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## Working Paper

# Cost-benefit analysis of spillover tax revenues of high-speed rail in Taipei, China

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**ADB Working Paper Series**

**COST-BENEFIT ANALYSIS OF  
SPILLOVER TAX REVENUES OF  
HIGH-SPEED RAIL IN TAIPEI, CHINA**

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No. 1357  
February 2023

**Asian Development Bank Institute**

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**Abstract**

This paper introduces the concept of spillover tax revenues, which are also known as “indirect” or “secondary revenues,” or “externality effects.” Based on a case study of high-speed rail in Taipei, China, the spillover tax revenues are identified using the regional tax data through a DID analysis. This paper proposes alternatives for financing infrastructure investments with incorporation of the floating bond and land trust scheme. Further on, a cost-benefit analysis is carried out for the case from both the public and private sector's perspective. Compared to the traditional investment scheme, the proposed financing schemes show a significant improvement of the IRR.

The introduction of spillover tax revenues is essential to meet the needs of infrastructure investment in Asia. Increased spillover tax revenues should be shared with the local government and private investors. Combined with the innovative financing schemes, the improved IRR would induce private-sector financing in infrastructure investments.

**Keywords:** spillover tax revenues, floating bond, land trust scheme, private investment, high-speed rail

**JEL Classification:** R40, R52

## Contents

1.	INTRODUCTION .....	1
2.	NEED FOR PRIVATE-SECTOR FINANCING IN INFRASTRUCTURE INVESTMENT .....	1
3.	NEED FOR LONG-TERM INVESTMENT .....	3
4.	ROLE OF MULTILATERAL INTERNATIONAL ORGANIZATIONS IN INFRASTRUCTURE INVESTMENT .....	4
5.	SPILOVER EFFECTS OF INFRASTRUCTURE INVESTMENT.....	5
6.	FLOATING INFRASTRUCTURE BONDS.....	7
7.	CASE STUDY ON HIGH-SPEED RAIL (HSR) IN TAIPEI, CHINA .....	7
8.	COST-BENEFIT ANALYSIS FOR DIFFERENT STAKEHOLDERS .....	11
9.	CONCLUSION AND POLICY RECOMMENDATIONS.....	12
	REFERENCES .....	14

## 1. INTRODUCTION

Sustainable economic development requires huge infrastructure investment in developing Asia. Traditional financing sources include public-sector investment, long-term financing instruments such as insurance and pension funds, and multilateral international organizations such as the World Bank and Asian Development Bank (ADB). However, in the context of developing Asia, most economies face a high government debt issue, and sources for long-term investment are lacking. Considering, in particular, the ongoing COVID-19 pandemic and the conflict between the Russian Federation and Ukraine, relying on the traditional financing sources only cannot fill the infrastructure investment gap.

Against this background, the objective of the paper is to attract private-sector investment into infrastructure financing. The key is spillover tax revenues, which are also known as “indirect” or “secondary revenues,” or “externality effects.” Through a case study of high-speed rail in Taipei, China, the paper describes how to identify spillover tax revenues quantitatively, and how to mobilize them and combine them with floating infrastructure bonds and the land trust scheme to improve the internal rate of return (IRR), which is an important indicator for private-sector decisions in investment. Compared to the traditional approach to infrastructure investment, the proposed financing schemes would improve the IRR significantly.

This paper contributes to the sustainable infrastructure financing in developing Asia by introducing spillover tax revenues. Floating infrastructure bonds can channel the available sources into long-term investment, while the land trust scheme is helpful in mitigating bottlenecks in the land acquisition process, which is a headache for South and Southeast Asia. The combination of these and the significant effect in terms of improved IRR are shown in the case study, and more context-specific integration of innovative financing schemes is expected in future practices.

The paper is structured as follows: Sections 2, 3, and 4 address the situation of traditional financing sources in developing Asia, and the need for private-sector investment is highlighted; Section 5 introduces the concept of spillover tax revenues and the difference-in-differences (DID) method; Section 6 introduces the concept of floating infrastructure bonds; Section 7 is the case study that incorporates the proposed financing schemes, and this is followed by Section 8, the cost-benefit analysis for both the public and private sectors; Section 9 presents the conclusion and policy recommendations.

## 2. NEED FOR PRIVATE-SECTOR FINANCING IN INFRASTRUCTURE INVESTMENT

Infrastructure such as water supply, electricity, roads, railways, etc. is an essential part of economic growth. Providing basic infrastructure such as water and sanitation, like the provision of security and safety, is an activity that should be treated as part and parcel of not only human development, but also enlightened governance at national and international levels (Seetharam and Rao 2006). Infrastructure can promote employment in the region and provide opportunities for small businesses to start their business after its completion (Sawada et al. 2014).

In 2016, the Asian Development Bank (ADB) estimated that in developing Asia an annual investment of \$1.7 trillion is required from 2016 to 2030 to fill the infrastructure investment gap for the ongoing growth momentum to be sustained (ADB 2017).

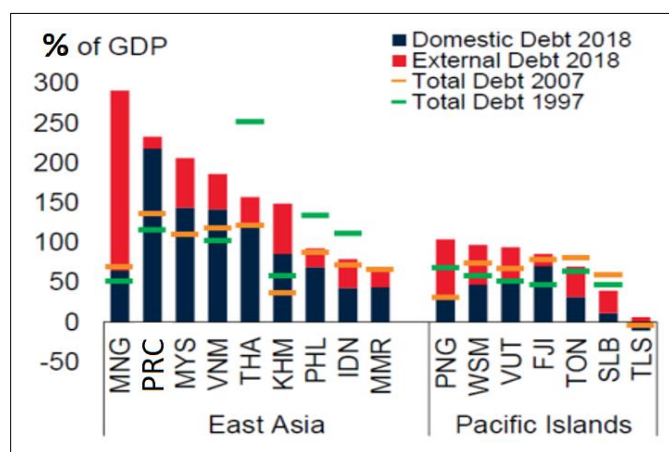
**Table 1: Estimated Infrastructure Needs in Asia**

	Baseline Total (US\$ billion)	% of GDP	Climate-adjusted (US\$ billion)	% of GDP
Central Asia	33	6.8	38	7.8
East Asia	919	4.5	1,071	5.2
South Asia	365	7.6	423	8.8
Southeast Asia	184	5.0	210	5.7

However, COVID-19 and the associated emergent fiscal spending for healthcare and compensation for affected people reduces the expected infrastructure investments in developing nations (Yoshino and Hendriyetty 2020). With the emergence of variants in the past two years, the pandemic and its impact will be long-term. In addition, escalating global geopolitical tensions arising from the conflict between the Russian Federation and Ukraine and the associated increases in energy and other commodity prices have pushed up the inflation rate in developing Asia, which is estimated to be 3.7% in 2022 and 3.1% in 2023 (ADB 2022). All risks are adding to the financial instability for infrastructure.

Public-sector spending is an important source for infrastructure investment. As illustrated in Figure 1, Asian economies have faced a high debt ratio, which has put a constraint on the infrastructure investment from the government side.

**Figure 1: High Debt Ratio in Asian Economies**



Source: IMF (2018).

Against this background, private-sector financing into infrastructure investments becomes quite important to pursue planned infrastructure investments, and to keep sustainable and equitable economic growth in developing Asia.

However, it is especially difficult to induce private-sector financing in infrastructure investments. There are several challenges for the private sector in making the decision. First, corruption in infrastructure investments is an issue that is often pointed out. Second, land acquisition is very difficult in Asia and politicians are often involved in

negotiations between landowners and infrastructure investors. Third, and most importantly, the initial cost, such as the cost for land acquisition and construction, is high while user charges (for toll roads and water supply) are kept low, which will result in a low rate of return from the investment as the revenue is not expected to cover the construction and other costs (Bambang, Donghyun, and Shu 2019).

### 3. NEED FOR LONG-TERM INVESTMENT

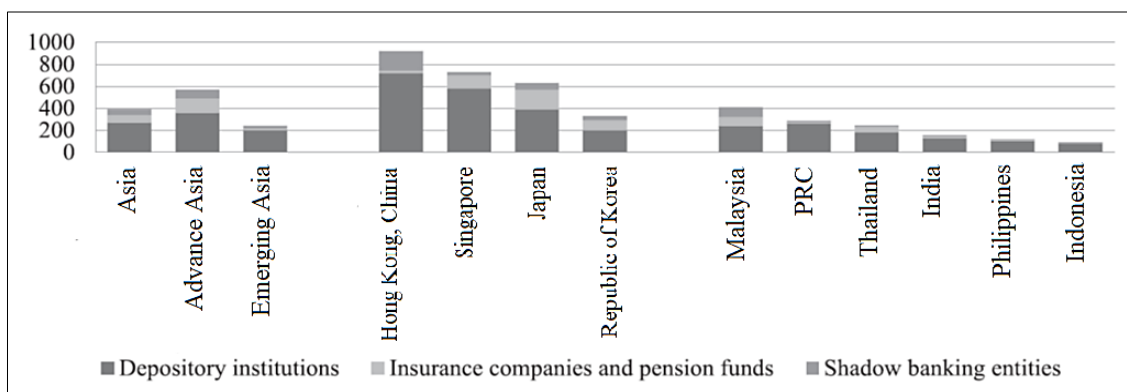
Infrastructure requires long-term finance. Insurance, pension funds, and long-term deposits can be utilized for long-term infrastructure investment. Life insurance has two merits. One is the support and protection of family against unexpected accidents, disease, or death. The other is the characteristic of its long-term nature. Life expectancy is increasing in many Asian economies, and pension funds and long-term deposits are essential as aging has become a social issue. Private pensions and public pension funds will also assist people’s daily living after their retirement. Without a good pension system, people cannot be supported after their retirement. Household members can benefit from long-term deposits to support their living as they get old.

Insurance and pension funds are long-term investors and they do not change their portfolio based on short-term fluctuations in the rate of return. They are patient investors and very suitable for infrastructure investment. Insurance and pension funds can invest in infrastructure as long as the rate of return is high, and risks are low.

However, the low share of insurance and pension funds in Asian economies makes investment in infrastructure difficult. As can be seen in Figure 2, Asian economies show a higher bank savings rate than in the 1990s when the Asian financial crisis of 1997–1998 hit the region. Many Asian economies relied heavily on foreign capital to support their investment because of the lack of domestic savings in the 1997–1998 period. Foreign investors normally request dollar-denominated infrastructure finance to avoid exchange rate risks. Foreign currency-denominated borrowing for infrastructure from abroad brought foreign exchange volatility to governments. Short-term capital made sudden inflows and outflows, which was one reason for the Asian financial crisis.

As a result, in Asia, savings are concentrated in bank deposits. In the Asian region, insurance and pension funds are often deposited in banks as deposits. Banks can provide one- to five-year loans. However, this is relatively short-term compared to the duration of infrastructure investment. Long-term savings such as insurance and pension funds are lacking.

**Figure 2: Assets of Financial Institutions in Asia (US\$ billion)**



Source: IMF (2018).



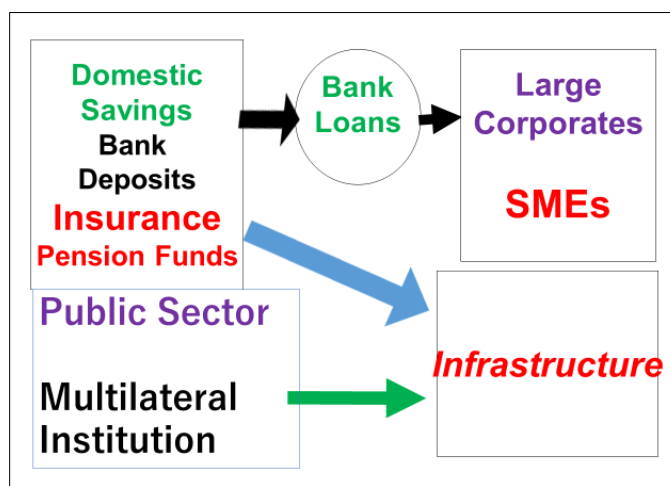
With the higher economic growth and higher remittance receipts in recent years, developing Asia has collected lots of bank deposits. If domestic savings are well circulated for domestic investments including infrastructure investments, there is a reduced need for foreign investments. This is quite different from the 1997–1998 period when huge overseas capital flew into the Asian region.

#### 4. ROLE OF MULTILATERAL INTERNATIONAL ORGANIZATIONS IN INFRASTRUCTURE INVESTMENT

Infrastructure has been financed by multilateral institutions in the Asian region together with spending from local government. Multilateral institutions such as the World Bank, ADB, EBRD, etc. can play an important role in avoiding corruption in infrastructure investment. In our view, multilateral institutions can be involved by investing a small share of the total infrastructure project cost (say 3% or 5%) so that they can act as a watchdog to secure compliance with contracts and transparency in general. The involvement of multilateral institutions with a small share of investment could avoid corruption in infrastructure investment and thus attract more private investors.

At the same time, multilateral institutions can provide long-term fixed interest rate loans for infrastructure investments in various economies. Some recipients complain that the fixed rate of interest is high. However, as discussed in the following section, if the spillover tax revenues created by infrastructure investments were considered (which are subtracted from fixed interest loans from multilateral financial institutions), the net interest burden from multilateral institutions would be reduced.

**Figure 3: Financing Sources for Infrastructure Investment**

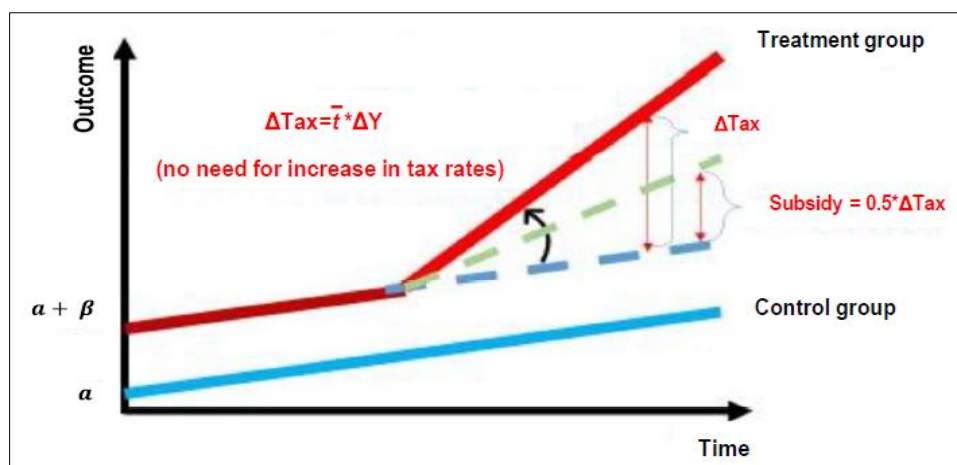


In short, in order to attract private investors, as well as insurance, pension funds, and bank loans, into the investment of infrastructure, the rate of return must be improved, and the risks must be minimized (Figure 3). A higher rate of return is the enabler for sustainable long-term infrastructure investment, and spillover effects and innovative financing schemes that incorporate spillover tax revenues are the key (Yoshino, Hossain, and Taghizadeh 2020).

## 5. SPILLOVER EFFECTS OF INFRASTRUCTURE INVESTMENT

Spillover effect is also called “indirect” or “secondary,” or “externality” effect of infrastructure investment (Yoshino, Helble, and Abidhadjaev 2018). To capture the spillover effect, Difference-In-Differences (DID) method is utilized. Two groups, the treatment and control group are defined based on the impact of policy interventions or infrastructure projects. The methods assumes that the changes in outcomes between groups are the same over time, and the policy or the project is the only intervention that creates a difference. It computes the double difference over time and region for groups, namely the differences between pre- and post-infrastructure investment (time-wise) and between treatment and control group (geography-wise). As illustrated in Figure 4, the differences in pre- and post-outcomes for both groups are obtained (the time axis). Then, for the treatment group, the difference is subtracted from the total difference to further exclude other time-varying factors (solid red line and dotted blue line). Finally, the net difference is interpreted as the spillover effect of the infrastructure project (Yoshino, Abidhadjaev, and Nakahigashi 2018).

Figure 4: DID for Spillover Effect



One Japanese case (for details, please refer to Yoshino and Abidhadjaev 2017b) is provided to illustrate the impact of infrastructure investment (Table 2). The first row of the table shows the direct effect of infrastructure investment where infrastructure construction pushes up regional GDP. The second and third rows are spillover effects (on private capital and employment, respectively). New businesses open along the new infrastructure project. New factories and new shopping malls hire people in the region, which will increase their employment. The last row is the ratio of spillover effects to direct effects. It is estimated that about 66%–68% of all effects lie in spillover effects created by infrastructure investment.

**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 (%)	66.644	67.481	67.210	66.907	66.691	66.777
	1986–1990	1997–1995	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), Public Policy Review (Ministry of Finance, Japan).

These spillover effects increased regional GDP and various tax revenues in the region. Business tax, income tax, sales tax, and property tax revenues will rise as infrastructure projects generate a larger and larger impact in the region. Currently, all these spillover tax revenues are absorbed by central and local governments. They are not returned to infrastructure investors and infrastructure operators.

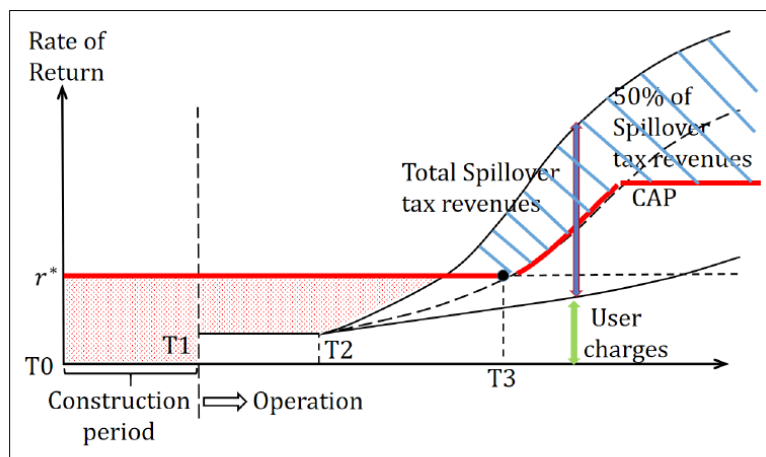
From the perspective of infrastructure investors and infrastructure operators, currently user charges are the main revenue source. In terms of water supply, the price must be as low as possible as water is a necessary good for the whole population (Seetharam and Fan 2014). As for electricity, the price must be as low as possible to serve the public. However, investors in infrastructure prefer a higher rate of return while users prefer a lower price. There are conflicts between users and investors in infrastructure. Rationalizing or raising tariffs may often require difficult institutional changes and the reasons for increasing tariffs may need to be fully explained to water consumers and producers as well as to politicians (ADB 2002). This is the reason why private participation in infrastructure investments is slow.

If part of spillover tax revenues were returned to investors in infrastructure, the rate of return would be user charges plus a fraction of spillover tax revenues, meaning a higher rate of return could be expected (Yoshino and Abidhadjaev 2017a). Detailed econometric estimation would be required to assess what percentage of spillover tax revenues should be returned to infrastructure investors. In the case of Japan, about 66%–68% of spillover tax revenues are identified, and a portion of this should be returned to infrastructure investors. In practice, sophisticated econometric methods cannot be easily applied to various infrastructure investments. In the case study, 50% of total spillover tax revenues are assumed to be returned to infrastructure operators and investors (Figure 5). In other words, the government and private sectors should share spillover taxes half and half. If spillover effects are large, infrastructure investors and operating companies do not need to rely too much on user charges. Users can pay only a small fee to use water supply, electricity, etc. (Seetharam and Rao 2010).

## 6. FLOATING INFRASTRUCTURE BONDS

Figure 5 shows the proposed floating infrastructure bonds to implement spillover tax revenue in practice.

**Figure 5: Proposed Floating Rate Infrastructure Bond Combined with Spillover Tax Revenues**



Source: Based on Yoshino, Azhgaliyeva, and Mishra 2020.

From T0 to T1 is the construction period where no return from infrastructure is observed. The interest rate of the government bond is set at  $r^*$ . The operation starts at T1. User charges can be collected, and spillover effects from infrastructure will gradually become larger. Between period T0 and T3 the interest rate of the infrastructure bond is the same rate as the government bond where enough revenues are not yet created by infrastructure. After T3, the rate of return is higher than the interest rate of the government bond.

It is possible to set a cap on the rate of return on infrastructure. If spillover effects are very large, the floating interest rate will rise to a very high level. The government will be able to set a “cap” for the interest rate to be paid to infrastructure investors. However, the cap has to be set up at the start of the infrastructure floating bond being issued. Otherwise, private investors will be very skeptical about the “cap” level of floating bonds.

Extra revenues above the “cap” can be kept as reserves to prepare for future disaster damages toward infrastructure by the government. Maintenance and repairs are needed to infrastructure hit by disaster, which must be supported by government spending. The proposed floating infrastructure bonds set a rule, or rather a reference, for the practice of spillover tax revenues in terms of setting the interest rate.

The implementation of a floating bond is demonstrated in the following case study.

## 7. CASE STUDY ON HIGH-SPEED RAIL (HSR) IN TAIPEI, CHINA

In this section, the floating-rate infrastructure bond scheme combined with spillover tax revenues is applied to the case of high-speed rail (HSR) in Taipei, China.

**Table 3: Timeline of High-Speed Rail Project in Taipei, China**

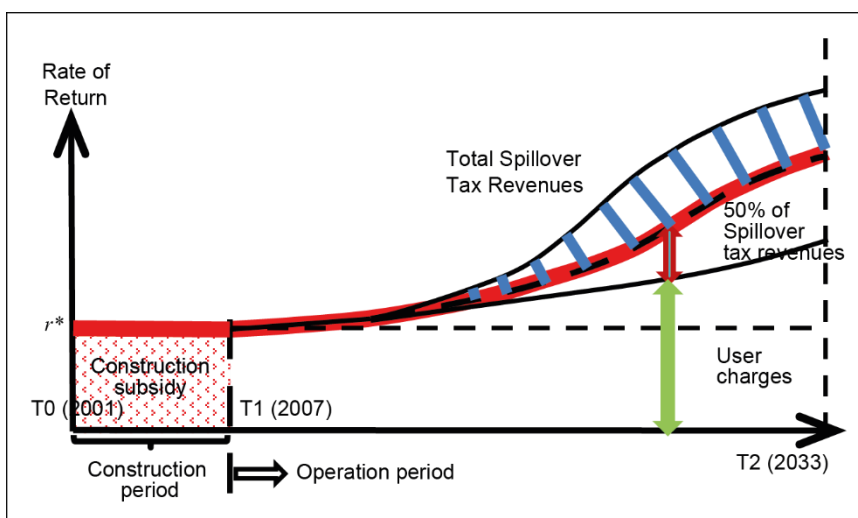
Project Phase	Year	Duration	Cost (NT\$ billion)	Revenue (NT\$ billion)	
Preparation	Before 1999	Not applicable	Land acquisition	106	0
Construction	1999–2006	8 years	Construction	408	0
Operation	2007–2033	27 years	Operation and maintenance	540*	User charge 1,890*
Total		35 years		1,054*	1,890*

Source: Authors.

Table 3 presents the project timeline. The project preparation period ended in 1999, during which the necessary land acquisition for HSR construction was conducted. The land acquisition cost was NT\$106 billion. From 1999 to 2006, seven years was spent on the construction with a total construction cost of NT\$408 billion. The operation and maintenance period started in 2007. It was contracted to a private-sector operator, and the 27-year operation contract was signed until 2033. The operation and maintenance cost was estimated to be NT\$540 billion. Summing the cost of different project periods, the total cost is about NT\$1,054 billion. In terms of revenue, when the HSR operation began in 2007, revenues could be generated. Fare revenues are expected to be NT\$1,890 billion by 2033. Therefore, as shown in the last row, the total expected revenue is NT\$1,890 billion and the total cost NT\$1,054 billion. Non-fare revenue is not considered for the case study.

Figure 6 and Table 4 show the evolution of the rate of return over the project implementation periods.

**Figure 6: Rate of Return vs. Operation Period**



In the construction period, the government bond interest rate is paid to infrastructure investors so that they can be sure about the rate of return even though revenues and spillover tax returns are not coming to infrastructure investors. The period between T0 and T1 is the construction period when the revenue is 0 but government is providing interest payment to infrastructure investors, which is indicated by the red shaded area. The operation started from T1 (2008) and gradually user charges and spillover tax revenues rose.

The blue shaded area is the 50% spillover tax revenue to the government and the lower half of the figure shows user charges plus 50% spillover tax revenues to the investors. After T1, as in the Taipei,China high-speed rail case, user charges plus 50% of tax revenues become higher than the government bond rate (the dotted line), meaning the investors' rate of return becomes higher than the government bond rate. As for the government, it subsidized the construction period between T0 and T1. However, after T2, 50% of tax revenue will become bigger and bigger, which is shown by the blue shaded area.

**Table 4: Subsidy, IRR, and Spillover Tax Revenue for Taipei,China HSR Case**

Subsidy Scheme	Construction Period						Operation Period					
	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	
Subsidy (NT, Billion)	118.4	58.3	58.3	58.3	58.3	58.3	0.0	0.0	0.0	0.0	0.0	
IRR	3.0%	3.0%	3.0%	3.0%	3.0%	3.0%	16.6%	22.4%	25.9%	28.3%	30.0%	
Total spillover tax revenue	0.0											
Year	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	
Subsidy (NT, Billion)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
IRR	31.2%	32.1%	32.8%	33.4%	33.8%	34.0%	34.3%	34.4%	34.6%	34.6%	34.7%	
Total spillover tax revenue	8.8	14.7	21.4	24.8	24.4	22.3	30.4	33.7	37.0	40.3	43.6	
Year	2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033	
Subsidy (NT, Billion)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
IRR	34.8%	34.8%	34.9%	34.9%	34.9%	34.9%	34.9%	34.9%	35.0%	35.0%	35.0%	
Total spillover tax revenue	46.9	50.2	53.5	56.7	60.0	63.3	66.6	69.9	73.2	76.5	79.8	

Note: Spillover tax revenue for 2007–2017 is based on actual tax data; for 2018–2033 it is based on author estimation.

As shown in Table 4, at the end of the operation period (2033), the total spillover tax revenue will become 502.7 (NT, Billion) and the total subsidy during the construction period is 409.9 (NT, Billion). Therefore, the net benefit is 92.9 (NT, Billion). This shows the benefit is bigger than subsidizing the government bond. It will be very attractive for private investors as traditionally private investors could not receive any return in the construction period. At the same time, as for the revenue of the operation infrastructure companies, 50% of spillover tax revenues is added in addition to these user charges. As a result, the rate of return will become higher and the internal rate of return will become about 35% when the spillover tax revenues are considered, which will attract lots of private investors.

From the government's perspective, the total cost is T0 to T1 times the interest rate on government bonds. This is the entire subsidy government has to provide to infrastructure investors. After T2, government starts to receive 50% of spillover tax revenues (blue shaded area). Meanwhile, the government does not lose its money because 50% of the spillover tax revenue returns to the government, which will exceed the cost of subsidies (Table 5).

**Table 5: Subsidy Scheme Summary**  
(unit: NT, Billion)

1	Subsidy in construction period (2001–2006)	409.9	(Cost)
2	Subsidy in operation period (2007–2033)	0	(Cost)
3	50% of spillover tax revenue (2008–2033)	502.7	(Revenue)
4 (3–1)	Overall surplus for public sector	92.9	(Net revenue)

Further, the investment scheme for the private operator (the investor) under the land trust scheme and spillover tax revenues is simulated.

### Land trust to smoothen land acquisition in infrastructure investment

In many developing Asian economies, land acquisition for infrastructure projects has been a major barrier. Due to the delay of land acquisition, the associated project delay may cause cost overrun, which prevents the investors (Yoshino and Pontines 2015). Landowners are reluctant to give up their land for development projects. The land trust scheme can be a solution. Under the scheme, the ownership of the land is retained by landowners while the right of use is leased out to infrastructure developers for a stipulated period. Trust Bank, who watches the proper use of land and guarantees the payment of dividends to landowners, can be involved. As a practice in Japan, land trust business can only be carried out by trust entities licensed under the Trust Business Act and financial institutions licensed under the Act for Financial Institutions' Trust Business, so that the land trust scheme can be implemented on a proper legal basis.

The land trust scheme can work as a way to avoid corruption related to land acquisition. Land prices are not well revealed in developing economies. Land acquisition is often handled face to face with individual negotiation. Land mafia can play a role in these transactions and create corruption. Disclosure of land price based on transactions is an important step to avoid corruption. Land price evaluators can be set up to assess various land based on a hedonic approach.

Simulation results are presented in Table 6. Three scenarios are considered, as shown in columns. Total cost (1), NPV cost (2), total revenue (3), NPV revenue (4), net NPV (5, which is 4–2), and IRR (6) for scenarios are listed. In the original scenario, where the investors purchased the land (thus a high initial cost), and spillover tax revenues are not considered, and total NPV cost (2) is –NT\$620 billion. Compared to scenario 2 where the land trust scheme is applied and the initial cost is reduced and replaced by land rent cost, the NPV cost is reduced to –NT\$606 billion.

In scenario 3, with both the land trust scheme and spillover tax revenues considered, the NPV cost remains the same (compared to scenario 2), while the total revenue increases from NT\$1,890 billion to NT\$2,393 billion. The NPV revenue (4) changes from NT\$628 billion to NT\$766 billion. In terms of net NPV revenue, it is NT\$160 billion for scenario 3, compared to only NT\$8 billion for the original scenario and NT\$22 billion for scenario 2 when only the land trust scheme is applied.

**Table 6: Net Present Value and Internal Rate of Return of High-Speed Rail Project in Taipei, China**  
(NT\$ billion)

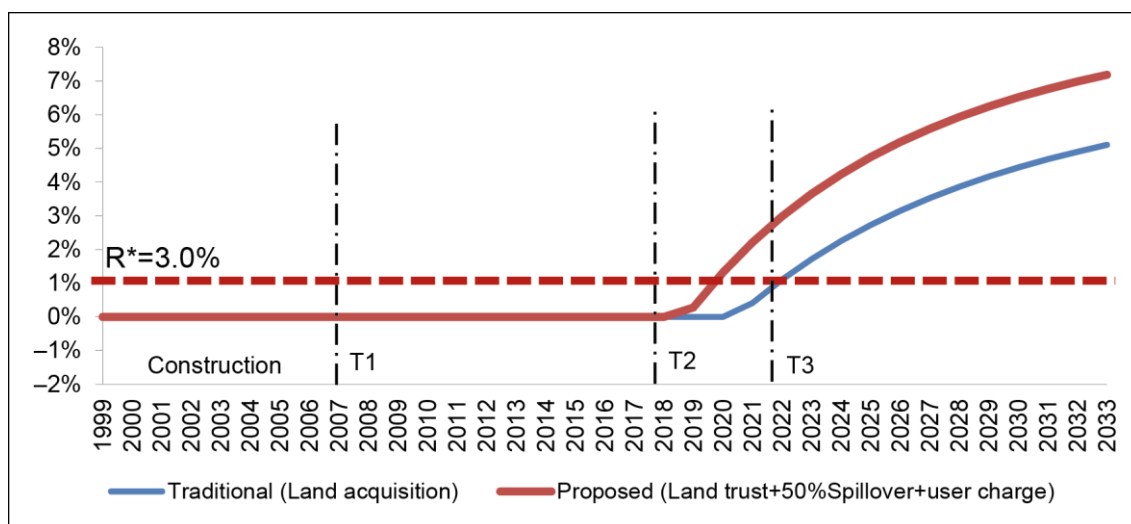
	Original (Land Acquisition)	With Land Trust	With Land Trust and Spillover Revenue
1 Total cost	–1,054	–1,134	–1,134
2 NPV cost	–620	–606	–606
3 Total revenue	1,890	1,890	2,393
4 NPV revenue	628	628	766
5 Net NPV	8	22	160
6 IRR	5.1%	5.4%	7.2%

Source: Authors.

In terms of IRR, scenario 1 was only 5.1%. With the land trust scheme, the IRR increased to 5.4% in scenario 2. Combining the land trust scheme and spillover tax revenues, the IRR becomes 7.2% in scenario 3, with which the infrastructure project can attract much more private investment than with the original scenario.

The evolution of the IRR for the traditional and proposed investment is plotted in Figure 7. The proposed investment scheme considers not only the user charge revenue, but also 50% of spillover tax revenues, in addition to the shift of land acquisition to the land trust scheme. It is clear that spillover effects will increase the IRR by 2.1%.

**Figure 7: IRR Evolution for Traditional and Proposed Investment**



Source: Authors.

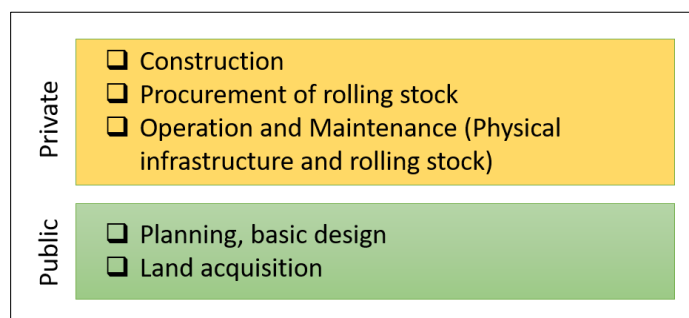
## 8. COST-BENEFIT ANALYSIS FOR DIFFERENT STAKEHOLDERS

Considering different stakeholders’ perspective, the introduction of spillover tax revenue would make the project much more attractive to private investors, yet without incurring additional financial burden on the public sector.

The privatization of the project was decided by the Taipei,China government in 1998, before the commence of land acquisition and construction. The project was awarded to a special purpose vehicle (SPV) called the “THSRC” (High Speed Rail Corporation of Taipei,China), which was given the right of construction and operation, while the planning and land acquisition responsibility was assumed by the public side, as indicated by Figure 8. It was planned that at the end of the concession period, the THSRC would return the asset back to government.

From the private sector’s perspective, based on the cost-benefit analysis, if 50% of the spillover tax revenue is returned to the private sector, the THSRC would receive much more revenue in the operation and maintenance stage. In addition, the revenue during the construction, procurement, and initial operation stage (T1 and T2 stage) could be guaranteed by the government’s floating bond. Overall, the revenue situation of the private sector can be improved significantly for the whole project cycle.



**Figure 8: Responsibility of Private and Public Sector**

From the public sector's perspective, the provision of the floating bond would not incur additional cost to the government. After T3, the government will receive spillover tax revenue. In addition, the application of the land trust scheme would save the land acquisition cost assumed by the public sector. Therefore, it is a gain to the public sector as well.

As we all know, the THSRC was taken over by the government after operating for a few years due to the high cost and low revenue, which put the private sector in an unsustainable financial situation. Under the traditional project finance scheme, a much longer time is needed before sufficient revenue is accumulated. It is believed that the proposed investment scheme would make the project much more attractive to private investors.

## 9. CONCLUSION AND POLICY RECOMMENDATIONS

In this paper, we have shown the importance of the spillover effect for infrastructure investment. The key is to improve the rate of return. In the United States, property tax revenues are explored to increase the rate of return to infrastructure investors. This paper suggests using not only property tax revenues, but also revenues from a variety of other taxes. Spillover tax revenues must be returned to investors so that the rate of return can be improved.

Government can issue floating interest rate bonds to give incentives to private infrastructure investors. The interest rate of the bond is "floating," i.e., it is kept the same as ordinary government bonds at the initial stage where there is no or insufficient revenues generated from the infrastructure projects, and changes over time when spillover tax returns plus user charges are accumulated. These bonds will give incentives to infrastructure companies to reduce the investment burdens at the beginning of the development. The floating bond will also be a means of keeping user prices as low as possible, which could in turn expand the number of infrastructure users. Portfolios of insurance and pension funds, which are long-term financing sources and thus suitable for infrastructure investment but are not widely mobilized in developing Asia, can be transformed under the floating bond arrangement.

From the public-sector perspective, even though governments share the spillover tax revenues with operators and investors, they will gain net revenues since the spillover tax revenues are additional revenues. The spillover tax returns above the cap (that set between the government and infrastructure investors) would be kept as government reserves to compensate for the construction costs, maintenance costs, and other costs. Extra spillover tax revenues above the cap can be kept as reserves to prepare for natural disasters such as typhoons or earthquakes.

In terms of private-sector involvement in infrastructure investment, their revenue is increased as spillover tax revenues are shared with the local government. Furthermore, the infrastructure investor, or supply firm, should diversify its revenue streams by promoting secondary activities surrounding infrastructure development, such as Transit Oriented Development (TOD) or real estate. In some cases, the revenue streams from these secondary activities may be more or less volatile than those from the main project. Subsequently, with a healthy financial situation, user charges like water tariffs and fares can be set at a more affordable level, making households better off. The improved social welfare will create a positive impact on the local economy and raise the marginal productivity of capital, which in turn will raise more tax revenues, assuming the tax rates are held constant. The dynamic circle of infrastructure investment justifies the viability of infrastructure projects and contributes to the sustainable development of the region.

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