THE BELT AND ROAD
PLEDGE OF THE DRAGON

BALKAN STABILITOCRACIES

A WORLD IN (DIS-)ORDER?

ABIDHADJAEV • BIEBER • BREMMER • HILARION • KATZ • LI
NAKAHGASHI • NOLAN • RAHMSTORF • RUDD • SALTYBAYEV
SOK • TROUBRIDGE • WANG • YOSHINO • ZAEV
CLOSING THE ASIA INFRASTRUCTURE GAP

BRI, PUBLIC INVESTMENT, PRIVATE FINANCING, AND SPILLOVER EFFECTS

Naoyuki Yoshino, Umid Abidhadjaev, and Masaki Nakahigashi

STRATEGIC, potentially game-changing growth projects like the Belt and Road Initiative (BRI) require vast amounts of infrastructure investment to be sustainable. The economic state of play in Asia is a case in point. Even in the absence of BRI, demand for such long-term investment is crucial to meeting the challenges associated with urbanization, aging populations, and climate change. As shown in Table 1, these demands differ from region to region, with East Asia and South Asia topping the list.

In Southeast Asia, infrastructure investments worth $8 billion are implemented every year. However, it is expected that infrastructure investment worth $40 billion is needed every year in that part of the continent alone. More broadly, the fact is that public money is insufficient to satisfy Asia’s infrastructure needs. In many Asian developing countries, we observe heavy traffic congestion in cities—with highways, trains, and various modes of public transport lacking. Public-Private Partnerships (PPPs) have been promoted for infrastructure development in India, Thailand, and elsewhere in Asia.

However, most PPP projects have been disappointing, since the rate of return on infrastructure depends mainly on user charges, such as train fares and highway tolls. When the region was hit by economic crisis after the 2008 Lehman Brothers shock, the private sector withdrew from infrastructure investment. The risks associated with infrastructure were so large that private investors were hesitant to put their money in infrastructure.

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Various infrastructure projects have to be developed in Asian countries, including power, transport, telecommunications, and water and sanitation projects. Looking at various sectors, we can see that demand is high in the power sector, followed by transport and telecommunications, then water and sanitation (see Table 2).

It is well known that good infrastructure creates significant positive regional spillover effects around a project (see Figure 1). Railways will bring manufacturing to the region by making the shipping of products faster, safer, and cheaper. Railways can connect manufacturers and farmers to markets and ports. New industry creates jobs in the region. Ultimately, service sector businesses, such as restaurants and hotels, are constructed to meet the increased demand. Farmers and small businesses can sell their products at train stations.
A study entitled “Explicit and Implicit Analysis of Infrastructure Investment: Theoretical Framework and Empirical Evidence,” which we published in 2016 for the American Journal of Economics, shows that good educational opportunities, coupled with infrastructure investment, create qualified workers who enhance regional productivity. Secondary and university education are shown to have a significant impact on GDP growth in the region. Secondary education will create the basic skills required for primary industries and agriculture, while university education is expected to produce better workers in service sectors.

The spillover effects of infrastructure investment will increase revenues from corporate, income, sales, and property taxes. In the past, all these tax revenues were collected by the government and not returned to investors as a budget subsidy in infrastructure. The difference-in-difference method can be used to compute the effect of spillovers on GDP or tax revenues in places where infrastructure investment occurred, compared to places where no infrastructure investment took place (see Figure 2).

It has been estimated that returning part of the additional tax revenues from spillovers to construction companies and investors in the form of subsidies would raise the rate of return on infrastructure investments by 39 percent to 43 percent in the case of Japan, and by 14 percent to 16 percent in the case of Uzbekistan. The spillover effect, shown as $\delta$ in Figure 2, is the increment of tax revenue (affected region) compared to the tax revenue in a non-affected region.

Many developing countries face a shortage of public funds to meet their huge infrastructure needs. In order to narrow the gap between investment needs and actual government allocations, private funds have to be injected into infrastructure investment. It is quite important to attract private investors into infrastructure by increasing the rate of return on infrastructure investments.

This can be achieved through spillover tax revenues generated by infrastructure development being returned to construction companies and investors. The government can provide subsidies to infrastructure investors based on an increase in additional tax revenue, as shown in Figure 2 as $\delta$. This essay will address the importance of spillover effects from infrastructure investment and how to utilize additional tax revenues.
created by the externality effects of infrastructure to attract private sector finance.

**ECONOMIC EFFECTS**

An increase in productivity is one of the economic effects of infrastructure investment. If infrastructure has a positive effect on productivity, private firms can increase output without changing inputs, and can further increase output by changing the amount of inputs in order to maximize profits.

The former effect is called the direct effect and the latter is said to be the indirect effect. In particular, the indirect effect (which for all intents and purposes equals the spillover effect) reflects the benefits of infrastructure investment for the economic activities of private firms, which, consequently, increase capital inputs and employment resulting from infrastructure investment.

Table 3 shows the productivity effect of infrastructure based on Japanese macroeconomic data and assuming trans-log production function. The direct effect of infrastructure investment is shown in the first row
of Table 3. The second and third rows show the spillover effects on private capital and labor. In the 1950s and '60s, the direct and indirect effects were both very large. The estimated tax revenues generated by these spillovers are computed by setting the tax rate at 20 percent. Since the economic impact decreases as time passes, the estimated amount of tax revenues diminishes, as shown in row 4. In the 1950s, it was 0.305, though it was only 0.042 in the period between 2006 and 2010.

Supposing that 20 percent of these tax revenues were returned to investors, how much would the rate of return increase? The last row presents the incremental rate of return achieved by injecting 20 percent of spillover tax revenues as government subsidies. In the 1950s, the incremental rate of return was about 43.8 percent, while in recent years it was about 39.1 percent.

Thus, based on Japanese macroeconomic data and assuming a trans-log production function, injecting 20 percent of the incurred additional tax revenues as subsidies from the government generated by project spillovers would increase the total return on infrastructure investment by roughly 39 to 43 percent.

**PRIVATE FINANCING**

In recent years, PPPs, including the use of private funds, have been emphasized. Utilizing private funds to develop infrastructure has the advantage of increasing pressure to: (1) shorten the period of construction and
Table 3: Spillover effect estimated from a macroeconomic translog production function

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<thead>
<tr>
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</tr>
</thead>
<tbody>
<tr>
<td>Direct effect</td>
<td>0.696</td>
<td>0.737</td>
<td>0.638</td>
<td>0.508</td>
<td>0.359</td>
<td>0.275</td>
</tr>
<tr>
<td>Indirect effect (Kp)</td>
<td>0.452</td>
<td>0.557</td>
<td>0.493</td>
<td>0.389</td>
<td>0.270</td>
<td>0.203</td>
</tr>
<tr>
<td>Indirect effect (L)</td>
<td>1.071</td>
<td>0.973</td>
<td>0.814</td>
<td>0.639</td>
<td>0.448</td>
<td>0.350</td>
</tr>
<tr>
<td>20% returned</td>
<td>0.305</td>
<td>0.306</td>
<td>0.261</td>
<td>0.206</td>
<td>0.144</td>
<td>0.111</td>
</tr>
<tr>
<td>% increment</td>
<td>0.438</td>
<td>0.415</td>
<td>0.410</td>
<td>0.404</td>
<td>0.400</td>
<td>0.402</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year</th>
<th>1986-90</th>
<th>1991-95</th>
<th>1996-00</th>
<th>2001-05</th>
<th>2006-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct effect</td>
<td>0.215</td>
<td>0.181</td>
<td>0.135</td>
<td>0.114</td>
<td>0.108</td>
</tr>
<tr>
<td>Indirect effect (Kp)</td>
<td>0.174</td>
<td>0.146</td>
<td>0.110</td>
<td>0.091</td>
<td>0.085</td>
</tr>
<tr>
<td>Indirect effect (L)</td>
<td>0.247</td>
<td>0.208</td>
<td>0.154</td>
<td>0.132</td>
<td>0.1250</td>
</tr>
<tr>
<td>20% returned</td>
<td>0.084</td>
<td>0.071</td>
<td>0.053</td>
<td>0.045</td>
<td>0.042</td>
</tr>
<tr>
<td>% increment</td>
<td>0.392</td>
<td>0.392</td>
<td>0.390</td>
<td>0.390</td>
<td>0.391</td>
</tr>
</tbody>
</table>

Despite these advantages, there have not been many PPP projects in Japan. The so-called third sector projects (a kind of PPP) implemented in Japan in the 1980s and 1990s failed due to irresponsible actions on the part of both public and private sector operators. Weak governance and lack of profit incentives also contributed to these failures.

Bad memories of these third sector projects have made governments reluctant to pursue PPP projects in Japan. Private sector actors are also reluctant to engage, since the risks associated with infrastructure projects are large and the expected rate of return is typically low. Many third party projects failed and generated major losses for local governments.

For these reasons, the injection of spillover tax revenues as government subsidies is an important means of making infrastructure projects viable in the time ahead.

**PUBLIC-PRIVATE COOPERATION IN HIGH-RISK PROJECTS**

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

An increase in productivity is one of the economic effects of infrastructure investment. Even in projects in which private funds are not traditionally involved due to low revenue expectations, it will be possible to introduce private funds in the time ahead. For projects whose only return comes from user charges (see Figure 3), the rate of return is quite low unless the government subsidy created by incremental tax revenues is added to user charges.

**Increased Rate of Return Through Internalization of Spillover Effects**

Infrastructure projects generate benefits in addition to operating revenues like toll fees. For example, a highway may benefit a company through cost savings and increased sales from faster transport of raw materials and final products, as well as generating usage fees.

In a 2015 study, Yoshino and Pontines analyzed the effect of injecting public funds into the development of the Southern Tagalog Arterial Road (STAR) highway project in Batangas Province in the Philippines. In particular, the study evaluated how the opening of the STAR highway contributed to revenues from business and property taxes, using the difference-in-difference method to compare tax revenues in areas affected by the project, with unaffected areas along the route shown in Figure 2.
Table 4 shows the change in tax revenues in three cities in Batangas Province before, during, and after the highway's construction. Construction took place during periods $t_1$ and $t_2$. For Batangas City, the table shows that tax revenues increased from 490.90 million Pesos before the project ($t_2$) to 622.65 million Pesos ($t_3$). Immediately after completion of the highway ($t_3$), tax revenues fell to 599.49 million Pesos, as businesses established their presence and adjusted to utilizing the highway. However, by period $t_4$, tax revenues had increased to 1,208.61 million Pesos. The spillover effects of the highway became very large following completion of the highway. Similar increases in tax revenues can be observed for Ibaan City and Lipa City (both in the Philippines), as greater economic activity in those cities added to tax revenues.

While construction companies may be mainly interested in making railways and highways, this study shows that the spillover effects from the development of such infrastructure are also very significant for the local economy. Infrastructure development can stimulate business activity in an area and create employment. Additionally, small and medium sized enterprises (SMEs) in the area can open stores along new roadways and at new railway stations, thus increasing sales.

If it is possible to confirm that the increase in tax revenue is due to the spillover effects of infrastructure, it
Table 4: Calculated increase in business tax revenues for tollway beneficiaries relative to non-beneficiaries

<table>
<thead>
<tr>
<th></th>
<th>t-2</th>
<th>t-1</th>
<th>t=0</th>
<th>t+1</th>
<th>t+2</th>
<th>t+3</th>
<th>t+4, forward</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lipa City</td>
<td>134.36</td>
<td>173.30</td>
<td>249.70</td>
<td>187.41</td>
<td>191.81</td>
<td>257.35</td>
<td>371.93</td>
</tr>
<tr>
<td>Ibaan</td>
<td>5.84</td>
<td>7.04</td>
<td>7.91</td>
<td>6.80</td>
<td>5.46</td>
<td>10.05</td>
<td>12.94</td>
</tr>
<tr>
<td>Batangas City</td>
<td>490.90</td>
<td>622.65</td>
<td>652.83</td>
<td>637.89</td>
<td>599.49</td>
<td>742.28</td>
<td>1208.61</td>
</tr>
</tbody>
</table>

Note: For the period t+4, forward in the case of Lipa City and Batangas City is the average increase in business tax revenues in each province.

might be possible to return the increase in tax revenue to private investors, as subsidies, and to the public sector (see Figure 3). By so doing, the rate of return to private investors is increased, and, as a result, it will become possible to lead private funds in various infrastructure projects.

**THE KYUSHU BULLET TRAIN CASE**

Looking back at the economic history of Japan over the past few decades, we can observe that the country has invested a significant amount in infrastructure. This is well reflected in development plans adopted both in the early 1950s as well as the late 1980s and ’90s. In particular, the Five-Year Economic Independence Plan (1956-1960), aimed at the rehabilitation of traffic and telecommunication facilities; the New Long-Term Economic Plan (1958-1962), focused on the reinforcement of transportation capacities by concentrating on the modernization of roads; the National Income Doubling Plan (1961-1970), centered on the development of infrastructure for reinforcing industrial infrastructure.

**Injection of spillover tax revenues as government subsidies is an important means of making infrastructure projects viable in the time ahead.**

Similarly, two development plans from 1980s and ’90s, the Co-Prospereity with the World Plan (1988-1992) and the Five-Year Economic Superpower Plan (1992-1996), covered the development of the country’s highway transportation network, with a focus on decentralizing the economy.

**Fiscal consolidation concerns were raised by the burst of the economic bubble in 1989, which was followed by two decades of virtually zero growth, significant increases in public debt, amounting to 220 percent of GDP, and increasing costs of social security for an aging population. The government**
responded with a gradual increase in the consumption tax rate, which rose as high as 10 percent in 2017. At the same time, current and future infrastructure projects might require more active private participation, both in the creation of new infrastructure facilities and maintaining existing ones.

To that end, in his Economic Policy Address to the 189th Session of the Diet, Japan’s Minister of State for Economic and Fiscal Policy Akira Amari stressed the importance of implementing an action plan toward reforming the PPP/PFI scheme to achieve economic growth through the encouragement of private-sector investment as part of the agenda for the “execution and realization of the growth strategy under the Abenomics policy.” Aiming for both economic revitalization and fiscal consolidation, the government seeks to achieve a primary surplus by 2020.

In a 2017 article published in the Journal of Infrastructure, Policy and Development, this essay’s first two coauthors estimated how the construction and operation of a high-speed rail line affected the tax revenues of Japanese prefectures located along the route, in order to estimate the impact of infrastructure investment on fiscal revenues. Our findings show a positive impact on the region’s tax revenue following the connection of the Kyushu rapid train with large cities like Hiroshima and Osaka. Tax revenue in the region increased significantly during
the construction period (1991–2003), while it dropped after the start of operations (2004–2010).

The rapid train’s impact on the neighboring prefecture of Kyushu is positive. The difference-in-difference coefficient methods reveal that corporate tax revenue was lower than personal income tax revenue during construction. However, the difference in corporate tax revenues rose following the completion of connectivity with large cities.

**Incentive Mechanism**

In order to narrow the gap between investment needs and actual government allocations, private funds have to be injected into infrastructure investment.

In order to enhance efficiency and increase the rate of return on infrastructure development, it is necessary to vary the dividend payment for private investors based on the project’s revenues, including both user fees and spillover tax revenues. It is also necessary for infrastructure operating entities to exert efforts to increase income. Table 5 shows the payoff matrix, depending on the presence or absence of effort by investors and the infrastructure-operating entity.

If neither the operating entity nor investors make any effort, the operator gains 50 in revenue and investors receive dividend income $r$. It is assumed that the operator could increase operating income to 100 by improving the salary system, such as by paying staff bonuses based on the entity’s revenue. Furthermore, investors could raise their dividend income to $ar$ ($a>1$) via efforts to reduce costs and increase infrastructure revenues, such as by increasing the number of highway junctions or the number of available cars.

The lower right cell of the payoff matrix represents the revenue when both the operating entity and infrastructure investors exert maximum effort to increase revenue and improve service. In this case, the income of both the entity and the investors is higher than in the normal case (the income of the entity increases from 50 to 100 and the income of investors from $r$ to $ar$). This illustrates the importance of designing the dividend policy for investors and the salary system of the infrastructure-operating entity to incentivize both the entity and investors to improve revenues.

To reiterate, it is necessary in the PPPs described above to improve the efficiency of infrastructure projects through private funds, and to introduce mechanisms to benefit the staff of an infrastructure-operating entity, for
example by paying staff bonuses tied to profit increases.

**Getting it Done**

Infrastructure investments are not only being promoted in Asia, but also in many other developing nations through strategic initiatives like BRI. We have shown in this essay that private funds have to be injected to cover the huge need for infrastructure investment. Bringing increased tax revenues from the spillover effects of infrastructure development, such as increased revenues from corporate, income, sales, and property taxes, will raise the rate of return above what can be gained from user charges alone. Long-term investors, such as pension funds and insurance companies, are growing in Asian countries.

Infrastructure investment projects require patient, long-term investors. If the rate of return on infrastructure were increased by injecting spillover tax revenues generated in areas surrounding infrastructure investments, much more long-term private capital could be forthcoming for infrastructure investment. Incentives to improve infrastructure, which in turn increase regional economic activity, would be created. Greater spillover effects would raise the rate of return for private investors. The higher the expected rate of return, the more private funds would be attracted.

To achieve proper sharing of benefits from infrastructure, which is one of BRI's goals, a ceiling cap for interest rate revenue may be established for cases when the rate of return on infrastructure investment is relatively high. At the same time, some sort of fixed payment should be guaranteed to private partners until a given infrastructure project reaches the break-even point. In some cases, both public and private sectors can agree on a specific cap, which would serve as a basis to evaluate a given project's performance. In cases when profits will be higher than the cap indicator, the difference can be transferred to special reserve within a development agency. There-
fore, such reserve funds can be used to support projects that might not reach the cap indicator. This model is clearly illustrated in Figure 5.

Furthermore, fewer public sector funds would be needed for infrastructure investment—whether in the context of BRI or any other framework. This means that government could increase the total amount of infrastructure investment by attracting private finance when incremental tax revenues from spillover effects are provided as subsidies and used to raise their rate of return.

The method of paying back increased tax revenues obtained from infrastructure investment as government subsidies will attract private long term investors and require less government funds. Many Asian countries will face the challenges of an aging population along similar lines as Japan, Korea, Thailand, and China. People have to increase their savings in the form of insurance and pensions to prepare for their old age. Insurance and pension funds are looking for the instruments to invest, in order to obtain stable, long-term rates of return. The government subsidies created by spillover tax revenues as a result of infrastructure investment were returned to investors in the context of infrastructure, and, as we have shown here, the rate of return on infrastructure investment will definitely rise. Finally, it will enhance the efficiency and governance of infrastructure investment to the benefit of all concerned—in the context of BRI and much else besides.
Financing Infrastructure
For sustainable growth in Africa

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Umid Abidhadjaev
Research Consultant, ADBI

June, 2018
Stock Budget and Flow Budget

Postal Savings Pension Funds

Ministry Of Finance

Loan to SME Infrastructure

Government Bond

Government Expenditures

SME Loans Infrastructure
Various Risks and Risk Sharing

1. Risks: Infrastructure Investment
   i. Political risk (government),
   ii. Construction risk,
   iii. Operation and maintenance risk,
   iv. Exchange rate risk.
   v. Environmental risk

2. User charges cannot be set too high
   User charges $\ll$ Total costs

3. How to maintain stable income stream?
   Utilize Spillover Tax Revenues
   USA: Uses property tax revenues
Financing for Infrastructure
Various Private Financial Investors in Asia

1. **Banks** --- **Safer projects**
   - Brown field (infrastructure)
   - Invest into operation period
   - Securitization after certain period of time
   - Privatized projects by the government

2. **Insurance and Pension funds** (Brown fields)
   - Long term projects (10 years – 20- 30 years)

3. **Revenue Bonds** (floating interest rate)
   - Uncertain income streams

4. **Equity Investments**
   - Construction period and Green fields
Different Classes of Infrastructure Assets

Safer Assets

Different Infrastructure Classes

Riskier Assets

Banks

Insurance

Pension Funds

Revenue Bond Equity
Regional Development Agency issues Revenue Bond (user charges) plus (Spillover effects)

Infrastructure Revenue Bond

Private Investors

Government

60%

40%
Equity and Bond Investment in infrastructure

*Infrastructure development*

*Company issues bond*

*And equities (Spillover effects)*

**Issue bonds to Investors**

70%

30%

**Equity Investors**
## Macroeconomic Effect of Infrastructure Investment

### Spillover Effects Estimated from a Macroeconomic Translog Production Function

<table>
<thead>
<tr>
<th></th>
<th>1956-60</th>
<th>1961-65</th>
<th>2001-05</th>
<th>2006-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Direct effect</td>
<td>0.696</td>
<td>0.737</td>
<td>0.114</td>
<td>0.108</td>
</tr>
<tr>
<td>Indirect effect ((K_p))</td>
<td>0.452</td>
<td>0.557</td>
<td>0.091</td>
<td>0.085</td>
</tr>
<tr>
<td>Indirect effect ((L))</td>
<td>1.071</td>
<td>0.973</td>
<td>0.132</td>
<td>0.125</td>
</tr>
<tr>
<td>20% returned</td>
<td>0.305</td>
<td>0.306</td>
<td>0.045</td>
<td>0.042</td>
</tr>
<tr>
<td><strong>Increment</strong></td>
<td><strong>43.8%</strong></td>
<td><strong>41.5%</strong></td>
<td><strong>39.0%</strong></td>
<td><strong>39.1%</strong></td>
</tr>
</tbody>
</table>

Source: Yoshino and Nakahigashi (2016)
New Book on Infrastructure

• “FINANCING INFRASTRUCTURE IN ASIA AND THE PACIFIC: Capturing Impacts and New Sources”

• Edited by Naoyuki Yoshino, Matthias Helble, and Umid Abidhadjaev
  – the latest evidence on the impact of infrastructure investment on economic and social indicators
  – country studies on how infrastructure investment can increase output, taxes, trade and firm productivity
  – innovative modes of infrastructure financing