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## Working Paper

# Connectivity between Asia and Europe: Implications for infrastructure convergence between the two regions

ADB Working Paper Series, No. 1067

### Provided in Cooperation with:

Asian Development Bank Institute (ADBI), Tokyo

*Suggested Citation:* Yoshino, Naoyuki; Hossain, Monzur; Taghizadeh-Hesary, Farhad (2020) : Connectivity between Asia and Europe: Implications for infrastructure convergence between the two regions, ADB Working Paper Series, No. 1067, Asian Development Bank Institute (ADBI), Tokyo

This Version is available at:

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**ADB Working Paper Series**

**ENHANCING FINANCIAL  
CONNECTIVITY BETWEEN ASIA  
AND EUROPE: IMPLICATIONS FOR  
INFRASTRUCTURE CONVERGENCE  
BETWEEN THE TWO REGIONS**

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No. 1067  
January 2020

**Asian Development Bank Institute**

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Suggested citation:

Yoshino, N., M. Hossain, and F. Taghizadeh-Hesary. 2020. Enhancing Financial Connectivity between Asia and Europe: Implications for Infrastructure Convergence between the Two Regions. ADBI Working Paper 1067. Tokyo: Asian Development Bank Institute. Available: <https://www.adb.org/publications/enhancing-financial-connectivity-between-asia-and-europe>

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**Abstract**

While discussing the enhancement of the connectivity between Europe and Asia, this policy paper explores a new area of cooperation, which is the use of European long-term investment funds in Asia's infrastructure. We argue that, if Asian countries agree to offer 50% of their spillover revenue to infrastructure investors from Europe, it will increase the rate of return of long-term investment funds, such as pension and insurance funds. This will create a win-win situation for both Asia and Europe, because investment in infrastructure will enhance various spillover benefits and increase the savings in these countries, which will ultimately enhance the economic growth in the Asian countries. On the other hand, idle European funds will generate higher returns from infrastructure investments in Asia, which will also be beneficial for European countries. This approach will reduce the divergence in infrastructure between the two regions and encourage regional connectivity, such as the People's Republic of China's Belt and Road Initiative. With some empirical evidence, this paper also highlights the methods of spillover revenue collection and approaches to share the revenues. It is important for Asian countries to review the approaches and develop some institutional mechanisms to allow private investors in infrastructure. Moreover, Asian and European leaders, for example in the Asia-Europe Meeting, might devise appropriate methods that would allow European long-term investors to invest in Asian infrastructure needs.

**Keywords:** financial connectivity, infrastructure investments, spillover tax revenue, pension and insurance funds, Europe, Asia

**JEL Classification:** O22, O23, O24, F36, F37

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## 1. INTRODUCTION

There are many discussions on economic integration, in particular trade integration and infrastructure connectivity between Asia and Europe. However, little research has explored financial connectivity to achieve infrastructure convergence between two regions. There is scope for enhancing institutional investments in meeting the financing needs of infrastructure in Asia given that there is a huge financing gap in infrastructure in Asia and available pension and insurance funds in Europe. With the establishment of a proper institutional mechanism, it would be possible for Asia to attract investments from Europe to finance its infrastructure investments, which could be a win–win situation for both the regions and help to achieve infrastructure convergence in the long run.

Asia has made good progress in infrastructure development; however, the growth of infrastructure lags behind the economic, urban, and population growth, highlighting a massive need for investments in infrastructure. Given this fact, the quantity and quality of infrastructure in Asia largely lag behind the international standards (Bhattacharya, Romani, and Stern 2012). Inadequate and poor infrastructure hampers the potential economic growth of Asian countries, weakens their international competitiveness, and adversely affects their poverty reduction efforts. Large national and regional infrastructure projects involving several Asian economies have great potential to act as new engines for promoting growth and creating jobs. The Belt and Road Initiative of the People's Republic of China (PRC) has opened up the possibility to achieve regional connectivity. Furthermore, there is scope for green connectivity, which could enhance environmental sustainability through the development of appropriate cross-border green energy and transport networks. An estimate has shown that Asia faces huge infrastructure financing needs of around \$750 billion per year on average in the coming years (Bhattacharya et al. 2012). Many Asian countries are not capable of meeting this large financing need, particularly in view of their fiscal constraints.

The divergence between EMU and Asian countries emanates mainly from the infrastructure deficit (Herrero and Xu 2016). For example, the quality of infrastructure is generally low in the ASEAN countries, except Singapore, and has fallen relative to their global peers, especially when compared with the huge improvement in the PRC. The ASEAN countries' need for infrastructure investment ranges from 5% to 13% of their GDP, and transportation is the sector that most needs such investment. The United Nations Conference on Trade and Development's (UNCTAD) latest estimate confirmed the need for investment in transport infrastructure in the ASEAN. An annual investment of \$110 billion is necessary in the ASEAN in 2015–25, and half of this amount is for transportation. The SAARC countries are lagging even further behind the ASEAN countries.

If further investment in infrastructure is essential, how can Asian countries finance this? The fiscal capacity of Asian countries is rather limited, and therefore public–private partnerships are essential for their success. Private participation has generally increased in more developed countries, but the ratio remains low in less developed ones. Asia clearly needs to expand the participation of private investors in its infrastructure projects, for which it needs to enhance the rate of return in excess of user charges. It can achieve this by sharing spillover tax revenues among the investors. We argue in this paper that Europe has idle institutional investment funds, such as pension and insurance funds, that it could invest in Asia's infrastructure, for which Asia needs to develop a mechanism to share spillover tax revenues to raise the rate of return on the investments. In support

of this argument, we show theoretically and empirically that spillover tax revenue sharing is a viable option to attract investments in infrastructure in Asia.

The paper is organized as follows. Section 2 discusses the need for infrastructure investments in Asia and estimates the financing gaps in Asia. Section 3 develops a theoretical and conceptual framework for spillover revenue sharing methods to increase the rate of return for private investors in infrastructure investments. Section 4 discusses approaches and methods to calculate spillover tax revenues and share them among the investors. Section 5 discusses the current status of European pension and insurance funds and the rate of return. Finally, section 6 concludes the paper.

## 2. INFRASTRUCTURE NEEDS AND FINANCING

### 2.1 Massive Infrastructure Needs in Asia

Huge infrastructure needs are observable in many Asian countries. The estimated climate-adjusted infrastructure investment shows that South Asia needs about 9% of its GDP and Southeast Asia needs about 6% of its GDP (Table 1). If public money alone finances all the infrastructure investment, huge budget deficits will arise and fiscal sustainability will be a concern. Therefore, private sector financing will be the key to satisfying the huge demand for infrastructure investment.

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

	Baseline Total	% of GDP	Climate Adjusted	% 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
The Pacific	2.8	8.2	3.1	9.1
Asia and the Pacific	1,503	5.1	1,744	5.9

Source: Asian Development Bank (2016).

### 2.2 Infrastructure Financing Gap

There are several estimates available on the need for finance for infrastructure investments, indicating that \$59 trillion worth of investments in infrastructure are necessary during the next 15 years (Citi GPS 2016). Growing Asia accounts for a major portion of the global infrastructure financing needs. Bhattacharya et al. (2012) estimated that, during the period 2010–20, the developing countries in Asia (32 major developing economies) will require investments in infrastructure totaling \$777 billion per year to support their high economic growth. Particularly, investments are necessary for energy, transport, telecommunications, water, and sanitation infrastructure.

Of the required investments, 68% are for new capacity and 32% are for the maintenance of existing assets. Sectoral estimates show that the energy sector requires 49%, while 35% are necessary for transport infrastructure, 13% for ITC, and 3% for the water and sanitation sectors. These infrastructure needs account for around 6.5% of Asia's annual regional GDP. However, this estimated amount for financing infrastructure exceeds the available resources of many of the Asian countries. Furthermore, Bhattacharya et al. (2012) estimated that regional or cross-border projects in Asia would require additional

investments worth \$320 billion—on average about \$29 billion per year during the period 2010–20.

Another ADB (2017) study estimated the required financing needs for the same 32 major developing countries to be \$17,426 billion (in 2008 prices) for the 15 years from 2016 to 2030. This estimate shows that the average annual national infrastructure financing need is about \$1,162 billion, which is 55% higher than Bhattacharya et al. (2012) estimate. Though it is difficult to produce a precise estimate of infrastructure financing requirements due to various externalities and changing country needs, the estimates provide an understanding of the huge requirements for financing future infrastructure growth in Asia. Taking into account the financing requirement for Sustainable Development Goals (SDG) implementation, the figure required will even be higher.

For example, we estimated the financing gap for Bangladesh (as it is a fast-growing economy) for the Seventh Five-Year Plan period (2016–2020) using the time series AR(1) model,<sup>1</sup> as Table 2 shows. The analysis suggests that there has been a big gap between the projected revenue and the targeted revenue collection in the Seventh Five-Year Plan period (about \$10 billion in 2020).

**Table 2: Gap between Projected and Seventh Five-Year Plan Targeted Revenue**  
(\$ billion)

	Projected Total Revenue	SFYP Target of Total Revenue	Gap	Projected Tax Revenue	SFYP Target of Tax Revenue	Gap
2015–16	26.1	26.1	0.0	22.8	22.8	0.0
2016–17	29.9	32.9	3.0	26.2	28.1	1.8
2017–18	34.4	39.6	5.2	30.2	34.1	3.9
2018–19	39.6	47.6	8.1	34.7	41.3	6.6
2019–20	45.5	57.8	12.4	40.0	50.7	10.7

Sources: Authors' estimation; Seventh Five-Year Plan Document.

However, the total additional cost of SDG implementation for Bangladesh in the period 2017–2030 would be \$928.48 billion at 2015–16 constant prices, with an annual average of \$66.32 billion (at constant prices) (Government of Bangladesh 2017). The additional cost/resource gap of the SDGs will be between 11.35% and 25.02% of the nominal GDP (according to the projected growth scenario for achieving the SDGs in Bangladesh), with the resource gap for all 17 goals being 11.35% of the projected nominal GDP in 2017 and 25.02% of the projected nominal GDP in 2030.

### 2.2.1 Meeting the Infrastructure Financing Gap

Given the increased scope of financing of the multilateral development banks (MDBs), which experienced an increase in their annual resource commitment from \$45 billion to more than \$100 billion over the last 10-year period, their resources to finance all the infrastructure investments needs in Asia are limited.<sup>2</sup> There has been a huge infrastructure financing gap in Asian countries, which it is not possible for them to meet due to their limited fiscal capacity. On the other hand, due to a lack of proper incentives,

<sup>1</sup> The model is as follows:  $Y_t = \beta_0 + \beta_1 Y_{t-1} + \varepsilon_t$ .

<sup>2</sup> NDB website: <http://ndb.int/about-us.php>.



regulatory barriers, and associated risks, the private sector is also not proactive in investing in long-term infrastructure projects. Furthermore, the turbulence and volatile episodes that the international and regional financial markets have witnessed in the near past have squeezed their possibilities for infrastructure and trade financing to some extent.

Therefore, a priority for developing Asian countries is to find ways and means to mobilize their huge savings to fund their infrastructure development, particularly in areas like transport, power, water, and sanitation. However, to mobilize domestic savings, the financial sector in Asian countries in most cases is not heading appropriately in the right direction. The financial sector in Asia is highly dependent on the banking sector, which often faces fund maturity mismatches. The capital market is underdeveloped, as is the bond market. Given the large, widespread, and diverse nature of the infrastructure financing needs in Asia, the region needs to harness multiple sources and mechanisms for funding with new mechanisms, instruments, and institutions. The existing and new institutions thus need to develop innovative financing mechanisms and instruments to utilize international savings for infrastructure development. As domestic savings in Asia have been following a rising trend due to countries' steady but high economic growth (Table 3), these savings can be invested in long-term pension and insurance funds, which can further finance infrastructure.

**Table 3: Average Domestic Savings and Investment Rates in Asia**

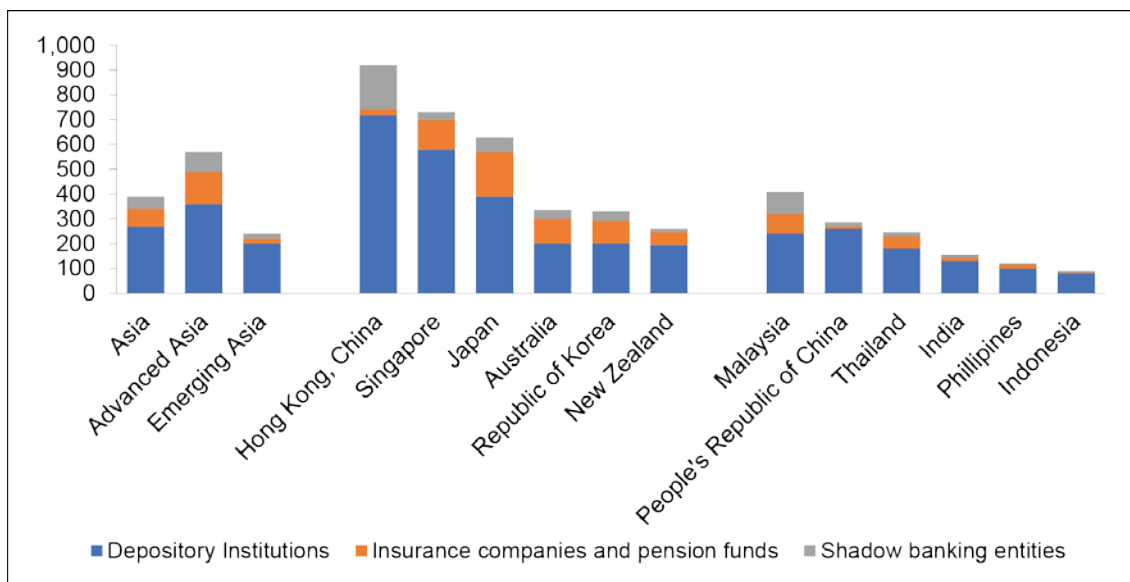
Country	Savings Rate/GDP (%)						Investment Rate/GDP (%)					
	2012	2013	2014	2015	2016	2017	2012	2013	2014	2015	2016	2017
People's Republic of China	49.7	48.8	49.0	47.5	45.9	46.0	47.2	47.3	46.8	44.7	44.1	44.6
Hong Kong, China	26.8	25.5	25.2	24.9	25.5	26.7	25.2	24.0	23.8	21.5	21.5	22.0
Indonesia	32.4	30.7	31.5	32.0	32.0	32.1	35.1	33.8	34.6	34.1	33.9	33.7
Japan	23.6	24.1	24.7	27.1	27.4	27.9	22.7	23.2	23.9	24.0	23.4	23.9
Republic of Korea	35.0	35.0	35.2	36.5	36.2	36.0	31.0	29.1	29.3	28.9	29.3	31.1
Malaysia	30.9	29.4	29.4	28.2	28.3	28.5	25.7	25.9	25.0	25.1	25.8	25.6
Philippines	21.0	24.2	24.3	23.7	24.0	24.4	18.2	20.0	20.6	21.2	24.4	25.1
Singapore	46.8	46.3	48.0	43.5	44.6	44.5	29.9	30.4	30.1	26.5	27.0	28.5
Thailand	27.6	26.3	27.7	30.4	32.6	33.9	28.0	27.5	23.9	22.4	20.9	22.8
Bangladesh	29.9	30.5	29.2	29	30.8	29.6	28.3	28.4	28.6	28.9	29.7	30.5

Note: Savings rate = gross national savings/GDP; investment rate = gross capital formation/GDP.

Source: IMF, World Economic Outlook Database, World Development Indicators.

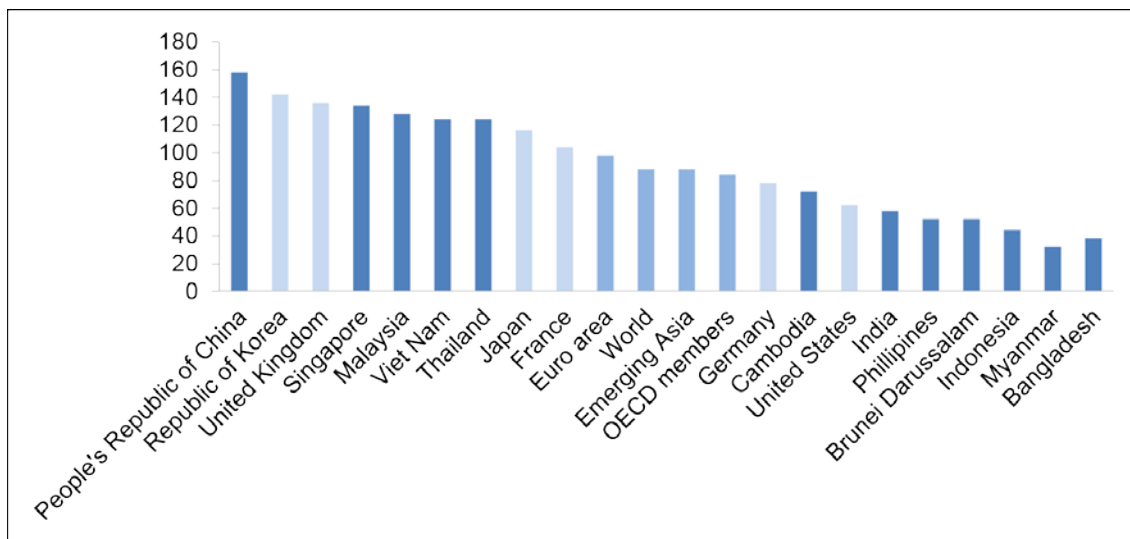
However, the private savings in Asia are still not sufficient for long-term investments considering the dominance of bank deposits and the small share of insurance (Figures 1 and 2). Moreover, the rate of return from infrastructure investments is not particularly high. Various risks accompany infrastructure investments. Therefore, most of the discussions surrounding infrastructure investments have focused on: (i) how to share the risks between the government and the private sector; and (ii) how to reduce the various risks associated with infrastructure investment. However, fewer discussions have considered how to increase the rate of return for a long period of time, which is critical for attracting private investments in infrastructure.

**Figure 1: Dominance of Bank Deposits in Asian Regions and the Small Share of Insurance in Asia**



Source: IMF (2018).

**Figure 2: Banks' Provision of Domestic Credit (as a Percentage of the GDP) to the Private Sector (2016)**



Source: World Bank (2016).

### 3. CONCEPTUAL AND THEORETICAL FRAMEWORK: SHARING SPILLOVER BENEFITS OF INFRASTRUCTURE INVESTMENTS

Long-term institutional investors could provide stable finance for infrastructure investments. However, banks dominate Asian regions. Bank loans have relatively short-term maturity, which will create a maturity mismatch with infrastructure needs. Europe has well-established institutional investors, such as insurance and pension funds.

Growing Asian countries are providing private and public pensions. Europe can teach Asia about the merits and demerits of various pension systems, such as the defined contribution system and the defined benefits system. The demographic structures differ from country to country in Asia, and Asian countries must construct insurance and pension systems well before they face the aging society.

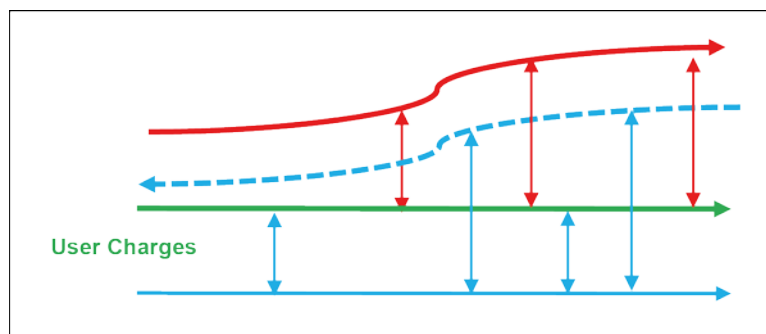
If foreign private investors supply finance for infrastructure investment, exchange rate risks will arise in the future. Domestic infrastructure companies must bear a large burden, and eventually the government might have to take over their losses for compensation. Establishing good insurance and pension systems will be the key to the success of infrastructure investment. If they have to rely on foreign investors, countries should hedge the exchange rate risk or borrow money in their home currency for their infrastructure investments. If foreign investors carry their exchange rate risks, they have to secure a high rate of return from their infrastructure investments. Otherwise, foreign investors cannot mitigate the currency risks.

Therefore, this section discusses the way to increase the rate of return on infrastructure investment to attract long-term investors. High-quality infrastructure can create huge spillover effects into the Asian region. New roads will enable farmers to transport their products at much lower costs and much faster to cities. New railways will bring business into the region, and commuting to large cities will become faster. The construction of new apartments, as well as new restaurants and shopping malls, will start. New employment will arise along new railway lines. The water supply will enable the development of new residential areas, and better sanitation will increase the health of the people, which will enhance high-quality human capital. Property tax, corporate tax, individual income tax, and sales tax revenues will rise.

In the past, in Japan and selected countries, land capture was an important source of revenues for railways in addition to user charges. When constructing a new railway, railway companies purchased the land from farmers. They sold the land to individuals for housing and to commercial businesses. Companies used similar methods in the US when expanding their railway to the west in the 19th century. However, the land capture brought only a one-time gain for railway companies. The railway company purchased the land before constructing the railway and sold it for housing, commercial buildings, and so on when the railway opened. They only received these gains when constructing the railway. This process does not create continuous income flows for railway companies.

It is important to have a continuous inflow of revenues for infrastructure developers and investors in infrastructure. Spillover tax revenues that the infrastructure creates will be a good source of revenues in addition to user charges. Railways make it easier for people to access cities and enable the construction of new residential areas. Businesses can set up offices near the station. Property prices will rise, which will increase the property tax revenues. New restaurants and shopping malls will start their businesses. Corporate income tax will rise. These businesses will create new employment, which will increase the income tax revenues. The sales of commercial businesses will rise, which will increase the sales tax revenues.

In the past, the government (either the local government or the central government) collected all these tax revenues and did not return them to the infrastructure investors. However, the spillover tax revenues that the new infrastructure creates, such as railways, roads, water supply, and so on, can partially return to the investors. If infrastructure companies only rely on user charges, as Figure 3 shows, they must increase to secure a high rate of return for the investors in infrastructure, which is not desirable.

**Figure 3: Return in Infrastructure**

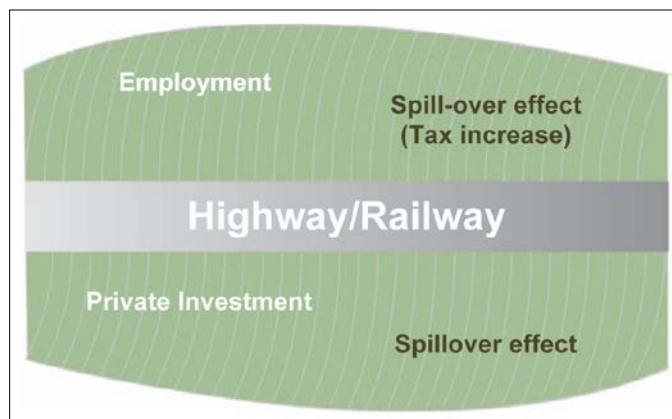
Private participation in infrastructure has become popular, starting with PFI (private finance initiative) in the UK. However, most of the discussions concerned how to mitigate the risks and how to share the risks associated with infrastructure investment. Fewer discussions have focused on how to increase the rate of return for a long period of time. Spillover tax revenues can be continuous sources for raising the rate of return from infrastructure investments.

The water supply will create huge spillover effects into the region. It will enable the construction of new apartments and the setting up of new commercial buildings. It will provide huge development along the water supply. If private investors finance the water supply, they will ask for a reasonable rate of return to secure their investment. If all the revenues from infrastructure investments come from user charges, the water price must increase. However, a water supply is necessary for everybody. Water companies cannot raise their price, but private investors in the water supply require a high rate of return. There are internal conflicts between users and investors in infrastructure.

Roads can create new residential areas, and farmers can sell their products much more quickly and at lower costs to cities. However, there are no revenues from regular roads. In the past, the government was the only body that could supply finance for road construction, since there were no revenues. If the government spends so much money on road construction, it must cut other government spending or the budget deficits will rise, and the government could lose its fiscal sustainability. Ordinary roads do not create any income; however, they will allow the region along the road to develop and will create huge spillover economic development, which creates large spillover tax revenues.

Traditionally, infrastructure investors received only user charges from infrastructure investment. However, in this paper, we propose the spillover tax revenue that infrastructure investment can capture. Yoshino, Helble, and Abidhadjaev (2018), in a recent book, argued that infrastructure projects can generate spillover effects through an increase in property tax, corporate tax, income tax, and so on, which can act as an incentive for private landholders. As Figure 4 demonstrates, the area highlighted in green gains from a newly built highway. This positive spillover effect is possible if this new highway generates more employment through an increase in private business and private investment along both sides of the highway.

**Figure 4: Expansion of Infrastructure Investment: Capturing Spillover Tax Revenues**



Nakahigashi and Yoshino (2016) used a trans-log production function to estimate the direct effect of infrastructure investment and spillover effects in Japan. The construction of infrastructure that will increase the output of the region creates the direct effect of infrastructure investment. Spillover effects (i.e., indirect effects) will have at least two channels depending on the types of investments. One is that infrastructure construction (roads, bridges, economic zones, etc.) will prompt the construction of other complementary infrastructures, such as new office buildings and new housing, growth centers, marketplaces, restaurants, and new residents, which will increase the efficient use of land. The second channel will be income enhancing, which might happen through three channels, as Khandker, Bakht, and Koolwal (2009) identified: road and bridge infrastructures affect households through changes in three mechanisms: (1) transportation costs as well as input and output prices; (2) labor supply, as well as farm and non-farm production; and (3) household outcomes, such as earnings, consumption, and schooling. They showed that rural households in villages that the road development project targets have on average 11% higher consumption per capita per year. They also found that a road improvement project in rural villages has led to an approximate 5% reduction of moderate and extreme poverty in Bangladesh.

Consider the following production function:

$$Y = f(K_p, L, K_G) \quad (3)$$

where  $K_p$  is private capital,  $L$  stands for labor, and  $K_G$  is the stock of infrastructure investment. The general type of the production function is a translog production function. Then, we obtain:

$$\begin{aligned} \ln Y = & \alpha_0 + \alpha_1 \ln K_p + \alpha_2 \ln E + \alpha_3 \ln K_G + \beta_1 \frac{1}{2} (\ln K_p)^2 + \beta_2 \ln K_p \ln L \\ & + \beta_3 \ln K_p \ln K_G + \beta_4 \frac{1}{2} (\ln L)^2 + \beta_5 \ln L \ln K_G + \beta_6 \frac{1}{2} (\ln K_G)^2 \end{aligned} \quad (4)$$

We can classify the production function in Eq. (4) into three categories, as Eq. (5) shows. The first term on the right is the direct effect, the second term is the spillover effect in regard to private capital, and the third term represents the spillover effect related to the labor input. Thus, the marginal productivity expresses the productivity effect of infrastructure.

$$\frac{dY}{dK_G} = \frac{\partial f(K_P, L, K_G)}{\partial K_G} + \frac{\partial f(K_P, L, K_G)}{\partial K_P} \frac{\partial K_P}{\partial K_G} + \frac{\partial f(K_P, L, K_G)}{\partial L} \frac{\partial L}{\partial K_G} \quad (5)$$

We can write the increased tax revenues from spillover effects as follows:

$$dT_{\text{spill}} = t \times dY_{\text{spill}} = t \times \left( \frac{\partial f(K_P, L, K_G)}{\partial K_P} \frac{\partial K_P}{\partial K_G} + \frac{\partial f(K_P, L, K_G)}{\partial L} \frac{\partial L}{\partial K_G} \right) \times dK_G \quad (6)$$

There are two portions in the spillover tax revenues. The first part is the contribution of private capital, and the second part comes from the increase in employment. We can express the increased tax revenues from the direct effect of infrastructure as follows:

$$dT_{\text{direct}} = t \times dY_{\text{direct}} = t \times \left( \frac{\partial f(K_P, L, K_G)}{\partial K_G} \right) \times dK_G \quad (7)$$

By adding Eq. (6) and Eq. (7), the total tax increase that the infrastructure creates is:

$$dT_{\text{total}} = dT_{\text{spill}} + dT_{\text{direct}} \quad (8)$$

An empirical exercise on the estimation of spillover revenue showed that a 1% increase in output will increase tax revenues by, on average, 20% in Japan. Nakahigashi and Yoshino (2016) showed that, if the government distributes 50% of the increased tax revenues to investors in infrastructure, the rate of return will increase by 43.8%. For the period 2006–10, a 50% incremental tax return would increase the rate of return by 39.1%. These significant increases in the rate of return are likely to attract private investors to invest in public infrastructures. Usually, the government coffer collects all the increased tax revenues, and investors in infrastructure only rely on user charges. Therefore, according to our proposition, if the government returns 50% of the spillover tax to investors and keeps the rest, this sharing will increase the rate of return for private investors and consequently encourage private investments in public infrastructures.

## 4. MEASURING SPILLOVER EFFECTS AND SHARING THE REVENUES

### 4.1 Measuring Spillover Benefits

We introduce a dummy variable before the construction of the infrastructure and after the start of the operation by taking the difference in the tax revenues between two regions: one along the infrastructure and another where there was no impact from the infrastructure investment. Yoshino and Abidhadjaev (2016, 2017) and Yoshino, Helble, and Abidhadjaev (2018) statistically estimated the difference in GDP or the difference in tax revenues. However, these econometric estimations take time to estimate, because the choice of the region, the explanatory variables, and so on is not

easy in practice. Therefore, in estimating the spillover benefits of infrastructure, we can follow the steps below:

1. Compute the national average growth rate of tax revenues for each tax item, such as corporate tax, personal income tax, property tax, sales tax, and so on.
2. Compute the growth rate of each type of tax revenue along the newly constructed infrastructure, such as roads, highways, railways, water supply, and so on.
3. Take the difference between (2) and (1) by defining the difference as spillover effects.

If there was no infrastructure investment, the government would never obtain increased tax revenues. Local and central governments are not reducing their existing tax revenues, but they can distribute part of the tax revenues to private investors who will invest in the infrastructure. The proposed methods for returning the spillover tax revenues (50%) will encourage the development of rural regions. In the Philippines, the central government has financed many infrastructure investments. However, the local governments mainly collect the spillover tax revenues, which increase their tax revenues. If they returned part of their increased spillover tax revenues to the central government, it could invest them in rural roads, which will mitigate poverty in rural regions in the Philippines. The proposal of returning the spillover tax revenues to private investors will apply not only to the private sector but also to the central government in certain countries.

## 4.2 Empirical Estimates of Spillover Effects

This section presents four case studies on the estimated spillover effects in Asia. Yoshino and Abidhadjaev (2017) developed an approach to compute the spillover effects that infrastructure investments create. The cases include a railway in Uzbekistan, a high-speed railway on Kyushu island of Japan, and a highway in Manila city (Yoshino, Helble, and Abidhadjaev 2018). The authors obtained all of these estimates through the difference-in-difference method.

In the case of Uzbekistan's railway, the non-affected region's economic growth changed from 8.3% to 8.5%, which is only 0.2% growth. On the other hand, the region along the railway (affected region) showed an increase of 2.2% GDP growth from 7.2% to 9.4%. Two regions showed a 2.0% difference in their economic growth. In other words, as Table 4 shows, the railway produced a 2.0% increase in GDP growth as its spillover effects compared with other regions, which created huge tax revenues for the government. Yoshino and Abidhadjaev (2017) presented a detailed analysis.

**Table 4: Numerical Estimation of the Difference-in-Difference Coefficient Using Regional Data for Uzbekistan, 2005–08 and 2009–12**

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.

Notes: The affected group includes the regions of Samarkand, Surkhandarya, Tashkent, and the Republic of Karakalpakstan. The non-affected group includes the rest of the observations.

Source: Authors' calculation.

In the case of the highway in Manila city, three cities along the highway received three times higher tax revenues after four years ( $t+4$ ) of operation (Yoshino and Pontines

2015). The tax revenues in Batangas city rose to 1,209.61 million pesos compared with the period before the construction of the highway, as Table 5 shows.

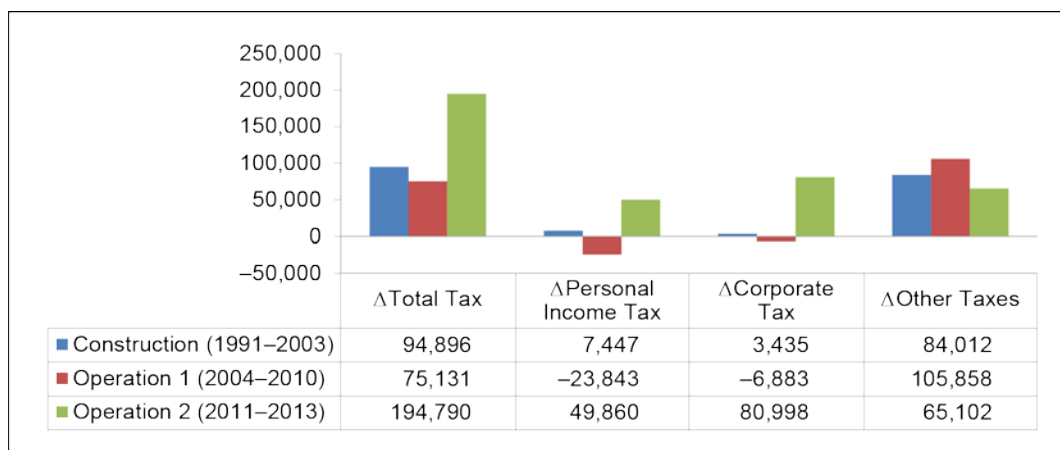
**Table 5: Calculated Increase in Business Tax Revenues for the Beneficiary Group Relative to the Non-beneficiary Group**  
(P million)

Years	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	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 (2015).

In the case of the high-speed railway in Japan (Yoshino and Abidhadjaev 2017), the authors compared the corporate tax, income tax, and other tax revenues (including property tax revenues) in three periods, namely (i) the construction period, (ii) the operation period without good connectivity, and (iii) the operation period with good connectivity to Osaka and Tokyo. They compared the total tax revenues, personal income tax revenues, corporate tax revenues, and other tax revenues (including property tax revenues) for three different periods. When the construction started, many speculators who anticipated high and rising property values started to purchase land along high-speed railways. Property tax revenues rose significantly. The construction required many workers and construction companies in the region, so personal income tax revenues and corporate tax revenues increased. However, in the operation period of no connectivity with large cities of Osaka and Tokyo, the personal income tax revenues and corporate tax revenues fell compared with those in the period of construction. However, good connectivity with Osaka and Tokyo brought businesses and passengers into the region, which created a huge increase in corporate income and individual income taxes in the region. An interesting phenomenon is that the property tax revenues kept on rising due to the speculation regarding increasing property values, as Figure 5 shows.

**Figure 5: Connectivity Increased Tax Revenue**



Source: Yoshino and Abidhadjaev (2017).

Apart from tax revenue generation, analyzing the impact of the big “Jamuna Multipurpose Bridge” in Bangladesh, Mahmud and Sawada (2018) found that, with decreasing household unemployment, the bridge construction facilitated a farm-to-non-farm shift in



employment, which was 4% on aggregate. The employment creation will enhance the tax revenues.

### Bangladesh Case: Public Infrastructure Investments Increase Tax Revenues

Government infrastructural expenditures provide public goods that are non-excludable. Therefore, firms both in the formal and the informal sectors benefit equally from the productivity gains from such public investments. Given the profit function

$$\pi_i = AK_i^\alpha L_i^{1-\alpha} G - w_i L_i - r_i K_i \quad (9)$$

we can write the total tax to output ratio as

$$\frac{\tau \pi_i}{Y_i} = \frac{\tau}{Y_i} (AK_i^\alpha L_i^{1-\alpha} G - w_i L_i - r_i K_i) \quad (10)$$

Differentiating the above expression with respect to  $G$  yields the response of the tax-to-output ratio to a marginal increase in  $G$  as follows:

$$\frac{d}{dG} \left( \frac{\tau}{Y_i} (AK_i^\alpha L_i^{1-\alpha} G - w_i L_i - r_i K_i) \right) = \frac{\tau}{Y_i} (AK_i^\alpha L_i^{1-\alpha}) > 0 \quad (11)$$

This expression implies that public expenditure should lead to increased competitiveness and hence profitability of the firms at the margin and hence the firms' ability to pay taxes.

Following Eq. 11, we run the following regression:

$$\Delta \text{tax}_{\text{gdp}_t} = \alpha_0 + \sum_{i=1}^k \alpha_{1i} \Delta \text{tax}_{\text{gdp}_{t-1}} + \sum_{j=1}^n \alpha_{2ji} \Delta x_{jt-i} + \alpha_3 \text{tax}_{\text{gdp}_{t-1}} + \sum_{j=1}^n \alpha_{2ji} \Delta x_{jt-i} + \sum_{j=1}^n \alpha_{4i} x_{it-1} + \varepsilon_t \quad (12)$$

where

$\text{tax}_{\text{gdp}_t}$  represents the tax–GDP ratio, a measure of tax revenue performance,  $x_t$  represents a vector of variables that explain changes in other factors, and  $\varepsilon_t$  represents a white noise error term.

Using time series data on development expenditures and tax revenue for the period 1986–2017 in Bangladesh, Table 6 reports the long-term and short-term estimates that the vector error correction model obtained. First, we tested the stationarity of the data series using the Phillips–Perron test, and the results suggested that the series tax–GDP ratio, development expenditures, and trade–GDP ratio are integrated of order 1 (I(1)) (Table 7). Therefore, we used the vector error correction (VEC) model. First, we selected the optimal lags for the model using the Akaike information criterion (AIC) and the Hannan–Quinn information criterion (HQ). According to the AIC and HQ, the optimal lag length is four. Then, we tested for cointegration using the Johansen cointegration test with the rank test and max-eigenvalue test, and the results suggested that there is one cointegration equation at the .05 level of significance. The VECM model results suggested that a long-run positive and significant relationship exists between public development expenditures and tax revenue, which we can consider as the spillover effects of the government's development expenditure. To be specific, the short-term effect, estimated through the VECM in Table 7 (panel B), shows that a 1% increase in public development expenditures increases the tax–GDP ratio by about 0.43 percentage points.

**Table 6: VECM Results****A. Co-integration Test**

<b>TAX_GDP</b>	<b>LNDEV_EXP_PER</b>	<b>LNTRADE_GDP</b>
1.000000	-5.98***	-4.027***
Std. Error	(1.02)	(0.34)

**B. Short-Run Equations**

<b>Coefficient Number</b>	<b>Coefficient</b>	<b>Std Error</b>	<b>t-Statistic</b>	<b>Prob.</b>
Error correction	-0.48313	0.243228	1.986326	0.0524
C(5)	4.329658	2.008728	2.155422	0.0359
C(6)	3.638672	1.74864	2.080858	0.0425

Note: The coefficients C(5) and C(6) show the short-run causality between TAX-GDP and LNDEV-EXP-PER and, according to the p values, C(5) and C(6) are significant at the .05 level. We ran some diagnostic tests for serial correlation, heteroscedasticity, and normality and found no serial correlation and heteroscedasticity; furthermore, the residuals were multivariate normal.

Sources: Authors' estimation.

### 4.3 How to Share Spillover Revenues

What percentage of the spillover tax revenues should return to private investors? The determination of an accurate share between the government and the private sector must rely on the theory. The translog production function will provide the distinction between direct effects and indirect effects (= spillover effects).

Table 6 shows the estimates of the spillover effects of infrastructure investment in the case of Japan (Nakahigashi and Yoshino 2016). The share of spillover effects from inducing private capital and employment in Japan was between 66.1% and 68.9%. Therefore, in the case of Japan, the government should take 31.1%–33.9% and private investors should receive 66.1%–68.9% of the spillover tax revenues. Accurately speaking, it is necessary to compute the share between the public sector and the private sector in each case. However, in practice, it is not easy to run the translog production function, as Table 6 shows. Therefore, the simple way will be to share the spillover tax revenues, say 50% each, between the government and the private sector. In this way, the local government will need to work hard to increase the spillover effects from infrastructure investments, which will create higher tax revenues.

The current system in infrastructure does not provide any incentives to the government to increase the spillover effects of infrastructure investment. The share of spillover tax revenues will cause both private investors and the government to work hard to develop the region along each infrastructure.

**Table 7: Japanese Macroeconomic Estimates of Spillover Effects**

Time Period	1956– 60	1961– 65	1966– 70	1971– 75	1976– 80
Direct effect of infrastructure investment	0.696	0.737	0.638	0.508	0.359
Spillover effect through private capital (Kp)	0.452	0.557	0.493	0.389	0.270
Spillover effect through employment (L)	1.071	0.973	0.814	0.639	0.448
Spillover effects of infrastructure investment (%)	68.644	67.481	67.210	66.907	66.691
Time Period	1986– 90	1991– 95	1996– 00	2001– 05	2006– 10
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

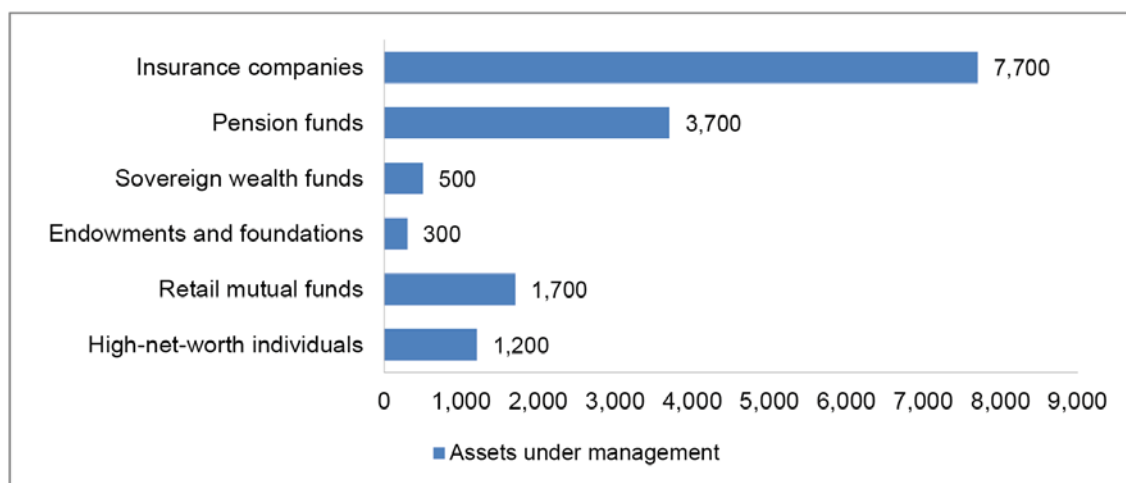
Source: Nakahigashi and Yoshino (2016).

## 5. FINANCIAL CONNECTIVITY BETWEEN ASIA AND EUROPE: INSURANCE AND PENSION FUNDS

As we have discussed in detail in previous sections regarding our proposal to increase the rate of return for infrastructure investments by sharing spillover revenues, say 50% with private investors, this type of sharing will create a viable opportunity for European long-term investors to invest in Asia's infrastructure development. To enhance the financial connectivity between Asia and Europe through infrastructure investments, we highlight in this section the current status of long-term investment funds in Europe.

### 5.1 Insurance Funds in Europe

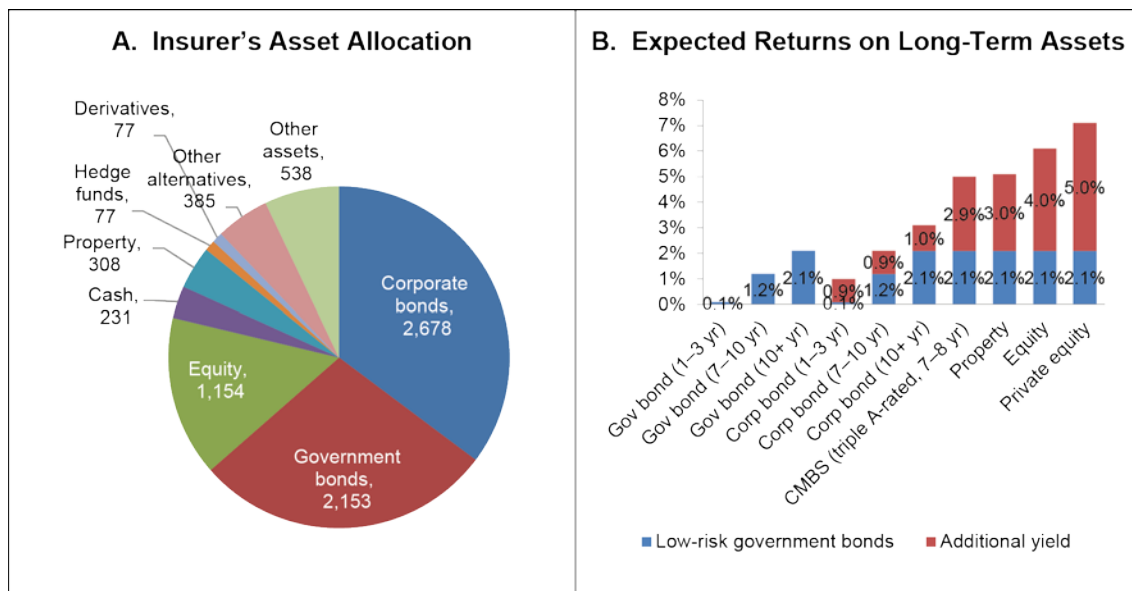
The large inflow of new premiums and the accumulation of assets backing insurers' long-term products have made the insurance industry the largest institutional investor in Europe, with more than 50% of all European institutional assets under management in 2011 (see Figure 6).

**Figure 6: Institutional Investors in Europe (€ billion)—End of 2011**

Source: Insurance Europe, and Oliver Wyman (2013).

The figure below shows the asset allocation under the insurance funds (Figure 7). The figure shows that government bonds and corporate bonds constitute the largest allocation of pension funds, which could be less profitable, having low risk. Investing these funds outside Europe, in particular in Asia’s infrastructure, through a proper public–private partnership mechanism, may yield higher returns.

**Figure 7: European Insurers’ Asset Allocation and Expected Return (€ billion; End of 2011)**



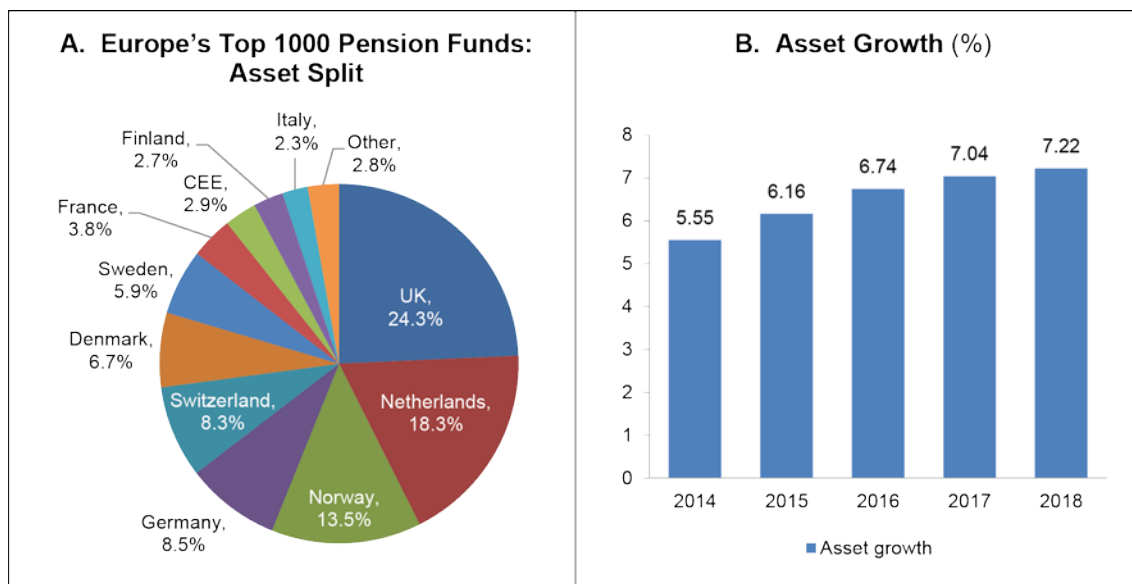
Source: Insurance Europe and Oliver Wyman (2013).

## 5.2 Pension Funds in Europe

In Europe, pension funds mainly invest pension assets in fixed-income securities and equities in over 80% of reporting jurisdictions, and bills, bonds, and equities account for more than 50% of the investments of pension assets. They invest pension assets in these instruments either directly or indirectly through collective investment schemes. Sweden invests 65% of assets, and the United Kingdom invests 28% of assets. However, the overall exposure of pension assets to fixed-income securities and equities is unknown in European countries.

The real rate of return on pension assets was over 4% both inside and outside the OECD area in 2017. The real investment rates of return, net of investment expenses, were above 5% in 22 (including 12 OECD countries) out of the 60 reporting jurisdictions. The booming stock markets worldwide contributed to this positive rate of return. However, the rate of return varies across countries. For example, in the US, pension assets accrued a 7.5% real net investment rate of return, which is higher than in Europe. Thus, there is scope to invest European pension assets outside Europe to secure a higher real rate of return. Given the huge pool of Europe’s leading 1,000 retirement funds, which now stands at more than €7.22 trillion with a 2.49% increase over the last year’s 4.45%, alternative investment scopes are possible.

**Figure 8: Europe’s Top 1000 Pension Funds: Asset Growth (€ trillion)**



Source: IPE (2018).

## 6. CONCLUSIONS

This paper highlights that the investment demand in Asia has been massive considering the high growth opportunities of these countries. Investment in infrastructure generates not only direct benefits but also huge indirect spillover benefits, which are long term in nature. Since investors in infrastructure only receive user charges, they are reluctant to invest in public infrastructure. If a better rate of return was possible, the private sector would be interested in infrastructure investments. Here is our proposal to share part of the spillover revenues with the investors.

While discussing enhancing the connectivity between Europe and Asia, this policy paper explored a new area of cooperation, which is the use of Europe’s long-term investment funds in Asia’s infrastructure investments. We argued that, if Asian countries agree to offer 50% of the spillover revenue to infrastructure investors from Europe, it will increase the rate of return of long-term investment funds, such as pension and insurance funds. This will create a win-win situation for both Asia and Europe, because investment in infrastructure will enhance various spillover benefits and increase the savings in these countries, which will ultimately enhance the economic growth in the Asian countries. On the other hand, idle European funds will generate higher returns from infrastructure investments in Asia, which will also be beneficial for European countries. This approach will reduce the divergence in infrastructure between the two regions and encourage regional connectivity, such as the PRC’s Belt and Road Initiative.

With some empirical evidence, this paper also highlighted the methods of spillover revenue collection and approaches to share the revenues. It is important for Asian countries to review the approaches and develop some institutional mechanisms to allow private investors into infrastructure investments. Moreover, Asian and European leaders, for example in the ASEM, might devise appropriate methods to allow European long-term investors to invest in Asian infrastructure.

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