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Financing Road Infrastructure in China and India: Current Trends and Future Options

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Abstract

Road infrastructure has been a key input in the economic growth and poverty reduction strategies of China and India. The two countries have used very different instruments for road financing with China mobilizing substantial resources through directed credit by state-owned banks and India heavily relying on international institutions and fuel taxes. However, current modalities of road financing will be insufficient to meet future investment needs requiring both countries explore new mechanisms to attract private capital and expand the fiscal space of central and subnational governments. Different instruments of resource mobilization and intermediation are assessed and compared extracting lessons that could be valuable to many developing countries. Facilitating the participation of the private sector in road development would require *inter alia* strengthening regulatory frameworks and deepening and broadening domestic financial markets. But given the strong public good characteristics of large segments of the road networks in China and India most of the funding for road construction and maintenance would need to come from the establishment of efficient and sustainable systems of earmarked road-related charges, including a fuel tax in China.

1. Introduction

The economic ascendancy of China and India is one of the most debated issues among development experts. Transport infrastructure has been a key input in their economic growth and accounts to a significant extent for regional socio-economic disparities within these countries (Demurger 2001, Ghosh and De 2005). Road development, especially improvements in rural connectivity, has contributed to poverty reduction in China and India creating employment and expanding access by the poor to basic services (Cook et al. 2005; Duncan 2007; Fan and Chang-Kang 2005).¹

Road networks in the two countries remain nevertheless far from adequate and economic and population growth trends are expected to place them under additional pressure. Expanding, upgrading and maintaining these road systems will require large investments. Historically, road infrastructure in China and India has been financed through general revenues but with mounting fiscal demands the public sector is proving increasingly unable to meet investment needs. Hopes that the private sector will take a greater role have not fully materialized and assistance from multilateral institutions remains too low to fill the gap. Hence, as traditional financing instruments are being exhausted, there is an urgent need for exploring new mechanisms for resource mobilization and intermediation.

Although China and India have very different economic and institutional settings both countries will confront common challenges as their road networks try to accommodate increasing traffic volumes in coming years. Given their geographical scale and diversity, road development would also have to be balanced reaching remote and less-favoured areas.

¹ During the last decade road construction in China generated over 4 million direct jobs and could have added up to 2% of GDP every year. On the other hand, deficiencies in its transport infrastructure is costing India up to 1-1.5% of GDP growth annually.

This manuscript attempts to look at the strengths and shortcomings of current policies for road financing in China and India and inquire into the ability of existing instruments in meeting future investment needs. Through a comparative analysis of modalities of resource mobilization in both countries—prevalent as well as still unexploited—this paper will try to extract lessons that could be valuable not only to each other but also to other developing nations. The rest of the paper is structured as follows. Next section summarizes the state of road infrastructure in China and India. Section three compares current expenditure patterns and financing mechanisms while section four explores future investment needs. Section five discusses alternatives for financing road infrastructure and section six concludes.

2. Current Status of the Road Sector in China and India

Prior to the economic reforms of the late 1970s, transport infrastructure in **China** was promoted mostly to the extent it served to move raw materials to the industrialized provinces in the north. In fact, until the late 1980s China had one of the lowest levels of mobility per capita in the world (WBCSD 2004, Economist 2005). Strong economic growth unleashed by the reforms led to significant increases in freight and passenger traffic and growing pressures on an ill-equipped road network. However, it was not until the 1990s that massive investments began to be poured into roads. The road network has doubled in length since 1990 with the expressway system alone expanding by more than 300 times (Table 1). No other developing country has expanded its road network to that extent over such a short period of time. Until recently China's strategy has centered on creating a trunk network of high standards and overcapacity (World Bank 2007). Only since 2000 have rural roads started to receive higher priority in China. Emphasis on high quality roads has taken place at the expense of low road densities placing the Chinese

road system as one of the sparsest in the world. National statistics also mask important regional disparities as road quality and density are several times higher in coastal regions than in western China. For instance, in 2002 lower standard roads accounted for an average 40% of the network in the six southwestern provinces, twice the national average and five times higher than in the north.^{2, 3}

==> **Insert Table 1 around here**

India's most recent efforts to improve its road network have also followed higher economic performance and traffic volumes but lagged a decade behind China, after the liberalization of the mid-1990s. In fact, investments in roads only started growing rapidly since 1999 with the implementation of the *National Highway Development Programme* (NHDP), the Indian arterial network. Contrary to China, India has traditionally prioritized feeder roads and almost all road expansion since 1990 has been in low-standard roads. Today, the district and rural networks in India total over 3.1 million km, almost twice as large as the entire road system in China (GOI 2007a). By contrast, the arterial network has only doubled in size since the time of independence sixty years ago.

Overall, the Indian network is regarded as of poorer quality than its Chinese counterpart with less than 1% of China's expressways and almost twice its share of unpaved roads (Table 1). The main segments of the Indian system remain highly congested with the National Highways (NH), which accounts for only 2% of the entire network, carrying over 40% of all road-based traffic and having only single lane in 33%

² In this manuscript the term province is used in a broad sense and referring to the 31 provincial-level divisions (22 provinces, five autonomous regions and four municipalities) and two Special Administrative Regions that form China.

³ In 2003 the share of low-standard roads (class IV) in the southwestern provinces of Guizhou, Sichuan, Tibet and Yunnan exceeded a third of their networks while high-standard roads (class I and II) accounted for less than 10%. This compares to the north and eastern provinces of Beijing, Jilin, Shanghai, Tianjin and Zhejiang where class IV roads represented less than 6% and 20-35% of the roads were class I-II roads (GOC 2005).

of its length. State Highways and Major District Roads—4% and 14% of the Indian network respectively—convey another 40% of the traffic. The remaining 80% of the network is constituted by sparsely used and lower quality rural roads (GOI 2007a; World Bank 2004). At the same time, and despite high road densities, 40% of habitations below 1,000 people still lack access to all-weather roads (World Bank 2004). There are also significant regional disparities with the proportion of unpaved roads in eastern and north-eastern states several times higher than in the north and east of the country.⁴ These deficiencies in the transport system are often cited in investment surveys as one of the most important obstacles for business development in India and could constraint future economic growth.

China and India are currently embarked on ambitious road development programmes although of very different scale. In addition to projects aiming at correcting transport deficiencies in western provinces—the *Western Development Programme*, (WDP) launched in 2000—, China is expected to complete in late 2007 its *National Expressway Network* (NEN), 45,000 km of expressways connecting its 100 largest cities. On its part, much of the efforts in India are concentrated on the arterial highway network. The first phase of the NHDP, to be finalized in 2008, will provide for 5,800 km of highways linking the four major cities in the country.

3. Investment Trends and Financing Instruments for Road Infrastructure in China and India

The impressive expansion of the **Chinese** network has been the result of very high levels of capital investments. Since the late 1990s, investments in road infrastructure in China have exceeded 3.5% of its GDP, equivalent to India's investments in all infrastructure

⁴ In 2002, the share of unpaved roads exceeded 65% in the eastern and north-eastern states of Assam, Jharkhand, Manipur, Nagaland, Orissa and Tripura. By contrast, in the states of Gujarat, Haryana, Punjab and the Delhi Union Territory unpaved roads accounted for less than 15% of their networks (GOI 2007b).

sectors (Table 2) (ADB 2005a; ADB/JBIC/WB 2005). In absolute terms, China's investments in roads have grown by over 40 times since 1990 to about US\$60 billion in 2005, a third of which allocated to the NEN (World Bank 2007). Current and planned investments by China in expressways are comparable to those made by the United States and Japan in the mid-1950s and mid-1960s respectively with the difference that China began developing the NEN at lower levels of GDP per capita (Churchill and Thum 2005, World Bank 2007).

Although road development represents a significant item for **Indian** central and state governments—up to 12% of total capital expenditures—in 2004 India invested US\$ 5 billion in its entire road sector, a tenth of China. Different investment priorities in the two countries are also reflected in the sectoral allocation of funds. In India rural and district roads absorb 50% of total road investments compared to 15% in China (Fan and Chan-Kang 2005, World Bank 2004).

==> **Insert Table 2 around here**

Economic reforms in **China** have transferred increasing responsibilities in infrastructure provision, but not necessarily resources, to sub-national governments that are now responsible for 90% of road investments (see below). Under the **Indian** federal system, construction and maintenance of 98% of the network—all roads outside the National Highway system (state highways, district and rural roads)—fall under the responsibility of state governments. However, road investments in India are roughly equally divided between central and state governments (Basu 2007; World Bank 2004).⁵

⁵ Road infrastructure development at the provincial level in China falls under the responsibility of *Provincial Communications Departments*. In India, state government agencies for road development are *Public Works Departments* and/or *Rural Development Departments* along with other subsidiary agencies in some states.

Road development in China and India also differs in the financing instruments used. Road infrastructure in both countries has been traditionally financed through government budgets. Even today most financing comes from public sources, either directly via budget allocations or through government borrowing and guarantees. Nevertheless, growing demands for road development have prompted both countries not only to increase but also diversify their sources of financing (Table 3).

General budget allocations for road development in **China**, from both central and local governments, have been declining since the 1970s representing today less than 4% of total investments. Instead revenues from earmarked taxes are taking a greater role (Churchill and Thum 2005; Fan and Chan-Kang 2004; Ruyu 2006). A tax on fuel has yet to be implemented ⁶ but the vehicle purchase tax contributes now to over 12% of road investments. Other road-related fees collected at the provincial level provide for an additional 30% of road funding (Table 3). Proceeds from these road charges, along with toll revenues, are leveraged by provincial governments to borrow funds from domestic banks. Financial intermediation in China is heavily biased towards bank lending.⁷ Low-interest credit extended by the China Development Bank (CDB) and the four state-owned commercial banks finances almost half of total road investments. On the other hand, loans from overseas commercial banks, foreign governments and international financial institutions (IFIs) provides less than 1% of road financing. Despite representing the single largest portfolio in any sector worldwide, over the last twenty years, combined funding for Chinese roads from the World Bank (WB) and Asian Development Bank (ADB) amounted to a mere US\$8 billion. In an interesting development, WB and ADB launched

⁶ Although a levy on fuel was approved by China's National People's Congress in 1999 it has not been implemented. The tax is opposed by provincial governments as their accrual by the central government, could threat the collection of other road use charges at the local level. Discussion on the implementation of the fuel tax has been gaining further momentum during 2007 but high oil prices could prevent or postpone its introduction.

⁷ Bank deposits account for three quarters of total financial assets. Bank loans for infrastructure development represent around 40% of all local currency lending (Farrell and Lund 2006, Farrell et al. 2006).

in 2005 yuan-denominated bonds (*Panda bonds*) for the equivalent of US\$250 million (ADB 2005b).

Although compared to other developing countries China has been quite successful in attracting private capital into transport projects, the private sector finances less than 7% of total road investments, mostly as joint ventures in toll roads (World Bank 2006b). The entire NEN, many segments of the arterial network and even some local roads operate on a toll basis—over 8% of the road network in 2003 was tolled. The existence of such a large toll road system has allowed China to experiment with road securitization (Ojiro 2003).⁸ However, deterred by an excessive number of toll stations and high fees—among the highest in the world relative to income—Chinese drivers keep using congested second-class roads leaving many expressways underutilized. Even in highly trafficked areas, many toll roads have failed to generate sufficient returns to repay loans and distribute dividends (Economist 2005; World Bank 2007).

==> **Insert Table 3 around here**

In **India**, a significant and increasing share of funding for roads comes from fuel taxes deposited in the *Central Road Fund* (CRF). Following its revamp in 2000 to augment its resource base and successive fuel tax hikes in 2004 and 2005 the CRF has increased its revenues to over US\$2.5 billion in 2007 from just US\$1.5 billion two years earlier (Bahadur 2006; Basu 2007). Proceeds from the CRF are distributed to central and state governments for development and maintenance of the road network. In fiscal year 2007-2008, 55% of CRF revenues will be allocated to National Highways (central government) whereas State Highways and district and rural roads (state governments) will receive 15% and 30% respectively (Basu 2007). Revenues from other road-related

⁸ Equity capital is raised through the issue of shares in the assets of provincial development expressway companies and backed by the revenues generated from tolls.

levies, in the range of US\$10 billion in 2002, go to engross the public coffers but not necessarily used for road infrastructure (Bahadur 2006; World Bank 2004).

Allocations from the CRF and other road-related charges, along with central government guarantees, are leveraged by Indian central and state road agencies to raise additional funding from domestic financial markets. However, in contrast with China, domestic borrowing plays a small role in infrastructure development in India.⁹ Between 1999 and 2002 the central agency for highway development—the National Highway Authority of India, NHAI—obtained total loans for the equivalent of US\$2 billion but borrowing has been negligible since then. Although bank lending in India is heavily directed by the government, infrastructure is not included among the “*priority sectors*” for domestic credit delivery (Chandrasekhar and Pal 2006; Suresh 2005).¹⁰ Instead, international credit from the WB and ADB represents a large source of road financing in India, almost 40% in the main arterial network. Most of these loans are negotiated by the central government, which retains the responsibility of repayment, but passed to state road development agencies in the form of grants and loans (GOI 2006; NHAI 2006). The ADB has recently provided for long-term local currency financing with the issuance in 2005 of rupee-denominated bonds worth US\$110 million (Farrell et al. 2006).

India has also established specialized institutions to tap into domestic and international capital markets and raise funds for infrastructure. The *Infrastructure Development Finance Corporation* (IDFC) provides long-term loans and guarantees, US\$1.3 billion in 2005, to public and private infrastructure projects. The *India Infrastructure Finance Company Limited* (IIFCL), a special purpose vehicle with a

⁹ Overall, the Indian banking sector lends less than half of China’s relative to deposits.

¹⁰ “Priority sectors” for credit delivery were established in the late 1960s as: a) agriculture, b) small scale industry and c) other priority sectors. Over time the latter group has broadened to include loans for housing, NGOs, the food and agro-based processing sector and the software industry.

borrowing limit of US\$2.2 billion in 2006, co-finances up to 20% of the cost of public-private partnerships (PPP) in infrastructure projects including roads.

Constrained by high fiscal deficits Indian governments have tried to lure private investment through, *inter alia*, the elimination of restrictions on foreign direct investment (FDI), tax holidays, revenue/traffic guarantees and a viability gap grant of up to 20% of the project to be paid out of the CRF. Despite all these inducements, the private sector has not come forward as anticipated, especially compared to other infrastructure sectors like telecommunications and energy. Originally, the government targeted 20% of the funding for the initial phases of the NHDP coming as PPPs; however, no more than 10% has been materialized in the first two phases. The government's goal is now to develop future phases of the NHDP *mostly* as private Build-Operate-Transfer (BOT) projects, in some cases the entire cost of the project (ADB 2005a; GOI 2006, 2007c).

The economics of the transport sector in India are also affected by distortionary tariff structures. The current system of road and railway tariffs have resulted in more freight traffic being hauled on road by trucks—contributing to congestion and damaging of roads—than economic efficiency would have otherwise dictated (GOI 2002a, 2006; World Bank 2004).

For a number of reasons accessing capital for road financing is especially challenging for **sub-national governments**. Most roads under local jurisdiction fail to offer sufficient profit perspectives for private investors. In the less-developed regions of both countries (western and central provinces in China and north-eastern states in India), where traffic is sparser and road tolls are less profitable, local governments have faced greater difficulties to raise revenue. Sub-national governments also face higher barriers to access financial markets increasing their cost for borrowing. In China, local governments also face strict limits for borrowing and issuing bonds (Fan and Chan-Kang 2005; World

Bank 2007). A small local debt market has been developed in India but most of public borrowing continues to be incurred by the central government (Kehew et al. 2005). In many cases, local governments in China and India may also lack the regulatory and administrative capacity to engage in complex operation and management arrangements with the private sector. As a result, only a few Indian States have been successful in signing BOT concessions for segments of their networks (Kehew et al 2005; World Bank 2004). In China, in addition to problems in planning and policy coordination (ADB/JBIC/WB 2005), decentralization of infrastructure provision has also further contributed to increase regional inequalities in road infrastructure. Nevertheless, there have been significant efforts by the central government in the two countries to correct these imbalances. Since 2000, and as part of the WDP, the twelve provinces in western China have received over US\$ 100 billion of investment in road and rail projects and their share in central government investment in roads has increased. In India, the budget for the *Special Accelerated Road Development Programme for the North East*, improving the road connectivity in the north-eastern states has been revised from US\$ 0.5 in 2005 to US\$2.7 in 2007 (GOI 2007c).

4. Will Current Financing Instruments Meet Future Investment Needs?

Road networks in both countries are expected to go under increasing pressure as economic growth and rising personal incomes multiply current levels of freight and passenger traffic in coming years (Singh 2007; WBCSD 2004). In order to attend projected demand, China and India have large-scale projects to expand their arterial networks, improve rural connectivity and eliminate regional disparities. Materializing these projects will require massive financial investments (Table 4).

The **Chinese** government estimates that investment needs in the road sector could amount to US\$50 billion annually during the next 15 years. While this figure remains

within current investment levels it is likely that future needs will surpass these projections. Except in toll expressways, China's investments are not keeping pace with demand and road utilization is outpacing construction. More importantly, current mechanisms of road financing may not be sustainable. Cheap credit is unlikely to continue as present levels as state-owned commercial banks are being forced to comply with more stringent lending regulations. In addition, there is a move towards interest rate liberalization and a reduction in overall liquidity to curb inflationary pressures. Altogether, these trends will increase the cost of raising capital through bank loans.

China has attracted significant private investment into toll expressways but it is unlikely that the private sector will continue to show similar appetite in the future. Not only toll revenues barely cover for operating costs in many segments of the NEN but the most profitable parts of the network are already in operation. Many of the roads yet to be built are in the non-arterial and rural networks where already overwhelmed provincial governments will have to come out with most of the financing. Innovative mechanisms will therefore need to be developed if the private sector is to participate in the construction of low trafficked segments.

During the last fifteen years the main focus of road transport policymakers in China has been on new construction with management of road assets lagging behind despite evidence of the high economic returns of maintenance. China spends in road maintenance the equivalent of 0.1% of its GDP— a third of actual needs—and only 6 of the 31 provinces, all of them in the east, generate sufficient funds for adequate maintenance of their road asset base (Donnges et al 2007; World Bank 2007).

==> **Insert Table 4 around here**

Estimates about road investment needs in **India** fail to get a clear consensus (Table 4). At any rate these are expected to be very large: from US\$6 billion per year for highways or US\$23 billion annually for all paved roads up to US\$122 billion per year for the entire road sector in some longer-term estimates. The projected cost of some individual projects are in the tens of US\$ billions. With a much larger road network, India also needs to spend on its maintenance considerably more than China. However, as the latter, maintenance expenditures in India are estimated to be only one third of what they should be. The relevant point here is that, even under conservative scenarios, in coming years India would need to finance investments several times current levels. Combined central and state fiscal deficits in excess of 10% of GDP during the last decade have been a major obstacle restricting public borrowing. The capacity of Indian governments to finance road projects through commercial lending has improved after reducing their combined fiscal deficit down to 6.4% in 2006 (OECD 2007). However, with allocations from the CRF and other revenues already committed for servicing the debt and BOT annuities for years to come, central and state governments have limited space for going into further borrowing.

Under present conditions, it is unlikely that later phases of the Indian NHDP—some with lower levels of traffic—could attract more private capital than the two first stages, let alone be financed *mostly* through BOTs. Even assuming a target of 25% of private funding in highway development—still high by emerging market standards and several times current levels of private involvement— and a conservative needs estimate of US\$4 billion per year, private investments in highways would need to reach US\$1 billion per year. To set this figure in context cumulative investments in transport projects (including also rail, sea and air transport sectors) with private participation—not only private funding—in the fifteen years between 1990 and 2004 amounted to US\$3.2 billion.

From 2000 to 2006 private participation in Phases I and II has involved little over US\$1.0 billion while the cost of Phase III alone has been estimated in US\$12 billion (NHAI 2006).

To meet this gap the Indian government hopes that the larger share of private investment into roads will come from foreign investors. The government-appointed *Committee on Infrastructure* calculated that the infrastructure sector in India has the potential to absorb up to US\$150 billion in FDI over the next five years. Once again these estimates have to be contrasted with *total* levels of FDI inflows in India of US\$6.6 billion in 2005 and US\$16.8 billion in 2006 (UNCTAD 2007).¹¹ Arguably, projected multi-billion programmes for road development in rural areas and the north-eastern states are unlikely to attract high levels of private investment whether domestic or international. While many of the future phases of the NHDP should carry enough levels of traffic to make projects profitable and commercially viable it is also evident that private financing, including FDI, cannot *replace* public funding as the Indian government optimistically expects.

In sum, it is becoming increasingly clear that traditional sources of public and private road financing in China and India are not only reaching their limits but there would be insufficient to meet projections of traffic growth and ongoing efforts to eliminate regional disparities. How existing financing instruments could be strengthened? More importantly, what additional resources, both international and domestic, could be tapped for financing road infrastructure?

¹¹ In 2005, India liberalized FDI caps and procedures in a number of sectors including mining and energy

5. Mobilizing Resources for Road Infrastructure Financing

Finding the most efficient ways to mobilize resources and channel them to finance infrastructure remains one of the key challenges faced by policymakers and where both countries could benefit from each other experience. For developing countries financing the large investments associated with road infrastructure requires the mobilization of all possible resources: domestic and international capital (including international assistance) and from private and public sectors. As in other infrastructure sectors, road projects are developed over long periods thus requiring financial resources that are matched not only in scale but also in time. In this section we will assess and compare the possibilities and limitations of road financing systems along several dimensions (Table 5). Their performance will be explored considering not only a) their capacity to mobilize the large sums of capital needed in road infrastructure—including recurrent expenditures associated with maintenance of the network assets—but also b) their sustainability in the long-term and capacity to adapt to the new pressures and demands that the two networks will face in coming years.

====→ **insert Table 5 around here**

■ Role of FDI and international capital markets. For most countries FDI constitutes a small share of total road financing being affected by the same obstacles discouraging private investment elsewhere. Although foreign investors may evaluate risks differently than domestic ones, creating an environment favorable for FDI involves similar factors to those nurturing domestic investment, *inter alia*, a stable macroeconomic environment, clear and fair regulatory systems and development of risk mitigation mechanisms. Although the Indian road network has received only a fraction of foreign

investment than China's, the elimination of ceilings on road sector FDI in India should help attracting more capital. Further liberalization in India of the capital account and eventual full convertibility should also improve foreign investor confidence.

Only road projects with commercial viability—highly trafficked segments amenable to toll exploitation—attract private capital (Table 5). However, uncertainties about traffic volumes and the legal/commercial feasibility to set fees also affect private interest. Pricing restrictions in India have traditionally limited private investments in infrastructure projects whether in transport, telecommunications or energy. The experience of China, where overestimation of traffic volumes and stiff rates have reduced the profitability of many toll projects, could be a valuable lesson for India. As India develops its arterial network, it is important that the commercial viability of road segments is clearly established before toll tariffs are introduced. On the other hand, China could explore the introduction of minimum traffic/revenue guarantees in privately operated roads as in BOT contracts in India (Table 6). While these options could boost FDI into roads it is unlikely that foreign capital could become a major source of road financing, at least to the extent hoped by the Indian government.

International financing for roads through commercial bank syndication, international bonds or equity has been—and is bound to be—limited in both countries and available only to public road development agencies or corporate entities with high credit ratings. Small companies and sub-national governments face even greater difficulties to tap into international capital markets. In addition to maturity mismatches implicit in any bank lending, road financing via international bank borrowing also involves currency risks as toll roads and road-related charges generate only local currency (Table 5). Enhancing access to global capital requires improving corporate governance and the credit-worthiness of governments (Table 6). Barriers to access capital could be reduced

once the initial construction risks have been cleared and traffic levels and revenues have been ensured. Nevertheless, securitization at the international level is only likely to be successful in highly profitable tolled segments. The Chinese government has plans to list several railway companies in foreign exchanges but securitization of road assets has been limited to domestic exchanges.

==> **Insert Table 6 around here**

■ An expanding role for IFIs. The contribution of IFIs to road financing in China has been small. In the case of India they still provide for quite a sizeable share but this will also decline as the country steps up investments in the sector. Instead, IFIs' functions beyond traditional lending need to be strengthened and expanded. Multilaterals could foster greater private participation in road projects by facilitating access to financial markets. In this line, the provision by the WB of loans to cover the *viability gap* grant in India is a significant step. The mere involvement of IFIs as co-financers in a project enhances investor confidence. The issuance of local currency bonds by WB and ADB is also a valuable instrument for road financing although total funding is still very low. Finally, the use of WB and ADB guarantee facilities is equally limited and there should be a higher emphasis on credit enhancement mechanisms (Tables 5 and 6).

■ Deepening and Broadening Domestic Financial Markets. In the end infrastructure projects have to be financed primarily through domestic resources hence the need of establishing efficient financial systems for the intermediation of domestic savings. Domestic savings are at record levels in China and India. However, households in both countries invest most of their savings in low-yielding bank accounts and other

non-financial assets (Farrell et al. 2006). If more efficiently allocated these savings could be channeled towards productive investments including infrastructure.

Control of banking systems by both governments has reduced their efficiency and raised costs of intermediation. Directed credit and excessive reliance on bank lending has left road projects in China vulnerable to maturity mismatches and lending flows. Some in India have called for the government to give *priority status* to infrastructure in bank credit provision (Suresh 2005). Instead, efforts in both countries should be concentrated in liberalizing the banking system, reducing government interference, eliminating holding requirements and give consideration to the introduction of international competition (Table 6).

Diversifying road financing mechanisms entails the development of domestic bond and equity markets. Longer maturities make domestic bonds a better alternative than bank loans for infrastructure projects. Their stable and long-term returns are also attractive to institutional investors (Table 5). However, bond markets in China and India, especially their corporate segment, remain underdeveloped (Huaipeng 2005; Xiaochuan 2005; ADB 2006; Farrell et al. 2006). Despite significant deepening in recent years, the bond market in China lags behind equity's accounting for less than 13% of total financial assets and is largely dominated by government (GB) and CDB bonds. Weakness in the stock market during the 2001-2005 period accelerated the development of corporate bonds (CB)—accounting for 39% of total bond assets in 2004 (Kolesnikov 2005)—although their issuance is rationed by the government and mostly reserved to state-owned enterprises. Pension funds and other institutional investors are legally required to invest in bank deposits and GBs but face strict limits in using the CB market. In addition, the regulatory framework remains poorly developed lacking adequate accounting procedures and credit rating systems. (Farrell and Lund 2006).

The need to fund persistent fiscal deficits has led to a relatively mature GB market in India that amounts to 34% of GDP and 95% of the entire debt market. Close to 75% of the GB market could be considered as captive demand by banks and institutional investors that, as in China, are required to invest a significant share of their assets, up to 90% for pension funds, in GBs. By contrast, the CB market is still quite small accounting for only 2% of GDP (Farrell et al. 2006).

Deepening and broadening the Chinese and Indian bond markets to finance road infrastructure will require that both countries develop sound macroeconomic environments, financial liberalization, appropriate exchange rate policies as well as improved governance in corporations and public road development agencies. Strengthening of regulatory standards should be made compatible with the removal of administrative obstacles that mar bond issuance and reduce their demand (Table 6). In China it would also demand improving the liquidity of GB trading, establishing independent credit rating agencies and eliminating restrictions on the issuance of CBs. Considering the increasing role of sub-national governments in infrastructure development in China current restrictions on their ability to issue bonds should be reconsidered. Developing a vibrant CB market in both countries would also implicate the elimination of holding restrictions on institutional investors.

Deregulation and liberation in China and India have made equity markets an important instrument in the mobilization of resources that account now for 14% and 35% of their total financial assets, respectively (Farrell et al. 2006). China has developed sizable securities markets but their poor performance during 2001-2005 despite sustained economic growth attests for the existence of underlying structural weaknesses.¹² Administrative hurdles hamper the issue of shares and captive demand on GB limits

¹² Cycles in the Shanghai and Shenzhen stock markets are extremely pronounced. A four-year market slump during 2001-2005—despite strong economic growth—has been followed by rapid appreciation during 2007 that has led to fears of a stock market bubble.

institutional investors' involvement in the equity market. Strengthening the regulatory framework and improving corporate governance will be first steps for the Chinese equity market to provide financing for road infrastructure. On its part, the Indian equity market enjoys greater financial depth and a solid regulatory infrastructure but high concentration of ownership among corporate insiders and low penetration of institutional investors has made the system vulnerable to trade manipulations (Table 6). Raising equity from domestic markets is particularly feasible in road projects with multiple stages where shares in the assets from the first stage could be used to access new capital. As India expands its arterial system, securitization could prove to be an important tool to mobilize capital. Nevertheless, as the Chinese experience illustrates, results with securitization have been mixed and there are limits on how much funding could be raised through this method.

Setting specialized financial institutions that could tap into domestic and international capital markets has been recently favored by India. However, the added value of creating new institutions should be assessed on their contribution to mobilize additional resources and not merely redirect capital. This is the case of the newly created IIFCL that will tap into the same type of resources than the IDFC. Furthermore, although borrowings by IIFCL are not reflected in government accounts, the provision of counter-guarantees will increase off-budget liabilities amounting to hidden deficit (Venkitaramanan 2005).

■ *Using foreign exchange reserves for road development?* Both countries have amassed large foreign exchange reserves (FERs), well beyond levels needed to maintain import cover and monetary stability—US\$1,4 trillion in China and US\$270 billion in India by the third quarter of 2007. It has been estimated that in 2006 China and India hold excess FERs in the range of 41% and 15% of their GDP, respectively (EIU 2006a,

2006b). With safety and liquidity, rather than return maximization, as prime goals a significant portion of FERs is invested in low-return U.S. Treasuries. Both countries are therefore incurring high opportunity costs by maintaining such high levels of FERs instead of deploy them in more productive uses (Table 5). In this line, other Asian countries such as Singapore and the Republic of Korea have invested part of their FERs through subsidiary investment corporations. China has channeled part of its FERs to recapitalize the state-owned commercial banks and even considered their use in building up a strategic oil stockpile (Forbes 2005). Investing excess reserves could add 1-1.5% of GDP each year in India and the Indian Planning Commission has suggested using FERs for infrastructure development (Shukla 2006). However, unless sterilized increased liquidity could lead to inflationary pressures. In India, the deterioration of the current account resulting from higher oil prices and demand for industrial inputs could also undermine the currency and complicate monetary policy as the country moves toward capital account convertibility (Singh 2005).

■ *Increasing public sources of funding for roads.* Private financing of roads is only possible to the extent that direct users can be charged. However, district and rural roads—and arguably even most of the arterial network—carry strong public good characteristics that cannot be captured commercially. Furthermore, higher sunk costs and natural monopoly features make roads less amenable to private sector financing than seaports and airports where the private sector has been taking a lead role, especially in China. Even at its peak in the mid-1990s private involvement in infrastructure development as a whole—and including highly liberalized sectors such as telecommunications and energy—did not exceed 20% worldwide. In sum, most of the financing for road infrastructure would need to come from public sources being these general revenues, earmarked taxes and charges or issuance of debt.

Financing *long-term* road development projects requires stable and sustainable sources of revenue beyond *annual* tax revenues. Earmarking road related charges and taxes into special accounts has been widely used in developed countries (ADB 2003). Establishing appropriate systems of charges could also help rationalizing traffic volumes and road use (Table 5). Over the last decade China and India have introduced road-related charges that, in addition to finance non-related expenditures, provide reliable streams of funds for road construction and maintenance. A still untapped option in China to raise capital is the implementation of a tax on fuel. As shown in other countries—including India—a fuel tax could become a sizeable and sustainable source of revenues for road development (Table 6). The introduction of a 30% tax on fuel prices in China could generate enough revenues to cover the maintenance expenditures of the entire network (World Bank 2007). The introduction of the fuel tax is certainly a sensitive issue but its impacts could be cushioned through a gradual introduction or the use of targeted subsidies.

Apart from the fuel tax, the bulk of road-related charges in India do not revert back to the sector generating surpluses for the government in the range of US\$10 billion annually. Meanwhile, revenues from the CRF are inadequate to cover current or projected construction and maintenance costs (World Bank 2004). Increasing the share of road charges reinvested in roads would be key to generate resources for road development in rural areas (Table 6). Cross-subsidization has been widely used in Japan and some European countries and India and China should also earmark revenues from profitable tolled expressways to finance non-remunerative roads.

In sum, this comparative exercise across financing instruments and in both countries argues for the need of expanding the fiscal space of governments, strengthening financial markets and enhancing opportunities for the private sector through policy and

regulatory reforms. However, beyond financial investments in infrastructure as discussed in this manuscript improving road transport also requires of actions in the area of road and traffic logistics. Long delays at tollbooths and checkpoints, high toll fees, outdated commercial vehicle fleets, traffic mix or lack of intermodal transport coordination contribute, among other factors, to higher transport costs and reduced connectivity in both countries.¹³ In this regard, removing tariff distortions in the Indian railway and road systems could raise additional revenues for road construction and lead to a more economically efficient distribution of passenger and freight traffic.

6. Concluding Remarks

Sustained economic growth in China and India has resulted in increasing freight and passenger traffic volumes. To meet current and future demands as well as reduce regional disparities both countries have made significant investments and improved their road networks although following quite different strategies. While China has prioritized the development of high-standard highways and expressways, India has concentrated investments on lower level district and rural roads. Comparing the outcome of their experiences suggests that a middle way approach could have been more appropriate (Table 6). For every region in China marginal returns to investment and poverty reduction impacts are several times higher for investments on low standard rural roads than on high quality arterial roads (Fan and Chan-Kang 2005). On the other hand, the underdeveloped arterial network in India is cause of huge economic losses (Johnson 2006; Jones 2006). Largely dictated by their economic and institutional settings these countries have also used very different financing instruments with China heavily relying on directed credit

¹³ In India, it has been estimated the annual cost to the economy of truck delays at checkpoints between states could be between US\$225 and 575 million.

from state-owned commercial banks and India mobilizing substantial revenues from fuel taxes but also depending on assistance from multilateral institutions.

In both countries current financing mechanisms for road development and maintenance appear to be inadequate and/or insufficient to meet expected demands in coming years. Private sector participation in road development has been moderate at best, especially when compared to other infrastructure sectors, and is unlikely it will take a much greater role unless governments address private investors concerns related to traffic risks and pricing structures. China and India have still much to do in creating policy and regulatory environments that facilitate access by the private sector to capital markets and provide guarantees for risk mitigation. Reducing government intervention in financial markets should contribute to their deepening and broadening as well as foster the growth of the investor base, especially institutional investors—a natural source for funding road infrastructure. Easing restrictions on the deployment of funds by institutional investors could significantly improve the flow of capital for roads and infrastructure development in general. China and India have created specialized institutions for long-term infrastructure financing and there are certainly arguments for establishing an Asian investment bank in the line of the European Investment Bank (ESCAP 2006). These institutions could indeed play an important role in mobilizing resources by tapping into global financial markets and channeling funds to road projects. However, their mere existence will not necessarily increase investments in road infrastructure. As the shortage of viable projects for funding by the IDFC in India illustrates, the underlying obstacles hindering investor confidence need to be addressed first to make infrastructure projects attractive. The strong public good characteristics attached to most of the road network dictate that the public sector should still be the main actor in financing roads whether through general, earmarked taxes and/or debt. Developing an adequate system of road-

related charges and taxes will be central in creating a sustainable model for road financing as well as encouraging an efficient allocation of freight and passenger traffic patterns.

There is not only abundant global capital but also large levels of domestic savings in both countries to finance the road infrastructure needs of coming years. The key challenge will be developing efficient, stable and sustainable mechanisms to intermediate those resources and achieving the right balance between international and domestic capital and between private and public financing.

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8. Abbreviations

ADB: Asian Development Bank

CDB: China Development Bank

CB: Corporate Bonds

FDI: Foreign Direct Investment

GB: Government Bonds

IDFC: [India] Infrastructure Development Finance Corporation

IFI: International Financial Institutions

IIFL: India Infrastructure Finance Company Limited

NEN: [China] National Expressway Network

NHDP: [India] National Highway Development Programme

PPP: Public Private Partnerships

WB: World Bank

WDP: [China] Western Development Programme

9. Tables

Table 1 — Road Infrastructure in China and India

	China	India
Km of network (millions)	1.87 (2004) ¹	3.34 (2005) ²
% of expressways	1.83%(2004) ¹ Aprox. 40,000 Km	0.003% (2005) ³ Aprox. 300km
% of unpaved roads	21%(2002) ⁴	37% (2000) ⁴ 43% (2002) ²
Density relative to population (Km/1000 people)	1.42 (2004) ^{1,4}	3.02 (2002) ⁴
Density relative to land area (Km/1000 square Km)	194.92 (2004) ^{1,4}	1008.40 (2002) ⁴
Business perception of the quality of roads (scale 1 to 7, 1 worst)	4.6 (2000) ⁵	3.0 (2000) ⁵

Sources: 1) GOC 2005; 2) GOI 2006, GOI 2007a, 2007b; 3) Bahadur 2006; 4) World Bank 2006a, World Bank 2004; 5) Estache & Goicoechea 2005

Table 2 — Major Investment Indicators in China and India

	China	India
Gross Fixed Capital Formation as % GDP	44.2% (2003) ¹	22.7% (2003) ¹
Investment in all infrastructure sectors as % GDP (all sources)	7.3-10.6% (2003) ^{2,4}	3.5% (2004) ^{2,3}
Investment in road infrastructure as % of GDP (all sources)	3.5% (2003) ^{2,5}	0.5% (2004) ²
Cumulative investment transport projects with private participation 1990-2004 (US\$ billion)	21.9 (1990-2004) ⁶	3.2 (1990-2004) ⁶

1) World Bank 2006a; 2) Johnson 2006; 3) ADB 2005a; 4) ADB/JBIC/WB 2005; 5) World Bank 2007; 6) World Bank 2006b.

Table 3 —Road Financing Mechanisms in China and India

Sources	China ¹	India ²
Fees & Charges	45% Vehicle purchase fee (≈12%) Other local charges and fees (≈32%): road maintenance fee, freight & passenger fees, tolls, etc.	40-50% Fuel Taxes (Central Road Fund 30-40%, higher for National Highways), other road-related charges & taxes.
Domestic Loans	43% Loans from China Development Bank & state owned commercial banks	≈10% Market borrowing by central (NHAI) and state road agencies
Foreign Loans	1% Multilateral organizations (WB, ADB), foreign commercial banks & foreign governments	30-40% Loans from ADB/WB to the GOI & passed to C/SRDAs. Occasionally direct lending to C/SRDAs
Private Investment	7% Both domestic & foreign	≈ 8-10% As BOT-toll, BOT annuity or special purpose vehicle.
Other	5% Including national & local budgets, National Frontier Defense Fund, Special Fund	

1. Approximate figures for 2005. Fan and Chan-Kang 2005; Ruyu 2006; World Bank 2006b

2. Approximate average figures for 2002-2005: Bahadur 2006; GOI 2006; NHAI 2006; World Bank 2006b
NHAI: National Highway Authority of India; C/SRDA: central/state road development agencies

Table 4 — Road Infrastructure Investment Needs
(US\$ million per year—during indicated period)

	China	India
Current Annual Investments ¹	45,000 (2002) 63,000 (2005)	4,794 (2002) NHs alone: 2,227 (2003)
Estimates		
Asian Development Bank-Japanese Bank for International Cooperation-World Bank ²	26,700 (2006-2010)	
World Bank ³	Expansion of NEN: 11,000 (2006-2025) Local roads: 10,000 (2006-2025)	Paved roads: 23,300 (2006-2010) NHs & SHs only: 6,084 (2002-2011)
Government Estimates ⁴	49,000 (2006-2020)	NHs alone (all items): 5,584 (2006-2012) Maintenance NHs: 500 Maintenance SHs: 700 <u>Total costs (not annual):</u> <ul style="list-style-type: none"> • Removing all deficiencies NHs: 37,500 • Phases II & IIIa of NHDP: 12,000 • Accelerated Progr. North-East: 2,700 • Rural Roads (PMGSY): 26,000
Research & Information Systems ⁵	7,680 (2004-2008) 20,784 (2009-2013) 26,295 (2014-2018)	11,400 (2004-2008) 27,933 (2009-2013) 122,450 (2014-2018)

1) World Bank 2004; GOI 2006; Ruyu 2006. 2) ADB/JBIC/WB 2005. 3) World Bank 2004; Chatterton & Puerto 2005; World Bank 2007. 4) Kamila 2004; GOI 2005, 2006a; People's Daily 2006; PMGSY 2006; Ruyu 2006. 5) De 2005
NH: National Highways; SH: State Highways

Table 5 — Assessing Modalities of Road Financing

	Scale of Financing	Limitations & Risks	Responsiveness & Strengths	Long-term Sustainability
Foreign Direct Investment	Small	<ul style="list-style-type: none"> ● Competition & instability of flows 	<ul style="list-style-type: none"> ● Only highly trafficked segments with clear commercial viability 	Low
International Capital Markets	Small	<ul style="list-style-type: none"> ● Maturity mismatches in bank lending ● Currency mismatches 	<ul style="list-style-type: none"> ● Only highly trafficked segments with clear commercial viability ● Only public agencies & companies with high credit rating 	Low
International Financial Institutions	Small	<ul style="list-style-type: none"> ● Declining role as lenders 	<ul style="list-style-type: none"> ● Other functions: guarantee facilities, local currency bonds 	Low
Domestic Capital Markets	Large	<ul style="list-style-type: none"> ● Bank lending: maturity mismatches & instability of flows 	<ul style="list-style-type: none"> ● Bonds: Stability & long maturities of bonds ● Equity: feasible for multi-stage projects 	Low for lending High for bonds Low for equity
Foreign Exchange Reserves	Large	<ul style="list-style-type: none"> ● Inflationary pressures 	<ul style="list-style-type: none"> ● More productive uses: Investment corporations (e.g. Rep. of Korea & Singapore) 	High
Public Sources (Taxes & Fees)	Large	<ul style="list-style-type: none"> ● Higher cost impact on the economy 	<ul style="list-style-type: none"> ● Only option for “public good” roads (e.g. district, rural) ● Reliable streams of funds for road construction and maintenance ● Rationalization of traffic volume & road use. Also of energy consumption for fuel taxes. 	High for ear-marked taxes & charges

**Table 6 — Lessons & Recommended Areas for Action
in Mobilizing Resources for Road Infrastructure**

	China	India
Attracting International & Domestic Private Capital	<ul style="list-style-type: none"> • Create enabling environments for private investment in toll roads: stable macroeconomic conditions, clear, fair & streamlined policy & regulatory systems, appropriate pricing structures, development of risk mitigation mechanisms. 	
	<p><i>Lesson from China</i> → Independent assessment of traffic volumes & toll price structures</p> <p>Introduction of minimum traffic & revenue guarantees ← <i>Lesson from India</i></p> <p>Reduce restrictions to FDI ← <i>Lesson from India</i></p>	
Expanding Role for Multilateral Institutions	<ul style="list-style-type: none"> • Foster private participation in road projects. • Larger role in the provision of guarantee facilities & credit enhancement mechanisms • Scale up the extension of financing in local-denominated instruments 	
Developing Domestic Financial Markets	<ul style="list-style-type: none"> • Liberalize the banking system: reducing government interference, eliminating holding requirements on banks & institutional investors & introducing international competition • Broadening & deepening bond markets: Reduce administrative obstacles increasing length & cost of issuing & listing. Strengthening regulatory standards. Improve governance of companies & public road development agencies. Eliminate captive demand on government bonds by institutional investors <p>Eliminate restrictions on issuing by non-state companies & local governments</p> <p>Independent credit rating agencies</p> <ul style="list-style-type: none"> • Strengthening function of equity markets: Reduce restrictions on institutional investors for allocating capital. Improve regulatory framework & corporate governance <p>Improve equity market regulatory infrastructure ← <i>Lesson from India</i></p> <p><i>Lesson from China</i> → Asset securitization of toll roads for development of further stages/roads</p> <ul style="list-style-type: none"> • Setting/Strengthen national (and/or regional) specialized financial institutions for mobilization of resources into infrastructure development 	
Increase Public Sources of Funding	<ul style="list-style-type: none"> • Establish sustainable & economically efficient models of road financing including appropriate systems of road-related charges <p>Introduce fuel tax ← <i>Lesson from India</i></p> <p>Reform distribution of revenues between national & local govts. ← <i>Lesson from India</i></p> <p>Reform distortionary pricing structures between freight & passenger traffic & between roads & railways</p>	