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INDUCING PRIVATE FINANCE TO WATER SUPPLY AND INLAND WATER TRANSPORT USING SPILLOVER TAX REVENUES

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Abstract

This paper discusses suggested ways to bring private sector finance into water supply and inland water transport. Typically, such water projects rely only on user charges as sources of revenues. For example, ships using inland waterways have to pay user charges to the government for port maintenance. However, water supply and inland water transport projects also attract new businesses to the region and bring about development of new residential areas. This leads to a rise in revenues from property tax, business tax, income tax, and sales tax due to expansion of new businesses. In the past, all these increased tax revenues were collected by the government; they were not returned to the infrastructure investors. If part of these increased tax revenues, for example 50%, were returned to investors in water supply and inland water transport, revenues would rise while keeping user charges as low as possible. Inland water transport thus can create a positive impact on farmers, helping them to sell their products to the market by reducing user charges. Inland water transport also can bring tourism into the region by increasing hotel businesses, restaurants, and so on. This in turn will increase tax revenues in the region. Insurance, pension funds, and bank loans could be provided to water supply and inland water transport projects if part of such increased tax revenues were returned to the investors every year. An increase in private investment in the water supply and inland water will expand services to a much larger area than if the government were to provide finance alone. Economic growth will be accelerated and income disparities will be mitigated by creating job opportunities for many people in the region.

Keywords: water supply, inland water transport, private finance, infrastructure investment, spillover tax revenues

JEL Classification: H54, O18

Contents

1. INTRODUCTION

Water is a necessary public good. Most of the water currently is supplied by the public sector. Participation of private investors in financing water supply could help expand the water network in many parts of the country and thus increase the supply of water. The reason for the lack of investment by the private sector is lack of returns. Water supply and many other infrastructure projects rely on user charges for their main revenue. Unless user charges are high enough to cover the costs of construction and operation, private investors are reluctant to put their money into infrastructure. Although public–private partnerships have been advocated for many years, private-sector participation in the area of water has been very low due to the low rate of return from water-related infrastructure.

Inland water transport also could be financed by private investors such as insurance and pension funds if the rates of return are high. If the inland water transport revenue only comes from user charges, however, financing inland water transport would be difficult since the rate of return is very low.

A good water supply will bring about many advantages. New apartments will be constructed, as will new restaurants and shopping malls. New business opportunities will arise along the water supply, attracting commercial and manufacturing businesses. This will increase property values and create new employment in the region where the water is supplied. Health conditions of the people in the region will improve, contributing to higher productivity. More tourists will visit the region.

All these so-called externality effects of infrastructure investment are considered difficult to measure. However, these positive effects to the economy will be reflected in increased tax revenues. Rising land prices will increase property tax revenues. New business activities and increased sales of existing businesses will increase business tax revenues. New employment will increase income tax revenues. And rising consumption of the region will increase sales tax revenues.

In Asia, insurance and pension funds are gradually growing and are looking for long-term investment in each country. Many Asian developing economies lack water supply, sanitation, inland water transport, road, railways, and similar facilities. Public money is not enough to cover the huge demand for infrastructure construction. If institutional investors such as insurance and pension funds could invest in water supply, sanitation, and inland water transport, much greater infrastructure development would be possible, leading to economic growth, job creation, and mitigation of income disparities.

In this paper, we address how to induce private finance in water supply and inland water transport. This will create large spillover effects for the region in terms of increasing economic growth through higher tax revenues, which can partly be returned to the private investors to satisfy a sufficiently high rate of return. Insurance companies and pension funds also could be mobilized for infrastructure investment in sectors such as water supply and inland water transport. Section 2 discusses the infrastructure investment needs in the region. Sections 3 and 4, respectively, show the importance of the spillover effects of water supply and inland water transport on the economy. Section 5 focuses on the financing for water supply projects. Finally in section 6, we propose ways of financing water supply and inland water transport based on our discussion, with section 7 covering specifically financing for start-up businesses as well as small and medium-sized enterprises.

2. HUGE NEEDS FOR INFRASTRUCTURE INVESTMENT IN ASIA

Infrastructure investment, such as for electricity supply, water supply, sewage, and so on, is very important in many developing economies. Although public–private partnerships have long been discussed, many countries have faced difficulties in engaging private-sector money.

In the case of the Japanese railways, for example, land value capture resulting from the new railway construction was used to induce investment by private companies. The private railway companies purchased farmland along the proposed route and then constructed the railways. They developed that land into residential areas and commercial business districts, and they constructed department stores and shopping malls near the train stations. Such transport-oriented development activities were of great benefit to the private railways because they assured revenue. Railways, water supply, and other infrastructure companies struggle with revenue if they rely only on user charges, since train fares and water tariffs are usually very low.

Countries in the region need various kinds of infrastructure. Table 1 shows the infrastructure investment needed in Asia and the Pacific, as estimated by the Asian Development Bank (2017). The power sector has the highest need for infrastructure investment (see last column), representing 51.8% of total infrastructure needs, followed by transport, telecommunications, and water and sanitation.

Table 1: Kinds of Infrastructure Investment Needed in Asia and the Pacific, 2016–2030
($ billion in 2015 prices)

	Baseline Estimates		
Sector	**Investment**	**Annual Average**	**% Share to Total**
Power	11,689	779	51.8
Transport	7,796	520	34.6
Telecommunications	2,279	152	10.1
Water and sanitation	787	52	3.5
Total	22,551	1,503	100

Source: Asian Development Bank (2017).

Water supply and electricity, especially, are necessary goods, and the government cannot increase user charges. Similarly, user charges for ordinary roads are nonexistent. This makes it impossible to entice private investors to develop such infrastructure, since the rate of return that they can expect is too low to cover their various costs, such as construction, operation, and maintenance.

3. SPILLOVER EFFECTS CREATED BY WATER SUPPLY

3.1 Macroeconomic Estimates of Spillover Effects of Infrastructure Investment

Infrastructure investments not only have a productivity effect but also create huge spillover effects. Yoshino and Nakahigashi (2004) and Nakahigashi and Yoshino (2016) used macroeconomic data of Japan to estimate the impact of infrastructure investment on the economy, in particular the direct effects of infrastructure investment and spillover effects (i.e., indirect effects). To examine the productivity effect of infrastructure in greater detail, estimates were made by classifying the direct effects and spillover effects (Yoshino and Nakahigashi 2004): direct effects refer to increments in production amounts due to new infrastructure construction; spillover effects refer to the effects of the increasing production amounts and employment by private enterprises due to the infrastructure construction. For example, infrastructure such as water supply, railways, and roads will bring private businesses into a region. New restaurants and new factories will be constructed, which will increase regional output. New businesses will bring new employment to the region, which will contribute to increasing consumption and will start up housing construction. Gross domestic product (GDP) in the region will further increase. The secondary effects created by infrastructure investments are called spillover or externality effects. Water supply will prompt the construction of new office buildings and new housing, which will increase the efficient use of land along the water supply.

Table 2 shows estimates of the direct effect of infrastructure investment and its spillover effects based on Japanese macro-level data. In 1966–1970, the direct effect of infrastructure investment in increasing output was 0.638 (first row). The spillover effect of increasing output induced by growth in private capital was 0.493 (second row), and the spillover effect of increasing output by growth in employment was 0.814 (third row). The biggest spillover effect was increased employment, which contributed to an increase in output (third row). The last row of Table 2 shows the share of the spillover effects in comparison to the total effect of infrastructure investment in Japan. These proportions are quite high at about 66%–68%.

The spillover effects, also known as externality effects, of the water supply are shown in Figure 1. Suppose that the red diagonal line represents the water supply and the new water supply to be constructed. Along these water supply corridors, new industries and companies come into the region to start up their manufacturing activities. Apartments for housing are possibly constructed along the new water supply routes. Restaurants and other services sector establishments also open up business. Hence, the region represented in yellow in Figure 1 enjoys the spillover effects created by the new water supply. And this economic development will increase regional output, which increases tax revenues both for local and central government in terms of property tax, business tax, income tax, and sales tax. In the past, however, all these incremental tax revenues went to local and central governments and were not returned to water supply companies. These relied solely on user charges for their source of returns. Private investors found it difficult to put their money into water supply due to the lack of returns. Water supply only relied on public money, which restricted the expansion of water supply in many parts of developing Asia. If spillover tax revenues were partly returned to the investors, the rate of return from the water supply would increase, leading private investors such as insurance and pension funds, together with banks, to invest in water supply, which could widen the water supply network.

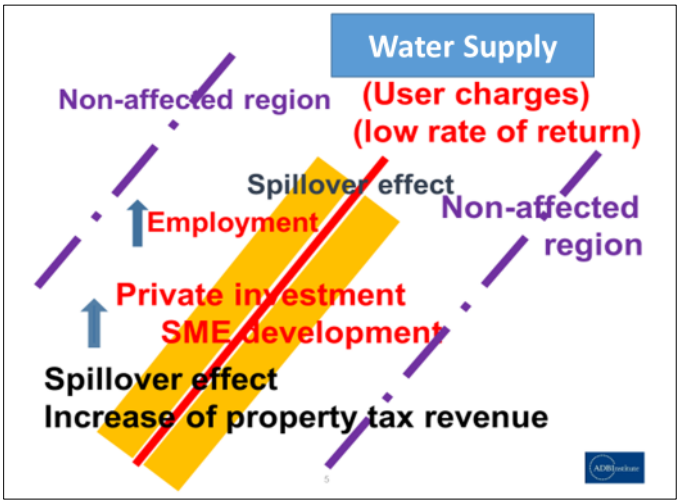
Table 2: Japanese Macroeconomic Estimates of Spillover Effects

	1956–1960	1961–1965	1966–1970	1971–1975	1976–1980	1981–1985
Direct effect of infrastructure investment	0.696	0.737	0.638	0.508	0.359	0.275
Spillover effect through private capital (Kp)	0.452	0.557	0.493	0.389	0.270	0.203
Spillover effect through employment (L)	1.071	0.973	0.814	0.639	0.448	0.350
Spillover effects of infrastructure investment (%)	68.644	67.481	67.210	66.907	66.691	66.777

	1986–1990	1991–1995	1996–2000	2001–2005	2006–2010
Direct effect of infrastructure investment	0.215	0.181	0.135	0.114	0.108
Spillover effect through private capital (Kp)	0.174	0.146	0.110	0.091	0.085
Spillover effect through employment (L)	0.247	0.208	0.154	0.132	0.125
Spillover effects of infrastructure investment (%)	66.222	66.200	66.094	66.122	66.139

Source: Nakahigashi and Yoshino (2016).

Figure 1: Spillover Effects of Water Supply



SMEs = small and medium-sized enterprises.
Source: Authors.

3.2 Microeconomic Estimates of Spillover Effects of Infrastructure Investment: Special Focus on Connectivity

To add to the Japanese estimates, we describe in this section the estimated spillover effects of three cases of infrastructure investment in Asian countries: the railway in Uzbekistan, the high-speed railway on Kyushu island in Japan, and the expressway in Manila (Yoshino and Pontines 2018). For our econometric estimation, we introduced a

dummy variable for before and after the construction periods by taking the difference in the tax revenues between two regions. This dummy variable has a value of 1 for the region along the infrastructure and 0 for other regions where there was no impact of the infrastructure investment.

As shown in Table 3, the railway in Uzbekistan resulted in a 2% difference in the economic growth of the region along the railway compared with other regions. This difference was due to the spillover effects after the railway connected the production region to the market, which created huge tax revenues for the government, especially through this connectivity (Yoshino and Abidhadjaev 2017a).

Table 3: Numerical Estimation of the Difference in Gross Domestic Product before Railway Construction in Uzbekistan (2005–2008) and after Completion of Connectivity (2009–2012)

Region Group	Outcome	Pre-railway Period	Post-railway Period	Difference
Non-affected group	Average GDP growth rate (%)	8.3	8.5	0.2
Affected group	Average GDP growth rate (%)	7.2	9.4	2.2
		Difference	2.0	

GDP = gross domestic product.

Note: Affected group includes the regions of Samarkand, Surkandharya, Tashkent, and the Republic of Karakalpakstan.

Source: Yoshino and Abidhadjaev (2017a).

Table 4 shows the case of the Star Highway in Manila (Yoshino and Pontines 2018). The periods $t-1$ and t indicate periods under construction. At the end of t, the highway had been completed and started operation. For Batangas City (last row), the calculations indicate that tax revenues increased from around ₱490 billion when construction was not going on ($t-2$) to over ₱622 billion and ₱652 billion after construction had started ($t-1$ and t, respectively). During the highway construction, construction workers and related construction works came to the region, which increased regional GDP. At the end of t, the Star Highway had been completed. Then at $t+2$, tax revenues diminished compared with the construction period until after the fourth year when the tax revenues increased drastically. At $t+4$, tax revenues went up as high as ₱1,208 billion, about twice as much as before the construction. These are the spillover tax increases coming from infrastructure investment, in this case the Star Highway. These tax revenues are the increases, not the existing ones. Thus, if the highway had not been constructed, tax revenues would have remained at ₱490 billion as at $t-2$. Because of the highway construction and increased economic activities, Batangas City had gained tax revenues of ₱1,208 billion by $t+4$. If part of these incremental tax revenues ($₱1{,}208\text{ billion} - ₱490\text{ billion}$) were to be returned to private investors, they would be willing to invest their money to construct the highway. The same effects apply to construction of new water supply infrastructure.

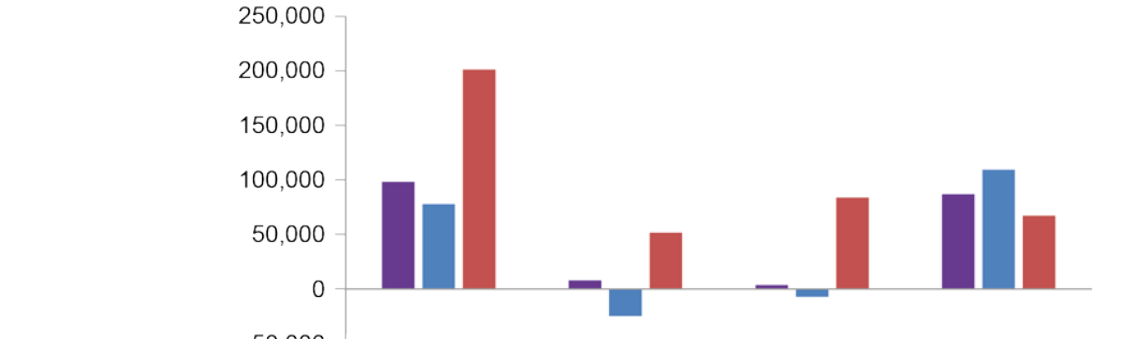
Table 4: Calculated Increase in Business Tax Revenues for the Beneficiary Group Relative to Nonbeneficiary Group
(₱ million)

Region	$t-2$	$t-1$	t	$t+1$	$t+2$	$t+3$	$t+4$
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	637.83	599.49	742.28	1,209.61

Source: Yoshino and Pontines (2018).

In the case of the high-speed railway of Kyushu Railway Company (JR Kyushu) in Japan (Yoshino and Abidhadjaev 2017b), tax revenues were compared in three periods: (i) the construction period; (ii) the operational period without good connectivity; and (iii) the operational period with good connectivity to large cities such as Osaka and Tokyo. Total tax revenues as well as revenues from personal income tax, corporate tax, and other taxes (including property tax) were compared for the three different periods (Figure 2). When the construction started, speculators who anticipated a significant rise of property values started to purchase the land along the high-speed railway, which caused property tax revenues to go up significantly (denoted in Figure 2 as other taxes). The construction involved hiring many workers and construction companies in the region, so personal income tax and corporate tax revenues increased. Due to the operational period when there was no connectivity with large cities such as Osaka and Tokyo, personal income tax and corporate tax revenues went down compared to the construction period. Furthermore, good connectivity with Osaka and Tokyo brought businesses and passengers into the region, which created a huge increase in corporate and individual income taxes. Interestingly, property tax revenues kept on rising because of the expected increase in property values that was speculated, as is shown in revenues from other taxes in Figure 2.

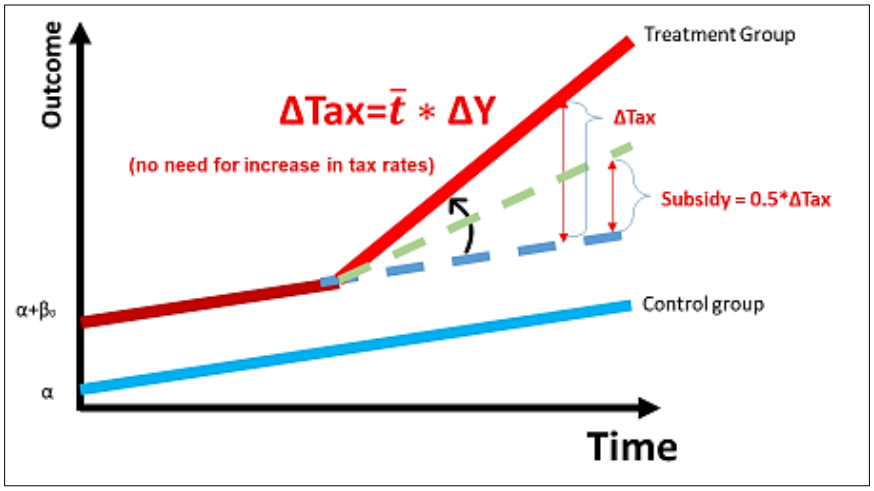
Figure 2: Changes in Tax Revenues by Connectivity in High-Speed Railway
(¥ million)



	Δ Total Tax	Δ Personal Income Tax	Δ Corporate Tax	Δ Other Taxes
Construction (1991–2003)	94,896	7,447	3,435	84,012
Operation 1 (2004–2010)	75,131	–23,843	–6,883	105,858
Operation 2 (2011–2013)	194,790	49,860	80,998	65,102

Source: Yoshino and Abidhadjaev (2017b).

Figure 3: Computation of Spillover Tax Revenues by Comparing Affected Region and National Average Tax Revenues



Source: Authors.

The spillover effects can be simply defined (Figure 3), as recommended by Finance Minister Carlos Dominguez of the Philippines when he tried to apply this method in his country:

(1) Compute the national average growth rate of tax revenues in each tax item, such as corporate tax, personal income tax, property tax, sales tax, etc.

(2) Compute the growth rate of all tax revenues along the newly constructed infrastructure, such as roads, highways, railways, water supply, etc.

(3) Take the difference between (1) and (2) by defining the difference as spillover effects.

Without investment into infrastructure, the government would not obtain the increased tax revenues. While not decreasing the existing tax revenues of local and central governments, part of the tax revenues could be distributed to private investors who financed the infrastructure. The proposed method of returning the spillover tax revenues to the investors will encourage the development of rural regions. In the Philippines, much of the infrastructure development is financed by the central government. However, the spillover tax revenues are mainly collected by the local government, which increases their tax revenues. If part of their increased spillover tax revenues is returned to the central government, these amounts could be invested into rural roads to help mitigate the poverty in rural regions in the country. The proposed return of the spillover tax revenues to private investors also applies to central governments in other countries.

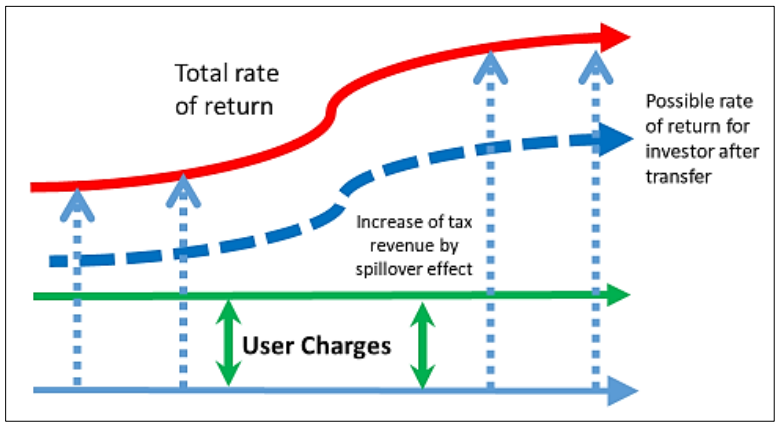
4. ECONOMIC IMPACT OF INLAND WATER TRANSPORT

Inland water transport is a high priority in South Asian countries, but the development of port and other facilities has not advanced well. The main sources of revenue by the ministries that manage inland water transport are user charges paid by the owners of boats and ships. Governments lack the vision of regional development of inland water transport. Inland water transport ports can be developed as tourist attractions which can

create employment in the region and greatly expand markets for farmers to sell their produce. Spillover tax revenues will be created when the inland water transport brings businesses into the region. Local and central governments can earn much higher tax revenues from property tax, corporate tax, income tax, and sales tax than from user charges collected from boats and ships. If spillover effects of inland water transport can be managed by private businesses, they would be much bigger and create new jobs and businesses.

Figure 4 demonstrates the importance of spillover effects in order to reduce user charges and increase the rate of return from inland water transport. The red curve shows total increased tax revenues. If part of the increased tax revenues are returned to private investors, the rate of return from inland water transport would shift to the dark blue dotted curve instead of the green line (i.e., user charges). If inland water transport can bring businesses and employment into the region, the red curve of incremental tax revenues will be much higher; that is, the government revenues will be much larger than relying only on user charges as a revenue source.

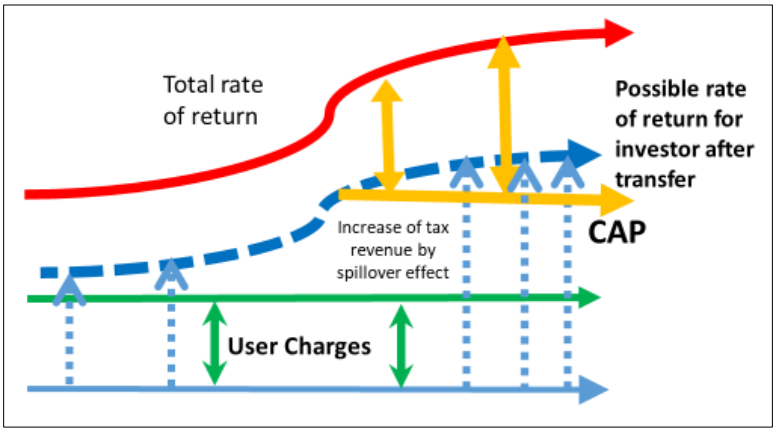
Figure 4: Injection of Increased Tax Revenues to Increase Rate of Return



Source: Authors.

Water supply and inland water transport will be able to create a bigger economic impact in regions with larger population densities. However, rural regions may not be able to create such sizable spillover effects, and the incremental tax revenues might not be large. Water supply has to be provided not only in cities but also in rural regions. The government can set up a cap for private investors. For example, the government can set its cap at 15%. This means that if the total rate of return (part of spillover tax revenues and user charges) surpasses 15%, the government will take the yellow portion of the increased tax revenues (Figure 5) and use the extra tax revenues to supply water to less densely populated rural regions. In this way, urban and rural mismatches of water supply will be mitigated.

Figure 5: Injection of Increased Tax Revenues to Increase Rate of Return with Government Cap

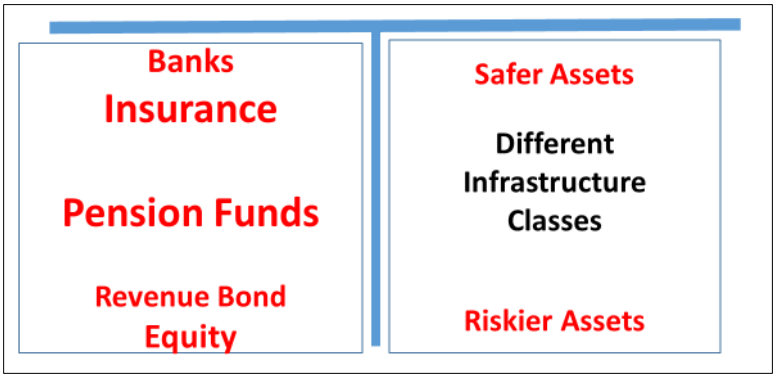


Source: Authors.

5. FINANCING FOR WATER SUPPLY

Next, we discuss the financing side of water supply projects. There are five different methods of private finance (Figure 6): (i) bank loans, (ii) insurance funds, (iii) pension funds, (iv) revenue bonds, and (v) equity investment. Bank loans are usually relatively short (1–5 years), insurance funds a little longer (about 10–20 years), and pension funds much longer. In the coming years, many Asian countries will be faced with aging populations. Public pension funds must be well established, and private insurance systems have to be started to cope with this future aging population. Once collection begins for insurance and pension funds, there must be a place to invest these long-term assets. For instance, insurance is growing in Thailand as a source of finance. As mentioned earlier, water supply and inland water transport needs in the Asian region are huge and require large amounts of money for infrastructure construction.

Figure 6: Different Classes of Infrastructure Assets and Kinds of Finance



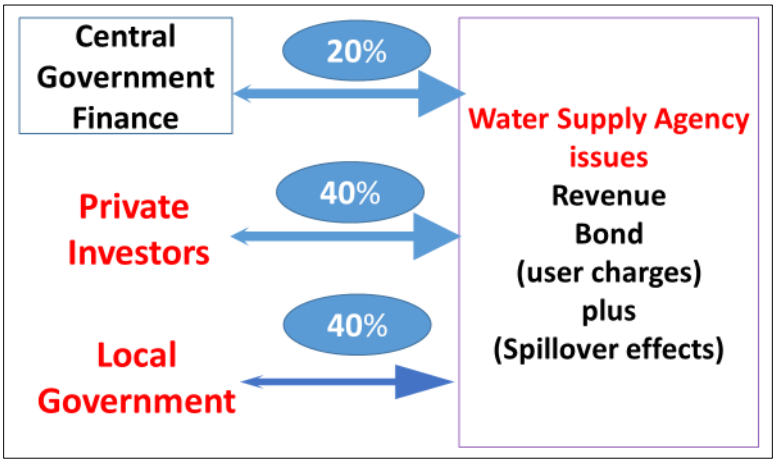
Source: Authors.

The right-hand side of Figure 6 shows safer infrastructure assets at the top and riskier infrastructure assets at the bottom. There are many different kinds of asset classes in water supply investment. Safe assets may be represented by water supply in large cities and densely populated urban region. For water supply operations that are already ongoing, the private sector can see continuous revenues from these facilities. If the rate

of return from the existing water supply is high, private investors can invest in brownfield infrastructure, which represents relatively safe assets. At the bottom are risky infrastructure assets, such as water supply in new towns and rural regions, for which the kind of revenues they can create is unknown. If spillover tax revenues from water supply are returned to investors, as proposed, the rate of return for private investors will increase significantly. Even risky infrastructure assets can be turned into safe assets if the extra spillover tax revenues created in large cities are injected. Thus, we can increase the rate of return for all kinds of water supply investment, and we can increase the safe assets in infrastructure investment that will allow insurance and pension funds to invest in the domestic water supply.

The next type of financing we look at is revenue bonds. If the water supply agency, which captures not only the user charges but also part of the spillover tax revenues, earns sufficient annual revenue (Figure 7), the agency can issue revenue bonds, for which the interest rate changes based on the revenues created by the user charges and spillover tax revenues. If the business goes well, the spillover tax revenues will keep on rising, and the interest rate on the revenue bond will achieve a higher rate of return. Revenue bonds can be purchased by a mix of entities. As an example, these could consist of the central government (20%), private investors (40%), and the local government (40%). The entities then share in all the risks but also the benefits, each in proportion to their investment.

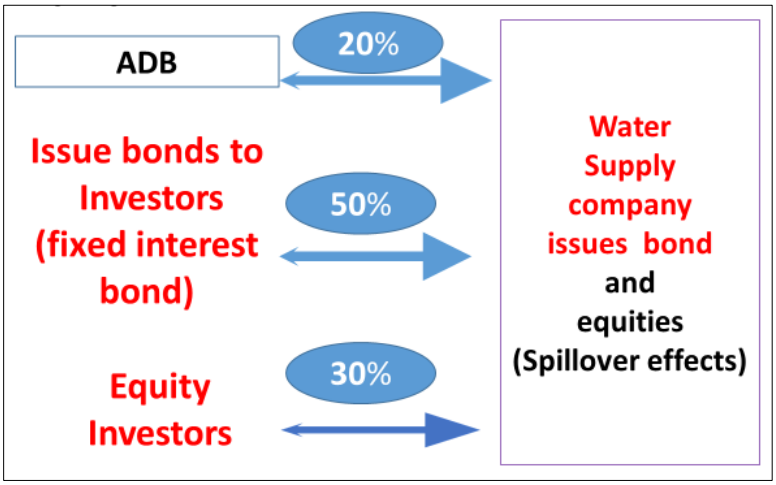
Figure 7: Revenue Bond for Water Supply



Source: Authors.

Figure 8 illustrates equity and bond investment in water supply. The right-hand side shows that the water supply company issues bonds and raises money from the equity market. User charges and spillover effects are both returned to equity and bondholders. Such a mix, for example, might include 20% from the Asian Development Bank, 50% from fixed interest rate bonds, and 30% from the stock market. If spillover tax revenues are returned to water supply investment investors, the rate of return of this fixed bond will be significantly higher. The last portion is equity investors. If the rate of return from user charges and spillover tax revenues is much higher than expected, then the equity investors in the bottom 30% will enjoy significant benefits.

Figure 8: Equity and Bond Investment for Water Supply



ADB = Asian Development Bank.
Source: Authors.

However, various risks are also associated with water supply investment:

i. Political risk
ii. Construction risk
iii. Operation and maintenance risk
iv. Exchange rate risk, if the investors are from overseas
v. Environmental risk (an additional risk that is often associated with infrastructure investment).

6. MODELS FOR RETURNING FRACTIONAL SPILLOVER TAX REVENUES TO INVESTORS IN WATER PROJECTS

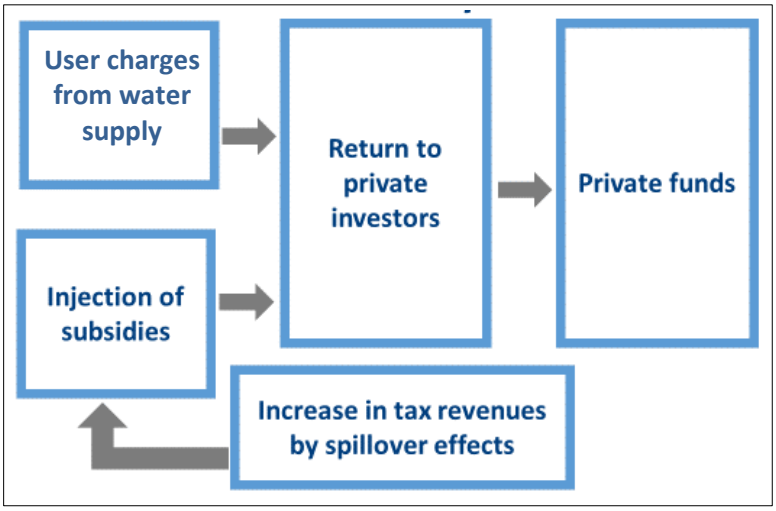
Water supply is an area for which it is especially difficult to induce private-sector financing. User charges are kept very low, and the rate of return from user charges is not expected to cover the construction and other costs. Spillover tax revenues must be returned to investors in this case, or water shortages will continue. If the rate of return is increased, as explained in section 4, private investors may be willing to invest in construction and other up-front costs.

Therefore, we are proposing to use spillover tax revenues created by the water supply. Property tax revenues have been used in the United States to add to the rate of return to infrastructure investors. Our proposal is to use revenues not only from property tax but also corporate business tax, income tax, and sales tax, and return them to the water supply investors. These increased spillover tax revenues should be shared with the local government and private investors in infrastructure investment.

By recommending that water supply and inland water transport firms develop nearby territories, we would like to point out that such an approach would not lead to the creation monopolies in terms of services. Issuance of infrastructure bonds and their wide dissemination in the market will increase the number of owners. At the same time, once the water supply infrastructure firm diversifies its revenue streams by creating other non-core activities such as real estate, water tariffs and fares will go down, making households better off. This will affect the local economy and raise the marginal productivity of the capital, resulting in increased tax revenues holding the tax rates constant. When part of this net increase in tax revenue is returned to the water supply firm, utility fees will be pushed further downward, increasing the survival chances of a water supply project and sustainable development of the region.

Finally, Figure 9 shows a model for the return of spillover tax revenues to private investors. At the bottom are increased tax revenues created by spillover effects of the water supply. The spillover effects then will be injected as subsidies by the government to private investors. In this case, if the local government receives total spillover tax revenues, the local government will inject a proportion of those tax revenues to private investors.

Figure 9: Injection of Fraction of Tax Revenues as Subsidy



Source: Authors.

7. FINANCING FOR START-UP BUSINESSES AND SMALL AND MEDIUM-SIZED ENTERPRISES ALONG WATER SUPPLY

To conclude, some comments about the financing of start-up businesses together with water supply. If clean water is supplied in a new region, many entrepreneurs will be interested in starting up a business, be it a restaurant or something else, because new residents will be available as customers. However, start-up businesses often find it difficult to raise money, and banks often deny them loans. The idea of hometown investment trust funds began in Japan about 20 years ago and then expanded to Cambodia, Viet Nam, and Peru. In such instances of hometown crowdfunding, money is collected from individuals in the region. When the water supply is started, people in the region contribute money to local business entrepreneurs—perhaps 200–300 people

giving $50–$100 each. Hometown crowdfunding sources money that can possibly be loaned to start-up businesses.

Recognizing the importance of water supply to regional development, it should be taken into account at the same time that financing for small businesses along with new water supply will mitigate income inequality and create business opportunities for start-ups. Spillover effects from water supply will be increased by allowing new businesses to start in the region. Hometown crowdfunding can thus finance not only the water supply but also provide funding to develop new businesses within the water supply region, which will create bigger spillover effects. In turn, this will also increase the number of investors willing to invest.

However, tax collection in many developing countries is difficult. Small and medium-sized enterprises do not pay tax, and even large businesses hide their revenue. To counter this, Finance Minister Dominguez and ADBI Dean Yoshino have suggested using satellite data for proper tax collection. These data could help inform how many people come to shopping malls or restaurants every day, how long the opening hours are, how many trucks deliver to each factory, how much greenery a farmland contains, and so on. Satellite data can provide tax authorities with rough figures of business activities and even estimates of farm crops. Such satellite data could capture spillover tax revenues properly and thus increase the rate of return to investors in water supply.

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