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Attract Private Financing to Infrastructure Investment by Injecting Spillover Tax Revenues

Need for Infrastructure Investment

In Southeast Asia, USD 8 billion in infrastructure investments are implemented every year. However, it is expected that USD 210 billion infrastructure investment is needed every year. Public money is insufficient to satisfy Asia's infrastructure needs. In many developing countries in Asia, we observe heavy traffic congestion in cities; highways, trains and various modes of public transport are lacking. Public-Private Partnerships (PPPs) have been promoted for infrastructure development in India, Thailand and other places in Asia. However, most PPP projects were disappointing since the rate of return on infrastructure depends mainly on user charges, such as train fares and highway tolls. When the region was hit by economic crisis after the Lehman shock, the private sector withdrew from infrastructure investment. Risks associated with infrastructure were so large that private investors were hesitant to put their money in infrastructure.

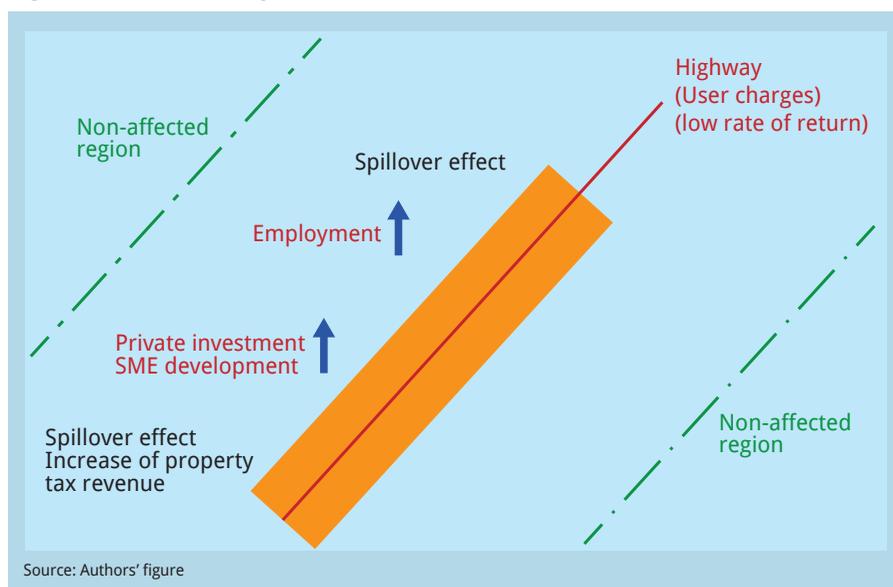
It is well known that good infrastructure creates huge spillover effects in the

region around a project (Figure 1). Railways will bring manufacturing factories into the region by making the shipping of products faster and safer. Railways can connect manufacturers to markets and to ports. New industry creates jobs in the region. Eventually, service sector businesses such as restaurants and hotels will be constructed to meet the increased demand in the region. Farmers and small businesses can sell their products at the train stations.

The spillover effects of infrastructure investment will increase revenues from corporate, income, and property

taxes. The difference-in-difference method (Yoshino and Abidhadjaev (2017), Yoshino and Pontines (2015a, 2015b)) can be used to compute the effect of spillover on tax revenues in places where infrastructure investment occurred compared to ones where no infrastructure investment took place. A study by Yoshino and Abidhadjaev (2016) shows that good educational opportunities together with infrastructure investment create qualified workers who enhance regional productivity. In the past, all these tax revenues were collected by the government

Figure 1: Schemes of Spillover Effects of Infrastructure Investment



and not returned to the investors in infrastructure. It has been estimated that returning the additional tax revenues from spillovers to construction companies and investors would raise the rate of return on infrastructure investments by 39 to 43% in the case of Japan and by 14 to 16% in the case of Uzbekistan.

Many developing countries face a shortage of public funds to meet their huge infrastructure needs. In order to narrow the gap between investment needs and actual government disbursements, the rate of return on infrastructure investment has to be increased by bringing the spillover tax revenues generated by infrastructure development to the construction companies and investors. This paper will address the importance of spillover effects from infrastructure investment and how to utilize additional tax revenues created by the externality effects of infrastructure to attract private sector finance.

Economic Effects of Infrastructure Investment

The increase in productivity is one of economic effects of infrastructure investment. If infrastructure has a positive effect on productivity, private firms can increase

output without changing inputs, and further can increase output by changing the amount of inputs to maximize profit. The former effect is called direct effect and the latter is said to be indirect effect (Nakahigashi and Yoshino (2016), Yoshino and Nakahigashi (2004)). In particular, the indirect effect reflects the benefits from infrastructure investment in the economic activities of private firms and can be said to be spillover effect of infrastructure.

Table 1 shows the productivity effect of infrastructure based on Japanese macroeconomic data and assuming translog production function (Nakahigashi (2015)). The direct effect of infrastructure investment is shown in the first row of Table 1. The second and third rows show the spillover effects on private capital and labor. In the 1950s and 1960s, both the direct effect and the indirect effects were very large. The estimated tax revenues generated by these spillovers are computed by setting the tax rate at 20%. Since the economic impact decreases as time goes on, the estimated amount of tax revenues diminishes, as shown in row 4. In the 1950s, it was 0.305, however it was only 0.042 in the period 2006-2010. Suppose 20% of these tax revenues were returned to investors, then how much would the rate of return increase? The last row presents the incremental rate of return achieved by injecting 20% of spillover tax revenues. In the 1950s, the incremental rate of return was about 43.8% while it was about 39.1% in recent years. Thus, based on Japanese macroeconomic data and assuming a translog production function, injecting 20% of the additional

tax revenues generated by project spillovers would increase the total return on infrastructure investment by roughly 39 to 43%.

Infrastructure Financing through Private Funds

In recent years, PPPs including the use of private funds, are being emphasized. Utilizing private funds to develop infrastructure has the advantage of increasing pressure to (1) shorten the period of construction and complete the project as quickly as possible, (2) complete the project at minimal construction cost, and (3) operate the project profitably at low cost after completion. Despite these advantages, there have not been many PPP projects in Japan. The so-called third sector projects (a kind of PPP) that took place in Japan in the 1980s and 1990s accumulated debts for local governments. These third sector projects were jointly funded by the public and private sector. Many of them failed due to irresponsibility by both public and private sector operators. Weak governance and lack of profit incentives were another reason for the failures. Bad memories of these third sector projects has made regional governments reluctant to pursue PPP proj-

Table 1: Spillover Effects Estimated from a Macroeconomic Translog Production Function

| | 1956-60 | 1961-65 | 1966-70 | 1971-75 | 1976-80 | 1981-85 |
|-------------------------------|---------|---------|---------|---------|---------|---------|
| Direct effect | 0.696 | 0.737 | 0.638 | 0.508 | 0.359 | 0.275 |
| Indirect effect(Kp) | 0.452 | 0.557 | 0.493 | 0.389 | 0.270 | 0.203 |
| Indirect effect(L) | 1.071 | 0.973 | 0.814 | 0.639 | 0.448 | 0.350 |
| 20% returned increment | 0.305 | 0.306 | 0.261 | 0.206 | 0.144 | 0.111 |
| | 0.438 | 0.415 | 0.410 | 0.404 | 0.400 | 0.402 |

| | 1986-90 | 1991-95 | 1996-00 | 2001-05 | 2006-10 |
|-------------------------------|---------|---------|---------|---------|---------|
| Direct effect | 0.215 | 0.181 | 0.135 | 0.114 | 0.108 |
| Indirect effect(Kp) | 0.174 | 0.146 | 0.110 | 0.091 | 0.085 |
| Indirect effect(L) | 0.247 | 0.208 | 0.154 | 0.132 | 0.125 |
| 20% returned increment | 0.084 | 0.071 | 0.053 | 0.045 | 0.042 |
| | 0.392 | 0.392 | 0.390 | 0.390 | 0.391 |

Source: Authors' estimation based on Nakahigashi (2015)

ects. Private sector actors are also reluctant since risks associated with infrastructure projects are large and the expected rate of return is typically low. Various third party projects which combined public sector and private sector funds were created. However the rates of return were so low. Many third party projects failed and created big losses for local governments. For these reasons, injection of spillover tax revenues is an important means to make infrastructure projects viable.

Public-Private Cooperation in High-Risk Projects: Viability Gap Funding

Infrastructure projects pose a variety of risks arising from: (1) regime change, for example when a change in local administration causes stoppages before project completion; (2) cost increases, for example when extensions in construction period or delays in land acquisition create additional interest expense; (3) unexpected decreases in revenue due to fee setting and decreased traffic; (4) unanticipated expenses, for example when compensation is required for noise occurring after the completion of an infrastructure project; and (5) delays in land acquisition due to complicated ownership structure.

Private investors apply various ideas in order to avoid possible risks and earn benefits. Some investors, however, may force the transfer of risks onto the public sector. In these cases, it will be essential to clarify the risk-sharing between public and private sectors in advance. In particular, Viability Gap Funding (VGF), which is the capital grant that the public sector guarantees private investors a certain rate of return to attract private finance, would be appropriate for infrastructure projects that are indispensable for the public, but are high-risk and low-earning. For example, government supplies 30% of the initial funding for a highway project, raising the rate of return to private investors. Through the injection of funds from the public sector, the rate of return realized in the private investors would increase by 10/7 or about 1.428 times the actual return. Even in projects in which private funds are not involved because of low expected revenue, it will be possible to introduce private

funds. However, in this case, if the ratio of the injection by the public sector is too high, it creates a moral hazard problem. The public sector secures a rate of return for private investors which exceeds the revenues from the infrastructure project, which leads to the accumulation of debt by the public sector. On the other hand, when this ratio is too low, there is a possibility that the private sector would not invest in the project at all.

However, it does not follow that the injection of VGF can improve the efficiency of the infrastructure project. For projects whose only return comes from user charges (Figure 2), the gap between the government guaranteed return and the actual return would be very wide. Private investors can secure a high rate of return, but the government sector will accumulate debt every year for the life of the project.

Increased Rate of Return through Internalization of Spillover Effects

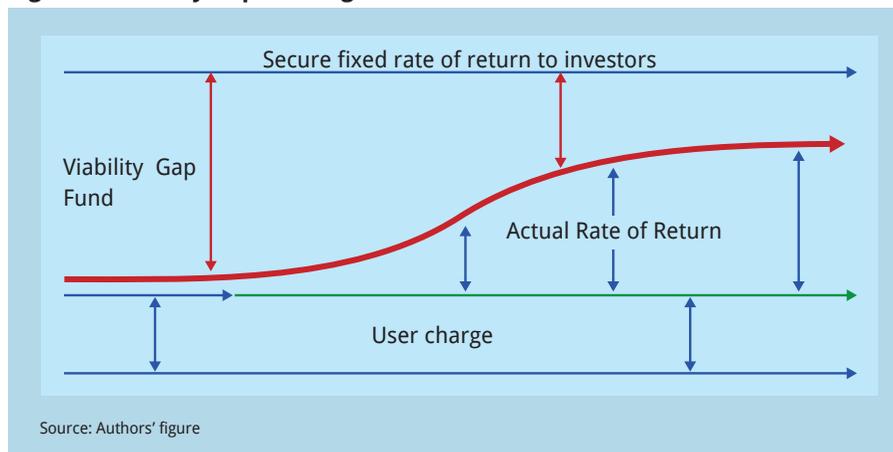
Infrastructure projects generate benefits in addition to operating revenues such as tolls. For example, a highway may benefit a company through cost savings and increased sales from faster transport of raw materials and final products as well as generate usage fees. Yoshino and Pontines (2015a, 2015b) analyzed the effect of injecting public funds in the development of the Southern Tagalog Arterial Road (STAR) highway project in Batangas Province

in the Philippines. In particular, Yoshino and Pontines (2015b) evaluated how the opening of the STAR highway contributed to revenues from business and property taxes, using the difference-in-difference method to compare tax revenues in areas affected by the project with unaffected areas along the route shown in Figure 3.

Table 2 shows the change in tax revenues in three cities in Batangas Province before, during and after construction of the highway. Construction took place during periods t_{-1} and t_0 . For Batangas City, the table shows that tax revenues increased from PHP 490.90 million before the project (t_{-2}) to PHP 622.65 million in t_{-1} . Immediately after completion of the highway (t_2), tax revenues declined to PHP 599.49 million as businesses established their presence and adjusted to utilizing the highway. However, by period t_{+4} , tax revenues had increased to PHP 1,208.61 million. The spillover effects of the highway became very large after the completion of highway. Similar increases in tax revenues can be observed for Ibaan City and Lipa City as greater economic activity in those cities added to tax revenues.

While construction companies may be mainly interested in making railways and highways, this study shows that the spillover effects from the development of such infrastructure are also very significant for the local economy. Infrastructure development can stimulate business activity in an area and create employment. Additionally, small and middle-sized enterprises (SMEs) in the area can open stores along new roadways and at new railway stations, increasing sales. If it is possible to confirm that the increase in tax revenue is due to the spillover effects of infrastructure, it might be possible to return the increase in tax revenue to private investors and the public sector (Figure 4). By doing

Figure 2: Viability Gap Funding



so, the rate of return to private investors is increased, and as a result, it will become possible to lead private funds in various infrastructure projects.

Incentive Mechanism for Infrastructure Operating Entities

In order to enhance efficiency and increase the rate of return on infrastructure devel-

opment, it is necessary to vary the dividend payment for private investors based on the project's revenues, including both user fees and spillover tax revenues. It is also necessary that infrastructure operating entities make efforts to increase income. Table 3 shows the payoff matrix depending on the presence or absence of effort by investors and the infrastructure-operating entity. If neither the operating entity nor investors make any effort, the operator gains 50 in revenue and investors receive dividend income r . It is assumed that the operator could increase operating income to 100 by improving the salary system, such as by paying staff bonuses based on the entity's revenue. Furthermore, investors could raise their dividend income to ar ($a > 1$) by

efforts to reduce costs and increase infrastructure revenues, such as by increasing the number of highway turnoffs or the number of available cars. The lower right cell of the payoff table represents the revenue when both the operating entity and infrastructure investors make maximum effort to increase revenue and improve service. In this case income of both the entity and the investors is higher than in the normal case. (The income of the entity increases from 50 to 100 and the income of investors from r to ar .) This illustrates the importance of designing the dividend policy for investors and the salary system of the infrastructure-operating entity to incentivize the entity and investors to improve revenues. To reiterate, in the PPPs, as described above, it is necessary to improve the efficiency of infrastructure projects through private funds and to introduce mechanisms to benefit the staff of an infrastructure-operating entity, for example by paying staff bonuses tied to the increase in profit.

Figure 3: Batangas Province and STAR Highway



Conclusion

Infrastructure investments are being promoted not only in Asia but also in the United States under President Trump. However, the U.S. government does not want to increase government debt. Private funds have to be injected to cover huge need for infrastructure investment. Bringing increased tax revenues from the spillover effects of infrastructure development, such as increased revenues from corporate, income, sales, and property taxes, will raise the rate of return above what can be gained

Table 2: Calculated Increase in Business Tax Revenues for Tollway Beneficiaries Relative to Non-Beneficiaries

| | t_2 | t_1 | t_0 | t_{-1} | t_{-2} | t_{-3} | PHP Million t_{-4} , forward |
|---------------|--------|--------|--------|----------|----------|----------|-----------------------------------|
| Lipa City | 134.36 | 173.50 | 249.70 | 184.47 | 191.81 | 257.35 | 371.93 |
| Ibaan City | 5.84 | 7.04 | 7.97 | 6.80 | 5.46 | 10.05 | 12.94 |
| Batangas City | 490.90 | 622.65 | 652.83 | 637.89 | 599.49 | 742.28 | 1,208.61 |

Note: For the period $t+4$, forward in the case of Lipa City and Batangas City is the average increase in business tax revenues in each province.
Source: Yoshino and Pontines (2015a, 2015b)

from user charges alone. Long-term investors such as pension funds and insurance companies are growing in Asian countries. Infrastructure investment projects require long-term and patient investors. If the rate of return on infrastructure were increased by injecting spillover tax revenues generated in areas surrounding infrastructure investments, much more long-term private capital could be forthcoming for infrastructure investment. Incentives to improve infrastructure which will increase regional economic activity will be created. Greater spillover effects will raise the rate of return for private investors. The higher the expected rate of return, the more private funds would be attracted.

Furthermore, fewer public sector funds would be needed for infrastructure investment which means the government could increase the total amount of infrastructure investment by attracting private finance when incremental tax revenues from spillover effects are used to raise their rate of return.

The method of paying back increased tax revenues obtained from infrastructure investment will attract private long-term investors and require less government funds. And it will enhance the efficiency and the governance of infrastructure investment.

Figure 4: Injection of a Fraction of Tax Revenues Gained from Spillover Effects

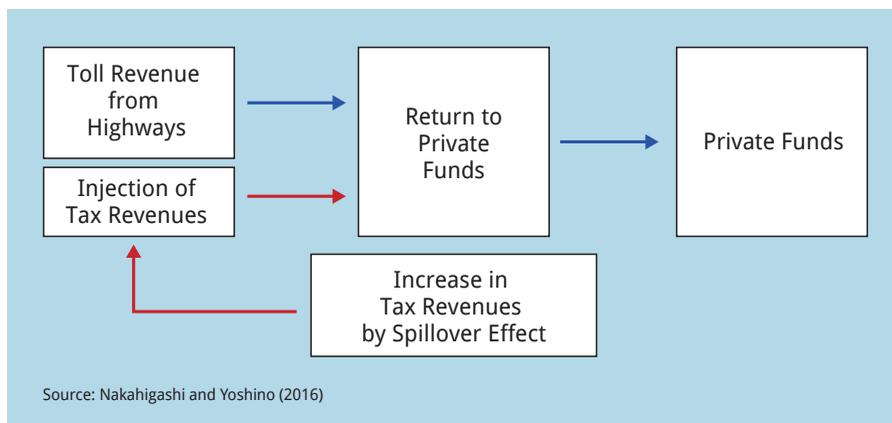


Table 3: Payoff Table for Infrastructure Operating Entity and Investors

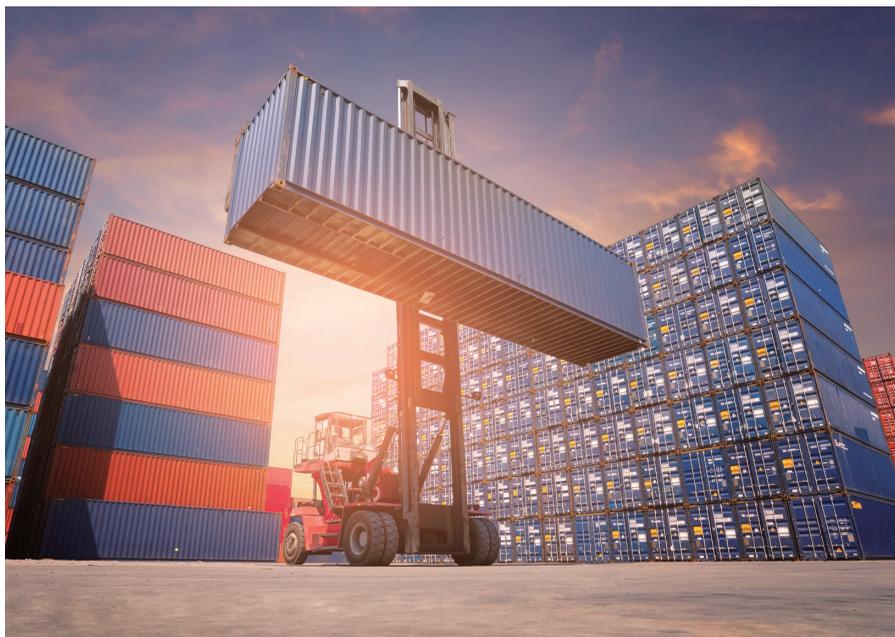
| | Normal Case | Effort Case |
|-------------|---|--|
| Normal Case | (50 , r) Operating Entity Investors | (50 , ar) Operating Entity Investors |
| Effort Case | (100 , r) Operating Entity Investors | (100 , ar) Operating Entity Investors |

Source: Nakahigashi and Yoshino (2016)



References

- Nakahigashi, Masaki. (2015) “Aging and Productivity Effect of Public Capital.” (in Japanese), in Naoyuki Yoshino, Keigo Kameda, Masaki Nakahigashi, and Masao Nakata (ed.), *Issues and Desirable Courses of Japanese Economy*, Keio University Press Inc., pp.99-108.
- Nakahigashi, Masaki and Yoshino, Naoyuki. (2016) “Changes in Economic Effect of Infrastructure and Financing Methods.” *Public Policy Review*, Ministry of Finance, Policy Research Institute., 12(1), pp.47-68.
- Yoshino, Naoyuki. (2010) “Financing Transport Infrastructure Investment.” OECD (ed.), *Southeast Asian Economic Outlook 2010*, OECD Publishing, Contributing chapter.
- Yoshino, Naoyuki. (2012) “Global Imbalances and the Development of Capital Flows among Asian Countries.” *OECD Journal: Financial Market Trends*, 2012(1), pp.81-112.
- Yoshino, Naoyuki and Nakahigashi, Masaki. (2004) “The Role of Infrastructure in Economic Development.” *The ICAI Journal of Managerial Economics*, 11(2), pp.7-24.
- Yoshino, Naoyuki and Abidhadjaev, Umid. (2016) “Explicit and Implicit Analysis of Infrastructure Investment: Theoretical Framework and Empirical Evidence.” *American Journal of Economics*, 6(4). DOI: 10.5923/j.economics.20160604.02.
- Yoshino, Naoyuki and Abidhadjaev, Umid. (2017) “An Impact Evaluation of Investment in Infrastructure: The Case of a Railway Connection in Uzbekistan.” *Journal of Asian Economics*, 49(1), pp.1-11.
- Yoshino, Naoyuki and Pontines, Victor. (2015a) “Asia-Pacific Infrastructure Investments in Collaboration – The Economic Effect of Infrastructure Investment: Case of the Highway in the Philippines –.” *GIE/AAA Special Kick-off Edition*, GIE network Publishing.
- Yoshino, Naoyuki and Pontines, Victor. (2015b) “The Highway Effect on Public Finance: Case of the STAR Highway in the Philippines.” *ADB Working Paper Series*, ADB Institute., (549), Oct 2015.



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