrastructure expenditure across regions (Mera, 1967; 1973; Behrman and Craig, 1987; Anderstig and Mattsson, 1989). While efficiency in the allocation of infrastructure spending entails incurring increased expenditure for the region where the marginal productivity of the expenditure is highest, the element of equity implies undertaking more infrastructure investment in the poorer regions as well. The empirical findings suggest that the government preferences in regional allocation of infrastructure expenditure diverge, with evidences of only equity (Yamano and Ohkawara, 2000), only efficiency (Mizutani and Tanaka, 2008) and of both equity and efficiency (Zheng and others, 2013; Kemmerling and Stephan, 2002; Castells and Solé-Ollé, 2005). Furthermore, one factor cited as being behind the absence of an equity motive in the case of developing countries is the lack of financial resources (Arimah, 2005). With regard to the influence of demography, certain categories of infrastructure are population-serving, such as hospitals and schools, and expenditure on them increases with the increase in population. However, for other categories of infrastructure that are space serving, such as roads, pipelines and waterways, expenditure on them decreases with an increase in population size or urbanization (Biehl, 1989). While Hansen (1965) finds a positive relationship between infrastructure expenditure and population size, Randolph, Bogetic and Hefley (1996) and Yu and others (2011) find that infrastructure expenditure declines with higher urbanization and population size, pointing to the existence of economies of scale in infrastructure provision.

Public expenditure on infrastructure projects could also show the phenomenon of temporal persistence. That is, once some expenditure is incurred on an infrastructure project, successive expenditures takes place in subsequent years until it is completed (Castells and Solé-Ollé, 2005; Zheng and others, 2013) or sometimes for maintenance. Moreover, the ability of the government to finance infrastructure depends on its revenue generation capacity (Arimah, 2005; Kemmerling and Stephan, 2002; Yu and others, 2011; Randolph, Bogetic and Hefley, 1996; Mizutani and Tanaka, 2008; Painter and Bae, 2001). In addition, the higher the economic status of a region can also lead to greater infrastructure spending, partly because of the higher level of public revenue, and also in response to higher demand for infrastructure from the well-off citizens (Randolph, Bogetic and Hefley, 1996; Arimah, 2005).

In addition to economic factors, political motives, such as the possibility of electoral gains and the political affiliation of the incumbent government (Costa-I-Font, Rodriguez-Oreggia and Lunapla, 2003; Joanis, 2011; Zheng and others, 2013; Castells and Solé-Ollé, 2005; Solé-Ollé, 2013; Crain and Oakley, 1995), the government's sensitiveness to the existence of lobbying from large business firms (Crain and Oakley, 1995; Mizutani and Tanaka, 2008; Cadot, Röller and Stephan, 1999) and to voters' preferences for more infrastructure (Ghate, 2008), and a majority or stable government (Kemmerling and Stephan, 2002; Crain and Oakley, 1995; Mizutani and Tanaka, 2008) can influence the regional allocation of infrastructure investment.

Apart from economic and political factors, spatial factors may also influence infrastructure expenditure across regions. This refers to the dependence on the level of public expenditure among neighbouring regions, which is explained by the existence of spillover effects,² yardstick competition³ and tax competition⁴ (Brueckner, 2003; Revelli, 2005; 2006). Yu and others (2011) find positive spillover effects among city governments' infrastructure expenditure. The spatial dependence in fiscal choices may also result from the lower tier (municipal) governments, in a federal set-up, reacting in a similar fashion to higher-tier (provincial) authorities' policies (Revelli,

² The expenditure by the government of a region could create beneficial or unfavourable effects on its neighbouring regions, reducing or increasing the need for spending on infrastructure in the latter region.

³ The ill-informed voters in a jurisdiction look at public services and taxes in neighbouring jurisdiction as yardsticks to judge the quality and efficiency of the same provided by their own government. Hence, governments are likely to mimic the behaviour (decisions on public expenditure) of their neighbours so as not to lose the confidence of the voters.

⁴ Tax competition hypothesis suggests that fiscal policy (with regard to tax rate and/or public spending) in one region elicits similar policy responses from other surrounding regions, leading to fiscal competition among governments of different regions in attracting people and businesses.

2003). Zheng and others (2013) find evidence of significant spatial dependence in central government investments across regions in China, resulting in two or more neighbouring jurisdictions receiving higher investment from the central government simultaneously.

The studies on the determinants of infrastructure expenditure at the regional or subnational levels are mostly directed towards developed countries. Furthermore, the findings about the relative importance of factors influencing infrastructure expenditure vary across studies. While some studies reveal the importance of economic factors, others have found that the role of political and institutional factors is significant and a few others have pointed to the role of spatial interaction among regions in influencing infrastructure expenditure. The difference in findings across studies is not surprising given that each of them pertain to different regions and time. While the form of governments, geographical size and conditions, demographic, economic and institutional features vary from region to region, the impact of some factors may vary over time as well. The findings may also be different because a different category of infrastructure services is being considered or of the adoption of different methodologies. Moreover, data deficiencies result in constraints in considering all factors in the case of all economies or regions. In view of those variations, the study of determinants of interregional expenditure on infrastructure is an empirical issue and the finding is likely to be case- or time-specific to some extent.

Empirical literature on the determinants of infrastructure expenditure across states is rather sparse with regard to India. The studies in the country are either concerned with the behaviour of public expenditure in general or on specific infrastructure expenditure, such as health and education. The existing studies are also less comprehensive with respect to the different possible factors, as most of them focus on political and, to some extent, on economic factors. For example, Khemani (2010) provides evidence of disproportionately more budget spending of state governments going to social programmes, such as employment and welfare transfers, which is more likely to ensure electoral gains than capital spending in infrastructure. Other studies demonstrate the association between coalition government and public expenditure (Dutta, 1997; Lalvani, 2005; Dash and Raja, 2013; Chaudhuri and Dasgupta, 2006). A few studies highlight the role of economic factors, such as per capita income and population size (Dash and Raja, 2013). Studies that explore the determinant of health and education expenditure, such as Rahman (2008) and Chatterji, Mohan and Dastidar (2015), find that per capita income and sources of revenue are significant determinants of expenditure.

To date, no studies in India have explored the role of spatial interaction effect and the existence of equity or efficiency motive nor have they examined the implications of infrastructure expenditure across states for regional imbalance in

infrastructure endowments, which matters most for balanced regional growth. In the present study, an attempt is made to fill the void in the literature by addressing all those issues. Using a panel data set of 14 major states during the period 1991-2010, the determinants of infrastructure expenditure is explored. Consequently, this study adds to the existing literature in several directions. First, total expenditure on infrastructure is split up into economic and social factors and, then further, into capital and revenue expenditure to investigate whether there are differences in the determinants of two kinds of infrastructure. Second, it is more comprehensive than existing studies as this study considers economic, political and spatial factors. Third, the issue of possible bidirectional causality between some of the determinants, such as per capita income and infrastructure stock with the dependent variable, namely per capita infrastructure expenditure through the spatial dynamic system GMM is addressed. Fourth, the implication of those factors for regional balance in infrastructure is examined.

IV. EMPIRICAL MODEL AND METHODOLOGY

Empirical model

The empirical model consists of an infrastructure expenditure function in which infrastructure expenditure of states⁵ are explained by the three possible groups of factors: economic, political, and spatial interaction. Economic factors comprise efficiency and/or the equity motive of the government, demography, per capita income of a region, financial capacity of the government, temporal persistence effect (lagged dependent variable). However, infrastructure expenditure may also be influenced by political motives (for example, to have majority/stable government). Above all, spatial factors may play a role in the form of spatial dependence in the infrastructure expenditure of states. Keeping in view those three factors and the way they are measured in the empirical studies, the state-level infrastructure expenditure function is set up as follows:

$$PCINFEXP_{it} = \alpha_i + \beta_1 PCINFEXP_{it-1} + \beta_2 W.PCINFEXP_{it} + \beta_3 PCRESMOB_{it} + \beta_4 PCSDP_{it} + \beta_5 POLSTAB_{it} + \beta_6 INFINDEX_{it} + \beta_7 HCR_{it} + \mu_{it} \quad (1)$$

Here $PCINFEXP_{it}$ is infrastructure expenditure per capita, $PCINFEXP_{it-1}$ is past per capita infrastructure expenditure, $PCRESMOB_{it}$ stands for resource mobility, $PCSDP_{it}$ is per capita income, $POLSTAB_{it}$ is political stability and $INFINDEX_{it}$

⁵ The determinant of regional distribution of central governments infrastructure expenditure function is not explored as data on state-wise allocation of such expenditure are not available.

represents infrastructure index. Subscript $i = 1...14$ refers to states and $t = 1...20$ represents time. α_i is the fixed effect for i^{th} state, which is included to capture the unobserved state-specific traits. The description of the dependent variable and the independent variables⁶ of equation (1) are as follows:

Infrastructure expenditure per capita ($PCINFEXP_{it}$)

The dependent variable in earlier studies is usually investment expenditure on infrastructure. However, the maintenance of existing infrastructure facilities is as important as expenditure on new infrastructure facilities. This is because diverting scarce domestic resources away from the maintenance and operation of existing stock may have a perverse effect on economic growth (Hulten, 1996). While addition to new infrastructure comes under capital expenditure, the maintenance of the existing infrastructure facilities is covered under revenue expenditure on infrastructure. Accordingly, the dependent variable, namely expenditure on infrastructure per capita is divided into revenue and capital expenditure. Furthermore, the dependent variable has two variants. In one variant, it is per capita expenditure on economic infrastructure (irrigation, power, transport, and communications); and in the second, it is per capita expenditure on social infrastructure (education, medical and public health, water supply and sanitation).

Past per capita infrastructure expenditure ($PCINFEXP_{it-1}$)

As infrastructure projects usually take several years to complete, necessitating continuous spending, public expenditure on infrastructure generally shows the phenomenon of temporal persistence. Hence, the effect of temporal persistence on expenditure per capita in the time t ($PCINFEXP_{it}$) is measured by the lagged per capita expenditure in the time $t-1$, i.e. $PCINFEXP_{it-1}$.

Spatial interaction effect ($W.PCINFEXP_{it}$)

As explained in an earlier section, spatial autocorrelation or spatial dependence in infrastructure expenditure of the states may exist because of such elements as competition, cooperation, and the spillover effect, manifesting in policy

⁶ It is useful to include a measure of demography, such as population density, as explanatory variables to determine whether the expenditure on infrastructure is population-serving or space-serving. However, population density or any measure of demography among explanatory variables have not been included, as the dependent variable is standardized using population, namely expenditure per capita, and population density is expected to affect the per capita expenditure negatively, which could result in a biased interpretation of the variable.

interdependence among the state governments. Furthermore, the so-called spatial dependence observed may be the result of some spatially auto-correlated shocks among the state governments. In addition, many economic infrastructures are characterized by networks that extend beyond administrative boundaries, such as roads, railways and power transmission. This can also lead to interdependence in infrastructure expenditure among neighbouring federal units.

The existence of spatial dependence is measured by the variable, $W.PCINFEXP_{it-1}$. This is the spatial counterpart of the dependent variable, which is calculated as the spatially weighted average of per capita infrastructure expenditure of the i th state's neighbouring states. The criteria for defining neighbours of a state and the weights (W) used are described in the next section.

Resource mobilization ($PCRESMOB_{it}$)

As with all expenditures, government revenue puts limits on the infrastructure expenditure. The variable $PCRESMOB_{it}$ is used as a measure of financial capacity of the government. This is calculated as the ratio of total receipts, revenue and capital receipts, to population. Several other measures of fiscal situation and budget constraint of the government, such as budget balance, composition of budget, budget cycle (the frequency with which budgeting exercise is conducted) and grants from a higher-tier of government and debt burden, are found in empirical studies. Some of the variables, such as central grants for state governments' infrastructure expenditure, could not be included because of unavailability of data. In addition, it should be noted that including all the variables would reduce the degrees of freedom.

Economic status ($PCSDP_{it}$)

The economic status of a state is captured by per capita state domestic product, namely $PCSDP_{it}$. The higher the per capita income, the greater the spending on infrastructure, which is spurred by the effect of higher revenue effect and increased demand for infrastructure. Hence, the coefficient of the variable is expected to be positive.

Political factor ($POLSTAB_{it}$)

The influence of a political factor is proxied by the variable, $POLSTAB_{it}$ (political stability), which is measured by the ratio of share of ruling party in the total number of seats in the state legislature. The ratio remains the same for the time period in which the same ruling party prevails. The values of political stability index should be between zero (perfect instability or president's rule) and one (perfect stability in which the government has all the seats). Infrastructure expenditure may be undertaken for

political rent extraction, namely to get the maximum number of votes. There is evidence in literature (Acharya, 2004; Khemani, 2010) that political parties tend to pursue infrastructure projects that ensure more short-term electoral gains than the provision of infrastructure as a long-term and broader public good. This implies that a stable or majority party at the legislature may spend less on infrastructure than a weak majority legislature, which is more likely to worry about the possibility of re-election. However, the effect of a stable or majority government may also be beneficial for the provision of infrastructure expenditure as infrastructure projects are less likely to be held up because of conflict with the opposition in the legislature.

Government's preference ($INFINDEX_{it}$ and HCR_{it})

Studies have used output in a region or existing stock of public capital to capture the government's preferences (existence of equity-efficiency elements) in the expenditure provision of infrastructure. Output or gross domestic product (GDP) per capita seems to be an appropriate measure of the equity/efficiency motive with regard to the regional allocation of the central government's expenditure on infrastructure. It may not be an indicator of equity/efficiency when dealing with the determinants of regional government's infrastructure expenditure. In this case, output or GDP per capita would reflect the economic status of the particular region. Hence, existing infrastructure stock is used to detect if it has a balancing effect on infrastructure expenditure or otherwise. Existing stock of infrastructure is proxied by the variable, $INFINDEX_{it}$. It may indicate the presence or absence of a process of catching up in infrastructure expenditure among the states. That is, the infrastructure-deficit/infrastructure-abundant states are spending more/less. If regions with high/low stock of infrastructure are spending less/more on infrastructure, there would be a narrowing in the gap between infrastructure-poor and infrastructure-abundant states, and the gap would widen in the opposite case. Three indices of infrastructure, namely aggregate infrastructure index, economic infrastructure index and a social infrastructure index, have been constructed applying Principal Component Analysis. The details of the Principal Component Analysis are given in the appendix. Apart from output in a region or existing stock of public capital, Randolph, Bogetic and Hefley (1996), Lalvani (2005), and Dash and Raja (2013) have also used some measure of poverty to capture the government's preferences in the expenditure provision of infrastructure. A key argument for the link between infrastructure spending and poverty alleviation, especially in less developed countries is that a reduction in poverty can be brought about through the promotion of economic opportunities through the construction of economic infrastructure, such as roads, electrification and irrigation, by development of human capital by providing social services, such as health and education, and by the provision of transfers to the poor (Randolph, Bogetic and Hefley, 1996). Accordingly, head count ratio (HCR_{it}) has also been used as a measure

of poverty, as an explanatory variable, to examine whether states with higher poverty are spending more/less on economic/social infrastructure.

Estimation strategy

The empirical model (equation (1)) is a dynamic panel specification with the presence of lagged dependent variable and state-specific fixed effects. Application of traditional procedures such as ordinary least squares to such a case is inappropriate as it could lead to dynamic panel bias resulting in biased estimates because of the correlation between the lagged dependent variables and the state-specific effect (Nickell, 1981). Furthermore, there could be the problem of reverse causality with some of the explanatory variables being endogenous. For instance, not only a higher or lower per capita income ($PCSDP_{it}$) leads to higher or lower spending on infrastructure, an increase in the latter also leads to higher productivity, which could push per capita income to a higher level. Similarly, as expenditure occurs in response to the existing level of infrastructure stock, an increase or a reduction in the former is also responsible for a higher or lower level of the latter. In addition to the problem of dynamic panel bias and reverse causality, equation (1) has the presence of a spatial interaction term ($W.PCINFEXP_{it}$), which calls for the adoption of some spatial econometric method for its estimation.

To address the dynamic panel bias problem and the reverse causality problem, there are two widely used methods: the “difference GMM” approach developed by Arellano and Bond (1991) and the “system GMM” approach of Arellano and Bover (1995) and Blundell and Bond (1998). The difference GMM approach adopts first-differencing to the model to remove the state-specific effects and all endogenous variables with their own lagged levels are used as instruments (Anderson and Hsiao, 1981; Hansen, 1982). The system GMM approach helps in estimating a system of two simultaneous equations: one is the original levels equation with lagged first differences as instruments, and the other is the first-differenced equation with lagged levels as instruments. Both approaches successfully overcome the dynamic panel bias and endogeneity problems by transforming instrumenting variables and applying GMM.

However, Blundell and Bond (1998) point out that the difference GMM estimator has a downward bias and low precision when the autoregressive parameter of the endogenous variable is moderately large, and the number of time series observations is moderately small. This is because lagged levels variables provide weak instruments for first differenced variables in this case. In comparison, the system GMM improve the precision of the estimator and reduces the bias. Although the system GMM approach seems suitable for the estimation of equation (1), the

presence of spatial interaction term calls for spatial version of the same. While several studies, such as Elhorst (2010), have extended the difference GMM estimator, studies, such as Kukenova and Monteiro (2008) and Jacobs, Ligthart and Vrijburg (2009), have extended the SYS-GMM estimator of Blundell and Bond (1998) to account for spatial effects. In the spatial version also, the difference GMM was found to have a large bias in respect of the spatial autoregressive parameter (β_2) and system GMM estimator was found to be superior with a small bias.

An important choice about the system GMM estimator is whether to use one-step or two-step estimator. While the one-step estimator is built under the assumption that the error term is independent (no serial correlation) and homoscedastic across countries and time, for the two-step estimator, the residuals of the first step are used to estimate consistently the variance-covariance matrix in the presence of heteroscedasticity and serial correlation. Although the one-step estimator is asymptotically less efficient than the two-step estimator in the presence of heteroscedasticity, Monte Carlo simulations by Arellano and Bond (1991) and Blundell and Bond (1998), suggest that standard errors of the two-step estimator are downward biased. Furthermore, even in the presence of heteroscedasticity, there is a small improvement in efficiency gains from the two-step GMM estimator relative to the one-step GMM estimator for which inference based on the one-step GMM estimator is much more reliable than the two-step estimator. Thus, the robust one-step spatial system GMM estimator has been used for the model in equation (1).

The consistency of the system GMM estimator is verified by two tests: (a) the Sargan/Hansen test of over identifying restrictions, which is based on the hypothesis that instrumental variables are valid (not correlated with the error terms); and (b) by using Arellano and Bond (1991) test to verify the hypothesis of the absence of second-order autocorrelation (AR(2)) in residuals.

Prior to implementing the spatial dynamic system GMM regression, specification tests are usually conducted to determine which model (spatial or non-spatial) is appropriate for the empirical study. To find out if there is any general spatial autocorrelation in the data, Moran's I test is used. To further detect which form of spatial dependence⁷ (lag or error) in the panel data, two Lagrange Multiplier (LM) tests with their robust counterparts are available.⁸ These tests (LM-lag and LM-error

7 While the spatial lag model (spatial autoregressive, or SAR) has the spatial lag of the dependent variable as an explanatory variable, spatial error model (SEM) includes a spatial autoregressive term in error.

8 While Anselin and others (1996) have developed these tests to be used in a cross-section setting, derivations of those tests for a spatial panel data model with spatial fixed effects is found in Debarsy and Ertur (2010).

tests) are conducted on the non-spatial model. The tests are preferred in their robust version as they are vulnerable to several forms of misspecification.

A spatial model, such as equation (1) requires creation of spatial lag variables for which a spatial weight matrix is necessary to impose a neighbourhood structure on the dataset. In spatial econometrics, neighbours are usually defined by a binary relationship (0 for non-neighbours, 1 for neighbours). Broadly, such binary weight matrices are classified into two categories: those based on distance and those based on contiguity. In spatial regression, models estimated with first-order (includes only direct neighbours and not neighbours' neighbours) contiguity weights matrices are seen performing better, on average, than those using distance weights matrices in terms of their higher probabilities of detecting the true model and the lower mean squared error (MSE) of the parameters (Stakhovych and Bijmolt, 2009). In addition, as recently shown by LeSage and Pace (2014), properly calculated marginal effects for spatial regression models yield robust results irrespective of the chosen spatial weighting matrix. As infrastructure facilities are likely to connect adjacent states, interdependence in expenditure on infrastructure is also expected between the states touching each other's boundary. Thus, the estimation of the model has been carried out with queen-contiguity weights, which defines neighbouring states as those with common borders and corners or vertices.⁹

V. DATA

The dataset comprises 14 major Indian states over a 20-year period (1991-2010). The states are Andhra Pradesh (undivided state), Bihar, Gujarat, Haryana, Karnataka, Kerala, Madhya Pradesh, Maharashtra, Odisha, Punjab, Rajasthan, Tamil Nadu, Uttar Pradesh, and West Bengal. These states constitute 93 per cent of the population and 91.5 per cent of net domestic product (NDP) of the country. The special category states of north and north-eastern parts and the small states, such as Goa are not included because of the differences in the structure of their economies from the rest of the states (Rao, Shand and Kalirajan, 1999). The data on different components of infrastructure expenditure, such as irrigation, power, transport and communications, education, medical and public health, water supply and sanitation and those on revenue receipts and capital receipt have been taken from *State Finances: A Study of Budgets* issued by the Reserve Bank of India for different years. The physical infrastructure data are gathered from a variety of sources. The data on

⁹ Contiguity-based weights matrices include rook and queen. Areas are neighbours under the rook criterion if they share a common border, but not vertices. In the queen contiguity, both border and corner contacts are considered.

road and railway per 1,000 square kilometers of area is sourced from the Centre for Monitoring Indian Economy, infrastructure statistics for 2013 and the Ministry of Statistics and Programme Implementation, while the data on per capita installed capacity of power (in megawatt (mw)) is gathered from *Statistical Abstracts of India* and the *Handbook of Statistics on Indian States*, issued by the Reserve Bank of India, the India Energy Portal and NITI Aayog. The data on gross irrigated area as a percentage of gross cropped area is from *Agricultural Statistics at a Glance* whereas telephone per 100 populations (including Public DELs, Pvt. DELs, CMPs and WLL (fixed and limited)) is obtained from infrastructure statistics given by the Ministry of Statistics and Programme Implementation and *Statistical Abstracts of India* for different years. In addition, the data on percentage of children fully immunized is from *State Fact Sheets* of different rounds of National Family Health Surveys, Indian households' access to safe drinking water in per cent is taken from the Economic Survey. Finally, data from total number of schools for general education (primary and secondary) per 1,000 population is gathered from *Statistical Abstracts of India* and the Economic Survey.

Gross state domestic product data have been taken from National Accounts Statistics of the Central Statistics Office in constant prices and in current prices and, as they were in different base periods, converted to the 2004/05 base period. The converted 2004/05 constant and current prices data are further used to construct the deflator at 2004/05 prices. The data on expenditure, revenue, and capital receipts have been converted into real magnitudes, being normalized by the 2004/05 deflators. The data on head count ratio are sourced from the Planning Commission. The timespan for which a ruling party prevailed is taken from Lalvani (2005) and extended until 2010. The data on total number of seats in the legislative assembly of the states and the seats obtained by the parties in government for different years are sourced from Election Reports on State for different years. The variables constructed from the data are as described in the previous section. All the variables have been taken in logarithms except the political stability and infrastructure indices.

VI. EMPIRICAL RESULTS

In this section, the estimated results of equation (1) are reported. To determine whether a spatial model or a non-spatial one is appropriate, the process begins with the results of spatial diagnostic test in table 1 based on non-spatial ordinary least squares models. While the LM tests for error dependence and its robust version are insignificant, the LM tests for spatial lag dependence are significant suggesting a spatial lag model as the appropriate specification.

Table 1. Spatial diagnostic tests

Test	Economic infrastructure		Social infrastructure	
	Statistic	P-value	Statistic	P-value
Moran's I	0.135	0.001	0.021	0.690
LM error	0.454	0.500	0.213	0.644
Robust LM error	1.475	0.224	0.346	0.556
LM lag	8.619	0.003	0.009	0.108
Robust LM lag	9.641	0.002	0.134	0.091

The system GMM estimation results for both capital and revenue expenditure on economic and social infrastructure as dependent variables are given in table 2. The results suggest that lagged per capita expenditure on infrastructure¹⁰ has a significant and positive effect on per capita infrastructure expenditure, indicating the existence of temporal persistence. Such temporal persistence is stronger in the case of social infrastructure than economic infrastructure as observed by the higher significance and larger coefficient of the former. This may be because expenditure on economic infrastructure, such as transport, communication and irrigation facilities, once earmarked, needs not be incurred in every year's budget, but the expenditure on social infrastructure, such as schools, health and drinking water facilities and some welfare schemes, is to be incurred in each budget. In addition, revenue expenditure shows more temporal persistence than capital expenditure. This means that an increase in a state government's revenue spending on economic and social infrastructure by 1 per cent in a year would lead to more than 0.15 and 0.65 per cent increase in infrastructure spending per capita in the subsequent year for these types of infrastructure. This seems usual as revenue expenditure includes some committed components, such as payments of salaries and wages, along with maintenance expenditure on infrastructure, which requires continuous allocation in the government budget.

While the spatial lag is insignificant for social and revenue expenditures, the spatial lag for capital expenditure on economic infrastructure is significant and has a positive sign, indicating that an increase in expenditure in neighbouring states lead to an increase in the concerned state's expenditure. A possible reason for this is the competition among states to attract domestic or foreign investment following the economic reform of 1991. Such competition is more likely in case of economic

¹⁰ When attempt was made with second and third lags of the dependent variable, the sign of all the variables are found to be intact, though there is some change in the level of significance of the variables.

Table 2. Determinants of per capita infrastructure expenditure

Independent variable:	Dependent variable: <i>PCINFEXP</i>			
	Economic infrastructure		Social infrastructure	
	Capital	Revenue	Capital	Revenue
<i>L1.PCINFEXP</i>	0.122 (0.092)	0.157 ** (0.075)	0.910 *** (0.123)	0.656 *** (0.161)
<i>W.PCINFEXP</i>	0.025 * (0.012)	-0.042 (0.025)	-0.011 (0.036)	0.007 (0.004)
<i>PCRESCMOB</i>	0.718 *** (0.269)	0.560 ** (0.219)	0.563 * (0.318)	0.131 * (0.065)
<i>PCSDP</i>	0.485 * (0.244)	1.098 * (0.178)	-0.417 (0.509)	0.369 (0.244)
<i>POLSTAB</i>	-0.535 (0.566)	-0.822 ** (0.377)	-0.219 (0.354)	0.085 (0.086)
<i>HCR</i>	-0.010 (0.023)	-0.027 *** (0.005)	0.014 (0.039)	0.000 (0.002)
<i>INFINDEX</i>	-0.139 (0.347)	-0.657 *** (0.202)	0.093 (0.437)	0.039 (0.039)
<i>Year dummy</i>	Yes	Yes	Yes	Yes
Observations	266	266	266	266
No. of states	14	14	14	14
No. of lagged instruments	1,1	1,1	1,1	1,2
No. of instruments	8	9	8	10
AR(1) test	0.154	0.003	0.030	0.004
AR(2) test	0.605	0.515	0.777	0.383
Hansen over-identification test	0.350	0.198	0.112	0.149

Note: *, **, *** show statistical significance of coefficients at 10, 5 and 1 per cent, respectively, and standard errors are reported in parentheses. p -values are reported for AR and Hansen tests.

infrastructure, which has components, such as transport, communication and energy, that add to productivity and growth directly, than social infrastructure. Another reason could be that the increased spending on interstate network facilities, such as highways and railways, which is mostly undertaken by the central government, may lead to more spending from several states in collaboration to increase their within-state infrastructure facilities needed for facilitating connection to the interstate network.

Regarding per capita resource mobility, it has a positive and significant effect on the provision of economic and social infrastructure, pointing towards the obvious importance of financial capacity of the states in dictating their expenditure. Both per capita resource mobility and per capita state domestic product are positive and significant for the provision of economic infrastructure. This indicates that economically better off states have greater fiscal capacity and, hence, can spend more on economic infrastructure. In addition, the relative importance of the two factors is also more for capital expenditure than revenue expenditure.

The effect of political stability is mostly insignificant except for revenue expenditure on economic infrastructure. It is also negative for all categories of infrastructure except revenue expenditure on social infrastructure. This suggests that, for the most part, greater provision of infrastructure may be a means to secure political positions. Hence, a stable government, which is less likely to worry about the opposition and possibility of re-election, tends to spend less on infrastructure. To determine whether such an effect of political stability is the same for the single-party government and coalition government, a separate regression is run in which political stability is multiplied with a dummy for a single-party government. The result is reported in table 3. It shows that the political stability-single dummy interaction term (POLSTAB*SINGLE) has a positive sign for the former variables having negative signs. This indicates that a government with a single party majority tends to spend more on infrastructure as it is less likely to face conflict within the government and from the opposition in the legislature. The results are the reverse for coalition governments in which there would be less spending on infrastructure, possibly because the government may face conflict from its coalition partners or the possibility of more frequent re-elections. This is evident from the negative sign of the political stability variable for those variables, which now represent the effect of political stability in the presence of a coalition government. An exception is the revenue expenditure on social infrastructure on which the effect of political stability in the presence of single government is negative, but in the presence of a coalition government, it is positive. Moreover, political stability and its interaction variable are seen to be relatively more important for revenue expenditure than capital expenditure.

**Table 3. Determinants of per capita infrastructure expenditure
(with political stability-single party interaction)**

Independent variable:	Dependent variable: <i>PCINFEXP</i>			
	Economic infrastructure		Social infrastructure	
	Capital	Revenue	Capital	Revenue
<i>L1.PCINFEXP</i>	0.124 (0.095)	0.168 * (0.086)	0.905 *** (0.128)	0.660 *** (0.172)
<i>W.PCINFEXP</i>	0.020 (0.014)	-0.055 ** (0.023)	-0.014 (0.035)	0.009 ** (0.004)
<i>PCRESCMOB</i>	0.730 ** (0.284)	0.627 ** (0.249)	0.569 * (0.329)	0.088 (0.078)
<i>PCSDP</i>	0.492 ** (0.235)	1.079 *** (0.196)	-0.390 (0.503)	0.391 (0.281)
<i>POLSTAB</i>	-0.762 (0.485)	-1.237 *** (0.395)	-0.326 (0.336)	0.170 ** (0.080)
<i>HCR</i>	-0.009 (0.021)	-0.023 *** (0.007)	0.011 (0.037)	-0.001 (0.002)
<i>INFINDEX</i>	-0.087 (0.323)	-0.615 *** (0.218)	0.072 (0.426)	0.035 (0.033)
<i>POLSTAB*SINGLE</i>	0.355 (0.286)	0.562 ** (0.272)	0.160 (0.165)	-0.138 ** (0.060)
<i>Year dummy</i>	Yes	Yes	Yes	Yes
Observations	266	266	266	266
No. of states	14	14	14	14
No. of lagged instruments	1,1	1,1	1,2	1,2
No. of instruments	9	10	11	11
AR(1) test	0.151	0.004	0.038	0.003
AR(2) test	0.716	0.757	0.782	0.313
Hansen over-identification test	0.567	0.360	0.394	0.153

Note: *, **, *** show statistical significance of coefficients at 10, 5 and 1 per cent respectively, and standard errors are reported in parentheses. p values are reported for AR and Hansen tests.

The negative sign of the coefficient of the economic infrastructure index indicates that there could be an element of equity or a process of catching up in infrastructure service provision, namely that infrastructure-deficient states may spend more than infrastructure-abundant states. However, such an effect is only significant for revenue expenditure on economic infrastructure; it is also absent for social infrastructure provision.

The negative signs of the head count ratio for the provision of economic infrastructure and positive sign for the provision of social infrastructure imply that states with a higher proportion of the people in poverty are spending less on economic infrastructure but more on social infrastructure. The effect of this is significant only in the case of revenue expenditure on economic infrastructure.

The diagnostic tests for all the estimated models validate the consistency of the system GMM estimator. The AR(2) tests rule out the existence of second order serial correlation in residuals. Hansen tests,¹¹ being insignificant, also justify that the instruments used in all the models are valid, namely that they are not correlated with the residuals.

VII. CONCLUSIONS

There is a broad consensus in the literature that regional imbalance in infrastructure is a major reason behind the wide regional imbalance in growth and development in Indian states. In the present paper, the role of possible factors influencing states' expenditure on infrastructure per capita on economic and social infrastructure and their two components, capital and revenue expenditure, are analysed. The results reveal that the financial capacity of the government and past expenditure have a significant positive effect on both economic and social infrastructure expenditure. Per capita income and financial capacity of the government have a positive effect on economic infrastructure. There is also an indication of positive spatial dependence in expenditure on economic infrastructure, namely an increase in a state's expenditure is associated with an increase in its neighbouring states' expenditure. Some factors, such as past expenditure, are found to be relatively important in influencing the revenue expenditure rather than capital expenditure. A catching up process in a government's provision of economic infrastructure is seen, but only with respect to revenue expenditure. Political stability also figures in the

¹¹ Roodman (2009) points out that dynamic panel models can generate too many instruments biasing the estimates. To limit the number of instruments, the maximum lags are restricted to two and the "collapse" option of Roodman (2006) is used in the present study.

revenue expenditures on infrastructure rather than the capital expenditure which counts for provision of infrastructure.

As those factors influence the creation of actual infrastructure facilities through their influence on infrastructure expenditure, they have implications for regional imbalance in infrastructure facilities. For example, the inverse effect of the infrastructure index on infrastructure expenditure implies more spending by infrastructure-poor states, which would help to lessen the regional imbalance in infrastructure facilities. Similarly, positive spatial dependence in the case of economic infrastructure also augurs well for the balanced creation of infrastructure facilities across states. However, differences in some factors and potential sources of infrastructure expenditure, such as past expenditure (temporal persistence), financial capacity and per capita income, may accentuate the regional imbalance on infrastructure. The backward states have much less spending power than the states with high incomes and high revenues.

No change in the relative status of states in infrastructure index between 1991 and 2010 points to the dominance of the unfavourable factors over the favourable factors. An additional reason is that some favorable factors, such as the effects of infrastructure and incidence of poverty are active with regard to revenue expenditure on infrastructure, which does not directly translate into creation of infrastructure facilities. Hence, the strategy for achieving regional balance in infrastructure would require the harnessing of the favourable factors, especially those that influence capital expenditure and, hence, actual infrastructure creation. This can occur by augmenting the financial capacity of the infrastructure deficit states through central government grants or promoting private sector participation in infrastructure investment. The positive spatial dependence in economic infrastructure expenditure among states needs to be reinforced by setting up more infrastructure categories, such as railways, national highways that are part of interstate networks. Moreover, as the spatial correlation in economic infrastructure expenditure may also be the result of competition in infrastructure spending among states to attract domestic and foreign investment, further reforms aimed at building a more conducive investment climate could boost this competition and help in bridging the infrastructure-divide among states.

REFERENCES

- Acharya, Shankar (2004). India's growth prospects revisited. *Economic and Political Weekly*, vol. 39, No. 41, pp. 4537-4542.
- Anderson, T.W., and Cheng Hsiao (1981). Estimation of dynamic models with error components. *Journal of American Statistical Association*, vol. 76, No. 375, pp. 598-606.
- Anderstig, Christer, and Lars-Göran Mattsson (1989). Interregional allocation models of infrastructure investments. *The Annals in Regional Science*, vol. 23, No. 4, pp. 287-298.
- Anselin, Luc, and others (1996). Simple diagnostic tests for spatial dependence. *Regional Science and Urban Economics*, vol. 26, No. 1, pp. 77-104.
- Arellano, Manuel, and Stephen Bond (1991). Some tests of specification for panel data: Monte Carlo evidence and an application to employment equations. *Review of Economic Studies*, vol. 58, No. 2, pp. 277-297.
- Arellano, Manuel, and Olympia Bover (1995). Another look at the instrumental variable estimation of error-components models. *Journal of Econometrics*, vol. 68, No. 1, pp.29-51.
- Arimah, Ben C. (2005). What drives infrastructure spending in cities of developing countries? *Urban Studies*, vol. 42, No. 8, pp. 1345-1368.
- Behrman, Jere R., and Steven G. Craig (1987). The distribution of public services: an exploration of local governmental preferences. *The American Economic Review*, vol. 77, No. 1, pp. 37-49.
- Biehl, Dieter (1989). *The Contribution of Infrastructure to Regional Development: Final Report*. Luxembourg: Office for the Official Publications of the European Communities.
- Blundell, Richard, and Stephen Bond (1998). Initial conditions and moment restrictions in dynamic panel data models. *Journal of Econometrics*, vol. 87, No. 1, pp. 115-143.
- Brueckner, Jan K. (2003). Strategic interaction among governments: an overview of empirical studies. *International Regional Science Review*, vol. 26, No. 1, pp. 175-188.
- Cadot, Olivier, Lars-Hendrik Röller, and Andreas Stephan (1999). A political economy model of infrastructure allocation: an empirical assessment. CEPR Discussion Papers, No. 2336. London: Centre for Economic Policy Research.
- Castells, Antoni, and Albert Solé-Ollé (2005). The regional allocation of infrastructure investment: the role of equity, efficiency and political factors. *European Economic Review*, vol. 49, No. 5, pp. 1165-1205.
- Chatterji, Monojit, Sushil Mohan, and Sayantan Ghosh Dastidar (2015). Determinants of public education expenditure: evidence from Indian states. *International Journal of Education Economics and Development*, vol. 6, No. 1, pp. 1-19.
- Chaudhuri, Kausik, and Sugato Dasgupta (2006). The political determinants of fiscal policies in the states of India: an empirical investigation. *Journal of Development Studies*, vol. 42, No. 4, pp. 640-661.
- Costa-I-Font, Joan, Eduardo Rodriguez-Oreggia, and Dario Lunapla (2003). Political competition and pork-barrel politics in the allocation of public investment in Mexico. *Public Choice*, vol. 116, No. 1/2, pp. 185-204.
- Crain, W. Mark, and Lisa K. Oakley (1995). The politics of infrastructure. *The Journal of Law and Economics*, vol. 38, No. 1, pp. 1-17.

- Das, Sandwip Kumar, and Alokesh Barua (1996). Regional inequalities, economic growth and liberalisation: a study of the Indian economy. *Journal of Development Studies*, vol. 32, No. 3, pp. 364-390.
- Dash, Bharatee Bhusana, and Angara V. Raja (2013). Do political determinants affect the size and composition of public expenditure? A study of the Indian states. *International Review of Economics*, vol. 60, pp. 293-317.
- Debarsy, Nicholas, and Cern Ertur (2010). Testing for spatial autocorrelation in a fixed effects panel data model. *Regional Science and Urban Economics*, vol. 40, No. 3, pp. 453-470.
- Dutta, Bhaskar (1997). Coalitional governments and policy distortions: the Indian experience. In *Fiscal Policy, Public Policy and Governance*, Parthasarasthi Shome, ed. New Delhi: Centax Publications.
- Elhorst, J. Paul (2010). Dynamic panels with endogenous interaction effects when T is small. *Regional Science and Urban Economics*, vol. 40, No. 5, pp. 272-282.
- Ghate, Chetan (2008). Understanding divergence in India: a political economy approach. *Journal of Economic Policy Reform*, vol. 11, No. 1, pp. 1-9.
- Ghosh, Buddhadeb, and Prabir De (2005). Investigating the linkage between infrastructure and regional development in India: era of planning to globalisation. *Journal of Asian Economics*, vol. 15, No. 6, pp. 1023-1050.
- Hansen, Lars Peter (1982). Large sample properties of generalized method of moments estimators. *Econometrica*, vol. 50, No. 4, pp. 1029-1054.
- Hansen, Niles M. (1965). The structure and determinants of local public investment expenditure. *Review of Economic Statistics*, vol. 47, No. 2, pp. 150-162.
- Hulten, Charles R. (1996). Infrastructure capital and economic growth: how well you use it may be more important than how much you have. NBER Working Paper, No. 5847. Cambridge, MA: National Bureau of Economic Research.
- Jacobs, Jan P.A.M., Jenny E. Ligthart, and Hendrik Vrijburg (2009). Dynamic panel data models featuring endogenous interaction and spatially correlated errors. CentER Discussion Paper Series, No. 2009-92. Tilburg, Netherlands: Tilburg University.
- Joanis, Marcellin (2011). The road to power: partisan loyalty and the centralized provision of local infrastructure. *Public Choice*, vol. 146, No. 1-2, pp. 117-143.
- Kemmerling, Achim, and Andreas Stephan (2002) The contribution of local public infrastructure to private productivity and its political economy: evidence from a panel of large German cities. *Public Choice*, vol. 113, No. 3-4, pp. 403-424.
- Khemani, Stuti (2010). Political economy of infrastructure spending in India. Policy Research Working Paper, No. 5423. Washington, D.C.: World Bank.
- Kukenova, Madina, and José-Antonio Monteiro (2008). Spatial dynamic panel model and system GMM: a Monte Carlo investigation. IRENE Working Papers, No. 09-01. Neuchâtel, Switzerland: Institute for Research in Economic.
- Lalvani, Mala (2005). Coalition governments: fiscal implications for the Indian economy. *American Review of Political Economy*, vol. 3, No. 1, pp. 127-163.
- LeSage, James P., and R. Kelley Pace (2014). The biggest myth in spatial econometrics. *Econometrics*, vol. 2, No. 4, pp. 217-249.

- Mera, Koichi (1967). Trade-off between aggregate efficiency and interregional equity: a static analysis. *The Quarterly Journal of Economics*, vol. 81, No. 4, pp. 658-674.
- _____ (1973). Trade-off between aggregate efficiency and interregional equity: the case of Japan. *Regional and Urban Economics*, vol. 3, No. 3, pp. 273-300.
- Mizutani, Fumitoshi, and Tomoyasu Tanaka (2008). Productivity effects and determinants of public infrastructure investment. *The Annals in Regional Science*, vol. 44, No. 3, pp. 493-521.
- Nickell, Stephen (1981). Biases in dynamic models with fixed effects. *Econometrica*, vol. 49, No. 6, pp. 1417-1426.
- Painter, Gary, and Kwi-Hee Bae (2001). The changing determinants of state expenditure in the United States: 1965-1992. *Public Finance and Management*, vol. 1, No. 4, pp. 370-392.
- Rahman, Tauhidur (2008). Determinants of public health expenditure: some evidence from Indian states. *Applied Economics Letters*, vol. 15, No. 11, pp. 853-857.
- Randolph, Susan, Zeljko Bogetic, and Dennis Hefley (1996). Determinants of public expenditure on infrastructure: transportation and communication. Policy Research Working Paper, No. 1661. Washington, D.C.: World Bank.
- Rao, M. Govinda, R.T. Shand, and K.P. Kalirajan (1999). Convergence of incomes across Indian states: a divergent view. *Economic and Political Weekly*, vol. 34, No. 13, pp. 769-778.
- Revelli, Federico (2003). Reaction or interaction? Spatial process identification in multi-tiered government structures. *Journal of Urban Economics*, vol. 53, No. 1, pp. 29-53.
- _____ (2005). On spatial public finance empirics. *International Tax and Public Finance*, vol. 12, No. 4, pp. 475-492.
- _____ (2006). Performance rating and yardstick competition in social service provision. *Journal of Public Economics*, vol. 90, No. 3, pp. 459-475.
- Roodman, David (2006). How to do Xtabond2: an introduction to "difference" and "system" GMM in Stata. *The Stata Journal*, vol. 9, No. 1, pp. 86-136.
- _____ (2009). A note on the theme of too many instruments. *Oxford Bulletin of Economics and Statistics*, vol. 71, No. 1, pp. 135-158.
- Romp, Ward, and Jakob de Haan (2007). Public capital and economic growth: a critical survey. *Perspektiven der Wirtschaftspolitik*, vol. 8, No. S1, pp. 6-52.
- Shah, Narottam (1970). Overall summary: infrastructure for the Indian economy. In *Infrastructure for the Indian Economy*, Vadilal Dagli, ed. Mumbai: Vora.
- Solé-Ollé, Albert (2013). Inter-regional redistribution through infrastructure investment: tactical or programmatic? *Public Choice*, vol. 156, No. 1-2, pp. 229-252.
- Stakhovych, Stanislav, and Tammo H.A. Bijmolt (2009). Specification of spatial models: a simulation study on weights matrices. *Papers in Regional Science*, vol. 88, No. 2, pp. 389-408.
- Yamano, Norihiko, and Toru Ohkawara (2000). The regional allocation of public investment: efficiency or equity? *Journal of Regional Science*, vol. 40, No. 2, pp. 205-229.
- Yu, Yihua, and others (2011). On the determinants of public infrastructure spending in Chinese cities: a spatial econometric perspective. *Social Science Journal*, vol. 48, No. 3, pp. 458-467.
- Zheng, Xinye, and others (2013). Central government's infrastructure investment across Chinese regions: a dynamic spatial panel data approach. *China Economic Review*, vol. 27, pp. 264-276.

APPENDIX

Infrastructure indices

The indices of aggregate, economic and social infrastructure have been constructed from infrastructure variables using Principal Component Analysis. The descriptive statistics for the variables are given in appendix table A.1. The steps for computation of aggregate infrastructure index are as follows. The Eigen values and the proportion of variance explained by each principal component is reported in appendix table A.2. The result shows that the first three components are significant as they have Eigen values greater than one. Those three components explain 30, 26 and 18 per cent of the total variance in infrastructure, respectively. Together, they explain 75 per cent of the total variance. Appendix table A.3 reports the rotated factor matrix, which shows the factor loadings of the original infrastructure variables for each principal component. The three principal components are combined to construct a single index of infrastructure using ratio of the percentage variation explained by each component to total variation accounted for by them jointly as weights. The indices of economic infrastructure and social infrastructure are also constructed in a similar way. The Eigen values and the proportion of variance explained by each principal component and the factor loading of the variables in the significant principal components used to construct these indices are given in appendix tables A.4, A.5, A.6 and A.7, respectively.

**Appendix table A.1. Descriptive statistics of infrastructure components
(total number of observations: 280)**

Variable	Mean	Standard deviation	Minimum	Maximum
Road density	1 120.586	911.755	316	5 268.69
Rail density	25.892	9.639	9.6	44.52
Power	4 242.088	2 366.12	766.1187	12 911.15
Irrigation	44.691	23.729	12.34	98
Teledensity	9.871	15.244	0.11	80.36
Drinking water	75.54236	17.7115	18.9	97.6
Immunization	50.96723	19.4019	10.7	88.8
Education	0.9949216	0.40809	0.2081652	2.173089

Aggregate infrastructure**Appendix table A.2. Eigen values and proportion of variance explained by Principal Components**

Component	Eigen value	Proportion explained	Cumulative total
Component 1	2.4259	0.3032	0.3032
Component 2	2.12599	0.2657	0.569
Component 3	1.49238	0.1865	0.7555
Component 4	0.977642	0.1222	0.8777
Component 5	0.500114	0.0625	0.9403
Component 6	0.225818	0.0282	0.9685
Component 7	0.171164	0.0214	0.9899
Component 8	0.809908	0.0101	1

Appendix table A.3. Factor loadings

Variable	Comp 1	Comp 2	Comp 3
Road density	0.1846	-0.5701	-0.1117
Rail density	0.6043	0.1385	-0.1524
Power	-0.033	0.0985	0.8259
Irrigation	0.4024	0.4172	-0.2355
Teledensity	-0.0641	0.0095	-0.0085
Drinking water	0.0832	0.6075	0.1799
Immunization	0.2824	-0.2403	0.4027
Education	-0.589	0.2126	-0.1791

Economic infrastructure**Appendix table A.4. Eigen values and proportion of variance explained by Principal Components**

Component	Eigen value	Proportion explained	Cumulative total
Component 1	1.77689	0.3554	0.3554
Component 2	1.30595	0.2612	0.6166
Component 3	1.14985	0.23	0.8465
Component 4	0.602566	0.1205	0.9671
Component 5	0.164749	0.0329	1

Appendix table A.5. Factor loadings (economic infrastructure)

Variable	Comp 1	Comp 2	Comp 3
Road density	0.0244	0.9273	0.0452
Rail density	0.7498	0.2292	-0.127
Power	0.0055	-0.0197	0.0125
Irrigation	0.6611	-0.2935	0.1568
Teledensity	-0.0099	0.0342	0.9783

Social infrastructure**Appendix table A.6. Eigen values and proportion of variance explained by Principal Components**

Component	Eigen value	Proportion explained	Cumulative total
Component 1	1.35303	0.451	0.451
Component 2	1.01013	0.3367	0.7877
Component 3	0.63684	0.2123	1

Appendix table A.7. Factor loadings (social infrastructure)

Variable	Comp 1	Comp 2
Drinking water	0.0053	0.9685
Immunization	0.7253	0.1677
Education	-0.6884	0.1814

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- Salagaev, Alexander (2002). Juvenile delinquency. Paper presented at the Expert Group Meeting on Global Priorities for Youth. Helsinki, October.
- Stiglitz, Joseph, and others (2006). *Stability with Growth: Macroeconomics, Liberalization and Development*. Initiative for Policy Dialogue Series. Oxford: Oxford University Press.
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