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Trade, infrastructure and income inequality in selected Asian countries: An empirical analysis

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Executive summary

Theoretical and empirical works related to international trade are confined to models which have labour and capital as explicit factors of production. Although income inequality and trade openness have been given importance in the literature, the role of quantity and quality infrastructure has barely been investigated in this context. Similarly, growth regressions have highlighted the role of infrastructure and trade openness in economic growth, while inclusive growth has not received much attention.

This paper attempts to unravel the interlinkages and interconnections among infrastructure, trade openness and income inequality, using panel data of 14 Asia-Pacific countries at different levels of development. The empirical exercise clearly reveals influence of trade openness and infrastructure on income inequality but the reverse is not necessarily true. Moreover, country-specific factors turn out to be important determinants of trade openness and income inequality. Further, dynamic panel estimates reveal importance of initial values of both income inequality and trade openness as important determinants in the evolution of these variables, apart from the positive influence of infrastructure as a determining variable.

Introduction

The relation between trade, inequality and poverty within countries is not beyond controversy. Most international trade economists have a perspective of a world in which countries exchange goods, factors and ideas. Free trade in goods leads to equalization of factor prices across countries according to the factor-price-equalization theorem. In the traditional literature on neo-classical growth model, capital and labour play the central role as two main factors of production. From the perspective of conventional one sector neo-classical growth theory international linkages do not matter, but from the trade perspective they are the crucial determinants.

Under free trade and competitive conditions, trade promotes growth, and growth reduces poverty (Bhagwati and Srinivasan, 2003). In the literature on international trade, the issues of income distribution, growth as well as distortions are more or less discussed in terms of endowments of capital and labour, their growth and their relative prices. Countries that initially had a more regulated trade sector experienced an increase in inequality where trade reform, however, does not appear to have significantly affected changes in income distribution.¹ In the income distribution literature, the functional distribution of the two major factors of production again explains the movement of inequality in income distribution over time.² Although infrastructure plays the role of a very important catalyst, it gets virtually no explicit mention in the relevant literature on trade and inclusive growth.^{3,4}

During the recent decades of globalization, economies in Asia and the Pacific grew rapidly until the ongoing global economic and financial crisis appeared in mid-2007. This acceleration of growth, in which international trade has played an important role, has helped Asian and Pacific countries to make impressive strides in economic development (ESCAP, 2009). At the same time, empirical evidence suggests that in some supply-constrained larger economies in Asia and the Pacific, such as China, India and Indonesia, prosperity through trade has been accompanied by rise in inequality.⁵ In fact, globalization in Asia and the Pacific has resulted in growing social and income inequalities.⁶ Thus, free trade is not necessarily a pro-poor growth strategy, where we take either the change in first order inequality as captured by the Gini coefficient, or the change in the number of people below a pre-specified poverty line.

There are compelling reasons why rising levels of inequality can slow down growth prospects when distortions affect different income groups unequally in Asia and the Pacific (e.g., the Lao People's Democratic Republic vs. Thailand). Among other things, high levels of inequality can

¹ There is strong literature on trade and income distribution supporting the fact that trade liberalization does not necessarily lead to equality of income in the presence of trade distortion. See, for example, Edwards, 1997, Slaughter, 1997.

² Refer, for example, Campano and Salvatore, 2007; Gourdon *et al.*, 2008.

³ However, development in endogenous growth theory has introduced the possibility of a productive role of public expenditure on infrastructure with an associated possibility of increasing returns to scale (Barro, 1990 and 1991).

⁴ In economics, there is a need to concentrate on economic infrastructure, which includes services from: (a) public utilities, such as power, telecommunications, piped water supply, sanitation and sewerage, solid waste collection and disposal, and piped gas; (b) public works, such as roads, and major dam and canal works for irrigation and drainage; and (c) other transportation sectors, such as urban and inter-urban railways, urban transport, ports and waterways, and airports (World Bank, 1994). Also refer, Canning, 2006, and Straub, 2008.

⁵ See, for example, Asian Development Bank, 2007.

⁶ See, for example, ESCAP, 2001.

have adverse consequences for social cohesion, quality of institutions and policies, and infrastructure. In turn, social divisions, low-quality institutions and policies, and a lack of infrastructure can have adverse implications for growth prospects of countries in Asia and the Pacific. Since the increases in income inequality can have important implications for the evolution of economic well-being in the long term, it is important to understand the present symptom of linkage, if any, between inequality, trade and infrastructure in developing Asian and Pacific countries. This paper attempts to provide a succinct answer to the debate on trade, inequality and infrastructure linkages. In addition, it deals explicitly with the recent literature aimed at bringing infrastructure to the forefront in the context of trade and inclusive growth.

Rest part of the paper is organised as follows. Section A presents a review of the literature on interconnections between infrastructure, trade and inequality. Section B provides the data and methodology. Section C presents stylized facts on infrastructure, trade and inequality in Asian and Pacific countries. The analytical results and possible implications are presented in section D and the conclusion is given in section E.

A. Infrastructure, trade and inequality: Literature review

Relationship between infrastructure and growth

The role of infrastructure in promoting growth is perhaps the most discussed topic as far as the role of infrastructure in the economy is concerned. The linkage between infrastructure and economic growth is multiple and complex, because apart from affecting production and consumption directly, it creates many direct and indirect externalities, and involves large flows of expenditure thereby creating additional employment (Ghosh and De, 2005). Estache (2006) pointed out that since the late 1980s, more than 150 published papers in English, French, or Spanish had analysed the macroeconomic effects of infrastructure. This literature, with regard to infrastructure, has mainly resulted from conceptual and technical developments associated with new growth theory and new economic geography. According to Estache, the most common way of estimating the impact of infrastructure on growth is to calculate the social rates of return of investment in various types of infrastructure. The methodology used – i.e., growth regressions – is quite common. The findings of the regressions are quite significant as they suggest that in recent years economic returns on investment projects have averaged between 30 per cent and 40 per cent for telecommunications, more than 40 per cent for electricity generation and more than 200 per cent for the construction of new roads. (However, when the outliers are excluded, the average is about 80 per cent for roads.) It was also found that returns tend to be higher in low-income countries than in middle-income countries (Estache, 2006). Thus the conclusion is that infrastructure has a very strong impact on the growth process of a nation, especially if it is a low-income country.

Change in public capital structure is one important factor affecting the long-term behaviour of a country. The decline in United States' productivity was preceded by lower infrastructure investment (Munnell, 1992). Aschauer (1989), while discussing productivity slowdown in the United States, argued that (a) public physical capital together with private and human capital are crucial inputs in the steady state production function; (b) the means of financing public capital

affects the level of productivity; and (c) efficiency of use of public capital together with the quantity of public capital are crucial determinants of the effective public capital stock. He also found that one percentage point increase in the efficiency of public capital increased transitional growth by 0.29 percentage points, while a rise in the debt-financed public capital reduced growth rate by 0.25 per cent. Thus, the quality of public capital, which incidentally in the United States' context points to infrastructure, plays a very important role in increasing the growth rate of the economy as long as it is not counter-balanced by external debt.

Similar research by Hulten (1996) places greater stress on the quality of public capital or infrastructure capital. He defined effective public capital as $K_g^e = \theta K_g$, where θ measured the degree of efficiency in the use of public capital. He used four different indicators to quantify the performance of public capital, i.e., faults in 100 telephone mainlines, satisfactory paved roads as a percentage of total roads, electricity generation losses to total, and the percentage of diesel locomotives to total rolling stock for transportation. He aggregated them into one performance index and then used data for 46 low- and middle-income countries in the period spanning 1970 to 1990. The regression used is real GDP growth per capita on infrastructure performance index, private investment and human capital. The output elasticity to infrastructure, which includes the efficiency term, shows variability ranging from 0.009 to 0.244, indicating that countries using infrastructure more efficiently attained much faster growth of per capita real GDP. More explicitly, his comparison of four East Asian fast-growing countries with 17 African countries showed that had the African countries used infrastructure at the same level of efficiency as the East Asian countries, their growth rates per annum would have been 0.75 per cent rather than -0.20 per cent, which is the actual recorded growth.

Thus, the above results point to the importance not only of the amount of public capital embodied mainly in infrastructure but also its effective use. High levels of public spending per se do not promote rapid growth. The performance of such capital is the main variable promoting faster growth. As Hulten (1996) found, public capital does not influence the growth of low- and middle-income countries very much; it is the effectiveness index that influences it decisively. Aschauer's later study (1998) supported the same conclusion. This points to the basic premise that total factor productivity has a close positive relationship with the performance of the infrastructure capital.

Briceño-Garmendia, Estache and Shafik (2004) highlighted the importance of infrastructure in developing countries unlike its impact on developed countries. They noted that of about 102 studies conducted during the past 15 years, few had found that infrastructure investment had a negative effect on productivity or growth. The sample included 30 studies of multiple countries (including developing countries), 41 studies of the United States, 19 of Spain, and 12 of individual developing countries (Argentina, Brazil, Colombia, India and the Philippines). As stated above, unambiguous results were found in the developing country studies. According to those results, the role of infrastructure is more prominent in the developing countries. Thus, infrastructure does not present any perverse signal for economic growth of any developing country.

A note of caution was sounded in this context by Roland-Holst (2006) who argued infrastructure and growth had causation in both directions, and failure to consider this factor would thus result in overestimation of the contribution of infrastructure to growth. In fact, Calderón and Servén (2005) presented an empirical analysis focusing on Latin America. They reported positive

and significant output contributions of three types of infrastructure assets, i.e., telecommunications, transport and power. Fedderke, Perkins and Luiz (2006) attempted to explain the relationship between investment in economic infrastructure and long-term economic growth by examining the experience of South Africa in a time-series context. Their results indicated that infrastructure had both a direct and an indirect impact on output, and that it may have had an important role in pushing the country onto a higher long-term growth trajectory.

(a) Infrastructure and inclusive growth

The above discussion provides an overview of the interconnection of infrastructure with growth. But as already emphasized, a strong positive influence by infrastructure on economic growth does not necessarily ensure inclusive growth. The discussion of inclusive growth can move in several directions, but the literature discusses this either in terms of access and affordability of, and access to, infrastructure by the poor or the effect of infrastructure on income distribution. The concept of inclusive growth is used interchangeably with the concept of pro-poor growth defined above. This section deals specifically with this pro-poor growth aspect..

Brenneman and Kerf (2002) argued that infrastructure expanded education (especially for transport and energy services), and positively affects health outcomes (especially for the water/sanitation, energy and transportation sectors), but that it was not that visible in telecommunications. Ravallion and Datt (1999) found that between 1960 and 1990 rural poverty levels changed considerably in Indian States. Their results showed that non-farm economic growth was less effective in reducing poverty in those States with "poor" initial conditions in terms of rural development and human resources. They explained that factors such as low farm productivity, low rural living standards relative to urban areas as well as poor basic education resulted in the poor not participating fully in the growth of the non-farm sector. Deninger and Okidi (2003) reported similar findings regarding growth and poverty reduction in Uganda during the 1990s. Their work indicates the importance of improving access to basic education and health care. At the same time, this paper points out the dependence of social infrastructure on complementary investments in electricity and other infrastructure.

Ghosh and De (2005) carried out a detailed study on the role of infrastructure in exacerbating the inter-state inequality in India. They took data for 18 major Indian States for the period of 1970-71 to 1999-2000. They regressed the real per capita State GDP on several social, financial and physical infrastructure variables. This study indicated that:

- (a) Inter-state disparity in per capita net State domestic product among Indian States has been rising significantly during the past 25 years;
- (b) Inter-state disparities in physical, social and financial infrastructure facilities have remained at an alarmingly high level during the same period. That is, the relative positions of the States have remained unchanged in terms of any definition of development. In other words, there have been enormous differences in individual performance among the States in terms of all the basic indicators of development;
- (c) Physical and social infrastructure facilities have proved to be highly significant factors in determining the inter-state level of development.

Ghosh and De's (2005) conclusions support the findings of Ravallion and Datt (1999). Hence, inclusive growth requires a balanced development of infrastructure across regions so that growth is evenly spread across rich and poor States over time. However, to overcome the initial imbalance, the poorer regions need more accelerated investment in infrastructure as revealed in the case of the Indian States.

Khandker and Koolwal (2006) analysed the impact of infrastructure development on pro-poor growth in context of Bangladesh. Using quantile regression techniques, they concluded that growth in overall income indeed led to a significant reduction in poverty, and that it had had a significantly higher impact on extreme poverty reduction compared with moderate poverty reduction. They argued that while those pure growth effects on household poverty incidence were not very large, income growth through certain policies – i.e., proximity to roads, electrification and commercial bank penetration – could lead to substantial reductions in overall poverty in the sample. This is an important observation that investment on specific infrastructure produces welfare enhancing distributional effect compared to pure growth.

In a similar paper, Khandker, Bakht and Koolwal (2006) revealed the importance of rural roads in Bangladesh. Again, using panel quantile regression, they found that in road development project (RDP) areas, both moderate and extreme poverty declined in project villages. In those villages, about 57 per cent of households were moderately poor before the road was paved, while some 48 per cent of households were poor after the road had been paved. A reduction of about 6 per cent in extreme poverty (from 35 per cent to 29 per cent) was registered in RDP project villages after roads were paved. Interestingly, they found that in control villages there was no significant change in poverty over time.

These results are very similar to the findings of Binswanger, Khandker and Rosenzweig (1989), who highlighted the importance of roads in India's rural economy. They said it worked through marketing and distribution scopes, and through reduced transportation costs for agricultural goods. Somewhat complementary to this are the findings of Barnes and Binswanger (1986) regarding the effect of rural electrification on agricultural productivity in India.

Fan, Zhang and Zhan (2002) documented the critical role of infrastructure development in China. Using Chinese provincial data for 1970 to 1997, the simultaneous equations model indicated that government investment in irrigation, education and infrastructure (particularly roads, electricity and telecommunications) not only helped in raising growth levels but also contributed significantly to the reduction of rural poverty and regional inequality in China. They showed that this happened

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