Public Sector Management of Revenue Risk in Public-Private Partnerships: Vietnam’s North-South Expressway Project

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Policy Analysis Exercise

PUBLIC SECTOR MANAGEMENT OF REVENUE RISK IN PUBLIC-PRIVATE PARTNERSHIPS: Vietnam’s North-South Expressway Project

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EXECUTIVE SUMMARY

For developing countries, infrastructure is often seen as one of the key factors contributing to a higher level of economic growth and a better quality of life. At the same time, the lack of investment in infrastructure can severely constrain their growth potential. Despite having the highest level of infrastructure spending over Gross Domestic Product in Southeast Asia, Vietnam still trails behind other major developing economies in the region in terms of infrastructure quality. The country would likely need to significantly increase infrastructure investment in order to sustain its current economic growth. As public financing is limited, the private sector’s participation in infrastructure investment through Public-Private Partnerships (PPPs) will be essential for Vietnam to meet its infrastructure needs.

Although Vietnam has attracted a considerable amount of private investment in infrastructure over the last 20 years, its PPP program remains a work in progress. For example, many investors are concerned about regulatory issues and the lack of risk-sharing by the government under the current legal framework. While the upcoming PPP Law could help improve the regulatory environment, capable foreign investors would likely demand concrete forms of government support for future PPP projects.

One of Vietnam’s major infrastructure projects is the North-South expressway, which could help address a significant part of the country’s transportation needs by 2030. Among the North-South expressway’s prioritized components, the Mai Son-QL45 expressway project will be the first one going through bidding in late 2019. As a result, it can be a useful benchmark for other projects in terms of the effectiveness of government support. In order to ensure the project’s success, the Vietnamese government needs an effective process of managing its risks. This process consists of three steps: risk identification, risk measurement, and risk governance, which can help the government evaluate support policies based on relevant criteria and ensure successful implementation.

<table>
<thead>
<tr>
<th>Risk management steps</th>
<th>Outcomes</th>
</tr>
</thead>
</table>
| Risk identification    | • Problem definition  
                         | • Government’s main objectives  
                         | • Policy evaluation criteria |
| Risk measurement       | • Most relevant policy options  
                         | • Quantitative and qualitative evaluations of policy options |
| Risk governance        | • Measures to mitigate risk during policy implementation |

In the risk identification step, revenue risk, which consists of traffic, collection, and exchange rate risks, is identified as a major concern of foreign investors. Moreover, they cannot manage all components of revenue risk effectively. The government should, therefore, bear some burden of revenue risk through specific risk-sharing mechanisms. Doing so requires the government to go beyond the current objectives of public spending minimization and private investment maximization. Instead, it should evaluate potential policy options based on their Impact (Investment Attractiveness and Value for Money) and Feasibility (Fiscal Sustainability and Political Support).

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Impact</strong></td>
<td></td>
</tr>
<tr>
<td>Investment Attractiveness</td>
<td>Level of attractiveness of Vietnam’s PPP projects in the perception of capable foreign investors</td>
</tr>
<tr>
<td>Value for Money</td>
<td>How government support potentially affects the value of PPPs over traditional public procurement</td>
</tr>
<tr>
<td><strong>Feasibility</strong></td>
<td></td>
</tr>
<tr>
<td>Fiscal Sustainability</td>
<td>How quantifiable forms of support can be provided without causing long-term fiscal risk to the public sector</td>
</tr>
<tr>
<td>Political Support</td>
<td>Level of political support from key stakeholders for the government’s choice of policy and its implementation</td>
</tr>
</tbody>
</table>
Although the Mai Son-QL45 expressway project can be economically beneficial, revenue risk is driving up costs of capital and making the project financially infeasible. In the risk measurement step, six government support options with different revenue risk-sharing profiles are assessed based on the four identified criteria. Fiscal effect - a component of fiscal sustainability - is measured by the cash flow at risk for the public sector. Investment attractiveness is measured by the standard deviation of possible Net Present Values of equity cash flows. In the Value for Money analysis, a hypothetical public procurement option (the Public Sector Comparator) is constructed and compared with PPP under different types of government support. Finally, relevant stakeholders and their interests are identified in order to assess the level of political support for each policy option.

In the risk governance step, ineffective public financial management is identified as a substantial implementation risk. A holistic public financial management framework involves deciding whether a type of financial support is affordable, how to budget for it, and how to report the impact of fiscal commitments. In Vietnam’s context, the government should also consider the whole portfolio of projects at both the national and provincial levels.

<table>
<thead>
<tr>
<th></th>
<th>Direct liabilities</th>
<th>Contingent liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Affordability check</strong></td>
<td>Measure expected cash flows</td>
<td>Measure cash flows at risk</td>
</tr>
<tr>
<td><strong>Budgeting</strong></td>
<td>Recognize payment liabilities as part of public debt</td>
<td>Create contingency line in budget and/or contingent liability fund</td>
</tr>
<tr>
<td><strong>Reporting</strong></td>
<td>Establish clear and consistent guidelines on reporting PPP assets and liabilities</td>
<td>Disclose key contract terms and multiple indicators of contingent liabilities</td>
</tr>
<tr>
<td><strong>Portfolio management</strong></td>
<td>Centralize registry of PPP fiscal commitments in one government agency</td>
<td>Have explicit cap on total subsidy amount across all projects at both national and provincial levels</td>
</tr>
</tbody>
</table>

For the Mai Son-QL45 expressway project, Full Concession and Least Present Value of Revenue are the most preferred options overall, though they are not without significant flaws. Among other options, Availability Payment may be regarded as the most inferior, and Public Toll Collection can become redundant if the government can successfully enforce automated toll collection. Exchange Rate Guarantee and Revenue Guarantee can be fiscally risky and difficult to manage without enough technical and organizational capabilities.

Although it is difficult for any of these policy options to satisfy all of the government’s objectives, a promising topic for future research is how they might be implemented sequentially or in different combinations within the scope of Vietnam’s PPP program. In designing a suitable implementation roadmap, the government might want to consider the development of a robust PPP market as one of its guiding principles. As the perception of revenue risk might be influenced as much by the lack of information as the actual risk level, such a barrier to entry could potentially exclude most capable foreign investors. If future research supports this hypothesis, limited use of guarantees in the short term might help Vietnam encourage such investors to participate in its PPP market and foster better assessments of market conditions.

However, in order to minimize fiscal risk and prevent moral hazards associated with guarantees, the government would need to make a good judgment about the prospect of Vietnam’s economic environment and the extent of guarantee provision. This would likely require a significant enhancement of both technical and organizational capabilities to ensure analytical rigor and coordination effectiveness among different agencies. As capable foreign investors become comfortable investing in Vietnam’s PPP projects, competition among domestic and foreign investors could gradually increase. When a robust PPP market is achieved, guarantees could be replaced by Full Concession and similar types of arrangement. The government could then focus on its regulatory role in ensuring projects’ Value for Money and quality of outcomes.
INTRODUCTION

Vietnam is facing a significant infrastructure investment gap

For developing countries, infrastructure is often seen as one of the key factors contributing to a higher level of economic growth and a better quality of life. This is because an increase in the availability and quality of infrastructure can potentially bring about significant benefits, ranging from expanded access to necessities for individuals to reduced operational costs for businesses.

Over the past decades, this link between infrastructure and countries’ development has been empirically tested in multiple studies. For example, Aschauer (1989) and Barro (1990) investigated the relationship between infrastructure investment and national income by incorporating infrastructure measurements in endogenous growth models. More recent studies such as Seethepalli et al. (2008), Caldedon et al. (2010), Kodongo et al. (2016) further reinforced the positive relationship between infrastructure and economic growth in different parts of the world (see Exhibit 1). In particular, Calderon et al. (2009) estimated that a 10% increase in infrastructure assets correlates with a 1% increase in GDP. Moreover, through economic growth, Kwon (2005) and Setboonsarng (2010) specifically showed that increased availability and quality of transportation infrastructure can help tackle poverty.

Exhibit 1
Infrastructure can be an important driver of economic prosperity

Note: Infrastructure includes power, water, sanitation, transport, information, and communications technology. Gross National Income (GNI) per capita is limited to 50,000 for graphical reasons. Size of data points in the ASEAN group reflects countries’ population.


3 Kalpana Seethepalli, Maria Caterina Bramati, and David Veredas, “How Relevant Is Infrastructure to Growth in East Asia?,” World Bank, 2008.
On the other hand, the growth potential of developing countries can be severely constrained by a lack of investment in infrastructure. McKinsey (2016) estimated that the world needs $3.3 trillion of infrastructure investment on average per year just to maintain the current trajectory of growth, out of which 60% is needed in emerging economies and 24% should specifically be channeled to the road sector. However, it is currently underinvesting by about $350 billion per year.

Vietnam is having the highest level of infrastructure spending over Gross Domestic Product (GDP) (5.7%) in Southeast Asia. With its 2017 GDP of around $224 billion, that translates to about $12.8 billion of annual investment. However, there is still much work to be done, as Vietnam still trails behind other major developing economies in Southeast Asia in terms of infrastructure quality (see Exhibit 2). Additionally, the World Economic Forum’s Executive Opinion Survey (2017) reported that the inadequate supply of infrastructure remains one of the most problematic factors for doing business in Vietnam.

Exhibit 2

Despite a relatively high level of infrastructure investment, Vietnam still has much to catch up in terms of infrastructure quality

![Exhibit 2](image)

**Note:** Infrastructure Investment as % of Gross Domestic Product (GDP) data includes the average annual public and private investment in various years (2011-2014). Infrastructure Quality Score is based on a global survey of 16,658 business executives between January and April 2018. Scores range from 0 to 100, with 100 being the ideal state.

**Source:** Asian Development Bank (2017); World Economic Forum (2018).

In order to sustain its current economic growth, Vietnam would likely need to increase the level of infrastructure investment by at least about 30% annually (see Exhibit 3). However, the country is facing significant financing constraints. As it attains lower middle-income status, Official Development Assistance (ODA) funding has become more limited. Moreover, public debt has been quickly approaching the ceiling level mandated by the National Assembly. As a result, the government acknowledged that public sector financing can at most provide for only half of total infrastructure spending. In that context, the private sector’s participation in infrastructure investment through Public-Private Partnerships (PPPs) will be essential for Vietnam to meet its infrastructure needs.

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Exhibit 3
Facing public financing constraints, Vietnam will need to significantly increase infrastructure investment from the private sector in order to maintain its current growth trajectory

Note: Current data is based on the 2017 nominal Gross Domestic Product (GDP). Projected need is based on the average annual infrastructure investment need over the 2016-2030 period.

Despite its potential, Public-Private Partnership remains a work in progress

The PPP Knowledge Lab (2017) defined PPP as “a long-term contract between a private party and a government entity, for providing a public asset or service, in which the private party bears significant risk and management responsibility, and remuneration is linked to performance.”14 While PPPs can help countries finance infrastructure projects and bring about efficiency gains, they are typically complex transactions with potential risks for all involved parties. To maximize net benefits, successful PPP programs around the world often require good legal and institutional frameworks that can also be improved over time.

Vietnam’s PPP program originated in 1997 with the introduction of Decree 77/1997/ND-CP, which regulated domestically sponsored Build-Operate-Transfer (BOT) projects. Over the next decade, subsequent regulations expanded the types of contract to include Build-Transfer-Operate (BTO) and Build-Transfer (BT) and permitted foreign investment.15 In 2010, the Prime Minister issued Decision 71/2010/QD-TTG, which piloted a coherent PPP program for the first time. Decree 15/2015/ND-CP and Decree 63/2018/ND-CP further consolidated the legal framework for PPP by specifying requirements for different stages of a PPP project.

Over the last 20 years, there have been 289 PPP projects in Vietnam with a total investment value of $50 billion (see Exhibit 4). The participation of the private sector in infrastructure finance has certainly helped alleviate some pressure on the public sector. However, the Asian Development Bank estimated that PPP still has a lot of potential in Vietnam, as private finance currently comprises only about 10% of total infrastructure investment - much lower compared to other countries in the region (e.g., 30% in India).16 Additionally, more than two-thirds of past projects have been in the area of transportation and almost all were implemented under either the BOT or the BT contract types. As its PPP program continues to expand, Vietnam could benefit from a more diversified portfolio of projects that would cater to a wider range of investment preferences.

**Exhibit 4**

Most Public-Private Partnership projects in Vietnam have been carried out in the transportation sector and under either Build-Operate-Transfer or Build-Transfer contract types

<table>
<thead>
<tr>
<th>% total (number of projects)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transportation: 72% (207)</td>
</tr>
<tr>
<td>Energy: 6% (18)</td>
</tr>
<tr>
<td>Water: 4% (13)</td>
</tr>
<tr>
<td>Others: 18% (51)</td>
</tr>
</tbody>
</table>

<p>| |</p>
<table>
<thead>
<tr>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Build-Operate-Transfer: 49% (141)</td>
</tr>
<tr>
<td>Build-Transfer: 48% (140)</td>
</tr>
<tr>
<td>Others: 3% (8)</td>
</tr>
</tbody>
</table>

*Source: Vietnam Ministry of Planning and Investment.*

Additionally, many investors remain concerned about regulatory issues and the lack of support from the government under the current legal framework. For example, major regulatory risks can come from unfavorable changes to current decrees. It is also unclear whether PPP projects should be subjected to laws governing traditional public procurement. In high-risk greenfield projects, there have been repeated calls for concrete government support. As a result, most investors are hoping that the upcoming PPP Law would finally resolve these issues.17

**The North-South expressway project is an important test of government support**

Vietnam’s fast-growing economy has been putting tremendous pressure on its transportation network (see Appendix 1). While upgrading existing local primary roads and promoting alternative modes of transportation would alleviate regional demand, they are only temporary fixes to a long-term issue. In 2017, the capacity of Vietnam’s transportation network along the North-South corridor was estimated to be 5.9 million passengers and 14.5 million tons of goods per year. By 2020, however, it would have to serve an annual demand of 45.4 million passengers and 62.3 million tons of goods.18

While traffic demand has become critical in recent years, the need to facilitate transportation along Vietnam’s North-South corridor has been studied by the Ministry of Transportation since the late 1990s. Following an important economic reform in 1986, Vietnam’s inter-provincial traffic volume increased by 2.1 times and 2.8 times in terms of passengers and goods respectively in the period of 1990-1997.19 As there was a need to plan a comprehensive national transportation network, the Government of Vietnam commissioned the Japan International Cooperation Agency (JICA) to help develop a national transportation development strategy between February 1999 and June 2000. JICA’s report (VITRANSS) anticipated that “the north-south movement between [Ho Chi Minh City] and Hanoi, which is not substantial at the present, will become more significant in the future,” and ranked the “North-South Backbone” as the 2nd highest priority after “International Gateways.” At that time, the study team envisioned 5 sections of a North-South expressway with “modern road facilities […] 4-lane dual carriageway and access control.”20

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20 Almec Corporation and Pacific Consultants International.
In its updated report (VITRANSS 2) in 2010, JICA noted that the gap between traffic demand and infrastructure supply had widened along the North-South coastal corridor, which led to an urgent need to develop expressways together with a high-speed railway, air transportation, and coastal shipping. Expressways were envisioned to serve four purposes: (1) segregate long-distance traffic from local traffic; (2) facilitate the provision of competitive transportation services to ensure efficiency, safety, and amenity; (3) serve as strategic means to achieve regional development; (4) serve as core transportation corridors integrating key transportation modes. It was estimated that the whole expressway network could accommodate around two-thirds of both passenger and freight inter-provincial traffic demand by 2030, significantly alleviating the pressure on primary roads.\(^\text{21}\) Preliminary evaluations showed that most provincial sections of the North-South expressway were economically feasible, though their financial feasibility was more uncertain (see Appendix 2).

Informed by this report, in 2016, the Prime Minister of Vietnam approved the Ministry of Transportation’s “Master Plan on Development of Vietnam’s Expressway Network through 2020, Vision to 2030.” The Master Plan included 21 expressways with the total length of 6,411 kilometers, in which the North-South expressway made up a significant part (see Exhibit 5).

Exhibit 5
The North-South expressway is a significant part of Vietnam’s expressway network development plan

Due to the large total investment needed, the North-South expressway was split into western and eastern sections, with the eastern section being prioritized for its higher projected traffic demand. In particular, traffic demand was projected to surpass the capacity of Vietnam’s primary road QL1A by 2020 in several areas within the eastern section.\(^\text{22}\) As a result, in 2017, the National Assembly approved a budget appropriation of VND 55,000 billion in order to construct the most urgent 654 km of the eastern section by 2021.\(^\text{23}\)

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As part of this plan, 11 projects were designed according to various criteria including traffic demand, total investment, financing scenario, preparation progress, etc. (see Exhibit 6 and Appendix 3)\(^{24}\) Among the 3 publicly procured projects, the Cao Bo-Mai Son project had previously been carried out under public procurement and only needed an upgrade from 2 lanes to 4 lanes, while the Cam Lo-La Son and the My Thuan 2 Bridge projects were financially infeasible under PPP arrangements due to low projected traffic demand and unfavorable technical characteristics.\(^{25}\) 8 other projects were all under the BOT contract type, among which those connecting Ninh Binh and Thanh Hoa provinces were prioritized due to their highest score in JICA’s multi-criteria analysis.\(^{26}\) The Ministry of Transportation also projected the highest level of traffic demand in these two adjacent provinces.\(^{27}\)

The two projects that connect Ninh Binh and Thanh Hoa provinces are Mai Son-QL45 and QL45-Nghi Son. 63km-long and 17m-wide, the 4-lane Mai Son-QL45 expressway is longer by design and would consist of 5 closed toll collection segments (see Appendix 4). As it will be the first one going through bidding in late 2019, any form of government support for this project will set an important precedent in terms of its attractiveness to investors. While government support should be determined based on not just a single project but the whole PPP program, the Mai Son-QL45 project can be a useful benchmark for other similar projects that constitute the North-South expressway.\(^{28}\)

Exhibit 6
Most projects in the eastern section of the North-South expressway are Public-Private Partnerships with a significantly higher level of total investment than publicly procured ones

<table>
<thead>
<tr>
<th>Project</th>
<th>Length</th>
<th>Public-Private Partnership</th>
<th>Public Procurement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cao Bo-Mai Son</td>
<td>1612km</td>
<td>14,703</td>
<td>16,012</td>
</tr>
<tr>
<td>Mai Son-QL45</td>
<td>63km</td>
<td>14,703</td>
<td>16,012</td>
</tr>
<tr>
<td>QL45-Nghi Son</td>
<td>43km</td>
<td>7,769</td>
<td>8,648</td>
</tr>
<tr>
<td>Dien Son-Dien Chau</td>
<td>50km</td>
<td>8,648</td>
<td>13,596</td>
</tr>
<tr>
<td>Bao Vot</td>
<td>50km</td>
<td>7,900</td>
<td>15,013</td>
</tr>
<tr>
<td>Cam Lo-La Son</td>
<td>102km</td>
<td>5,131</td>
<td>19,648</td>
</tr>
<tr>
<td>Nga Trang-Cam Lam</td>
<td>29km</td>
<td>5,131</td>
<td>19,671</td>
</tr>
<tr>
<td>Cam Lam-Hoa</td>
<td>97km</td>
<td>19,648</td>
<td></td>
</tr>
<tr>
<td>Vinh Hao-Phan Thiet</td>
<td>106km</td>
<td>19,671</td>
<td></td>
</tr>
<tr>
<td>Phan Thiet-My Thuan 2</td>
<td>99km</td>
<td>5,125</td>
<td></td>
</tr>
<tr>
<td>Mai Son-QL45</td>
<td>7km</td>
<td>5,125</td>
<td></td>
</tr>
</tbody>
</table>


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PROJECT RISK MANAGEMENT

Vietnam needs an effective process of managing risk in Public-Private Partnership

One of the key reasons for the failure of large infrastructure projects around the world has been a “significant undermanagement of risk in practically all stages of the value chain and throughout the lifecycle of a project.”29 As a result, the application of a robust risk management process to the North-South expressway project is key to its success. While the scope of this Policy Analysis Exercise is limited to the Mai Son-QL45 expressway, it can provide a concrete template for future assessments of risks in other components of the North-South expressway project.

The risk management process can be generally divided into three steps: risk identification, risk measurement, and risk governance (see Exhibit 7).30,31,32 In the first step, the project’s most relevant risks are identified by triangulating different sources of evidence. While theoretical literature may provide broad insights on the typical risks of a PPP transportation project, a survey of past projects in Vietnam and feedback from stakeholder meetings are critical for a more contextual understanding of the problem. In the second step, appropriate policy options to address the identified risks are assessed both quantitatively and qualitatively. Finally, appropriate risk governance rules for policy implementation are derived from international best practices.

Informed by this risk management exercise, relevant government support options are evaluated based on predetermined criteria. Moore (2013) proposed a “Strategic Triangle” concept in which public management approaches are assessed in terms of public value, organizational capacity, and political support.33 Bardach (2015) distinguishes between “evaluative” and “practical” criteria, with the latter being relevant to “what happens to an alternative as it moves through the policy adoption and policy implementation processes.”34 Applying these concepts in the context of the Vietnamese government’s main objectives, the policy options can be evaluated along two broad dimensions of Impact and Feasibility. The result of this evaluation can help the government make an optimal policy decision and implement it successfully.

Exhibit 7
An effective risk management process can help the government choose the best policy and implement it successfully

<table>
<thead>
<tr>
<th>Risk management steps</th>
<th>Outcomes</th>
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| Risk identification   | • Problem definition  
|                       | • Government’s main objectives  
|                       | • Policy evaluation criteria  |
| Risk measurement      | • Most relevant policy options  
|                       | • Quantitative and qualitative evaluations of policy options  |
| Risk governance       | • Measures to mitigate risk during policy implementation  |

Source: Author’s analysis.

Step 1: Risk identification

While there are many types of risk that a PPP project might have throughout its life cycle, the relevance of each type of risk is often dependent upon the project’s sector, nature, and other specifications. Moreover, what is critical for one stakeholder might not be relevant for another. As a result, there can be different yet valid ways to identify and categorize risks for the same project. For example, Yescombe (2011) in a proposed Risk Matrix identified 7 typical risks and grouped them in 3 categories of General, Construction, and Operation. From the viewpoint of a lender assessing the financing options for a project, a similar list of risks can be grouped into Commercial, Macro-Economic, Regulatory, and Political Risks.

However, since risk assessment can often be a complex task, “it would generally be inappropriate to devote excessive time and resources to valuing minor, or less sensitive risks.” As one of the Vietnamese government’s key objectives is to attract private investors, especially capable foreign investors who can help improve the quality of Vietnam’s PPP market, it is important to understand their most significant concerns when it comes to evaluating investment opportunities. During stakeholder meetings, investors have suggested that regulatory and revenue risks are their most common worries. The Ministry of Transportation has also echoed these concerns in a recent proposal to the Prime Minister. While it has been the case that investors often find Vietnam’s PPP-related regulations contradicting and uncertain, the upcoming PPP Law can hopefully address most of these issues. On the other hand, revenue risk and the appropriate mechanism for the government to share it with the private sector, if it should happen at all, remain a thorny issue.

Revenue risk is driven by traffic, collection, and exchange rate risks

Revenue from a PPP expressway project is critical for both debt and equity holders to recoup their initial investments and earn expected rates of return. This revenue can come either directly from the government or from the users, depending on the type of payment arrangement of the project. Regardless of the payment source, revenue risk can be broadly driven by 3 components: traffic, collection, and exchange rate (see Exhibit 8).

Exhibit 8
Revenue risk is driven by traffic, collection, and exchange rate risks

Source: Author’s analysis.

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38 PPP Law Consultative Workshop organized by Vietnam Ministry of Planning and Investment (December 2018).
• **Traffic risk** can be understood as the possible deviation of actual traffic volume from the initial forecast. It is “one of the most common factors contributing to [high-profile toll-highway] failures.”

Standard & Poor’s (2005), Flyvbjerg et al. (2005), and Bain (2009) empirically proved that such a deviation is commonplace among projects around the world and there is a tendency of overestimation by around 20-30% in privately financed toll roads (see Exhibit 9). This deviation can sometimes be voluntary (e.g., bidders trying to win a contract, government agencies trying to meet project approval targets), in which case administrative solutions such as conducting independent audits and realigning incentives of different parties may suffice. On the other hand, the impact of forecasting errors and uncertainties - due to either the nature of any attempt to predict the future or the quality of applied forecasting techniques - could be mitigated with a good risk management process.

The inaccuracy of traffic estimations can be especially pronounced in developing countries due to their relative lack of expertise, experience, or resources to conduct comprehensive forecasting exercises. In 2017, the Vietnam Ministry of Transportation reported that 11/51 BOT road projects had traffic lower than the forecast level. A report from the National Assembly in the same year also pointed out multiple errors in past BOT projects’ forecast techniques, including outdated survey results, inadequate sampling time, insufficient consideration of revenue drivers, etc.

Exhibit 9  
Inaccurate traffic forecast is one of the most common reasons for road project failures

Note: X-axis starts from 0 with intervals of 0.2  
Source: Bull, “Toll-Road PPPs. Identifying, Mitigating and Managing Traffic Risk.”

• **Collection risk** can be understood as the difficulties associated with toll collecting logistics, public opposition, or collection fraud that prevent the project from receiving the full expected revenue per

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traffic unit. Toll rate variability, though can be a driver of collection risk in other contexts, is less relevant in the case of the North-South expressway project, since the government and the private sector are expected to abide by a fixed toll rate schedule set in the initial contract.

Past BOT projects in Vietnam have often experienced toll collection disruptions because of public opposition, for reasons such as the allegedly inaccurate locations of toll booths and high toll fees. A recent investigation of the Ho Chi Minh-Trung Luong BOT expressway project revealed how toll booth operators could under-report revenue using fraudulent software. While collection risk may have been significant over the past few years, there is currently significant public pressure on the government to mandate the installation of automated toll collection systems. As the North-South expressway project is expected to adopt this technology, collection risk can be assumed to be relatively minimized compared to other revenue risk drivers.

- **Exchange rate risk** is the risk that the actual toll revenue collected in local currency when converted to foreign currency could be higher or lower than expected, due to either currency appreciation or depreciation. While exchange rate risk can typically be mitigated with a reasonable cost in developed countries, the under-development of derivatives market in countries like Vietnam can make currency hedging prohibitively costly, especially given the long-term, large-volume nature of funding needed for infrastructure projects. This is particularly relevant to Vietnam’s objective of attracting capable foreign investors, who have repeatedly requested for exchange rate guarantee as a precondition for entering Vietnam’s PPP market.

> “We have heard many times in this forum about foreign exchange risk and in fact there must be a party bearing this risk. If foreign investors are forced to do so, they will raise the risk premium, making the project more costly and less feasible.”

Kenneth Atkinson, Chair of British Business Group Vietnam, speaking at Vietnam Business Forum

### Revenue risk should be shared by the government using appropriate support mechanisms

In the initial phase of its PPP program, like many countries around the world, the Vietnamese government preferred to shift almost all revenue risk to the private sector. However, the variation in the financial performance of past BOT projects due to inaccurate traffic forecasts and toll collection issues has raised the concern of whether revenue risk should be borne solely by the private sector. Moreover, the government’s struggle to attract foreign investors despite much effort over the past decade further highlighted the need for the government to reassess its stance on sharing exchange rate risk as a component of the overall revenue risk.

A commonly agreed principle of risk management in the context of PPP is that risk should generally be borne by the party who can manage it best. Irwin (2007) further broke down this principle into 3 ways to

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assess parties’ risk management ability: influencing the risk factor, influencing the sensitivity of the project to the risk factor, absorbing the risk (see Exhibit 10).

Traffic, collection, and exchange rate risks are influenced by the general political, social, and economic conditions of a country. Income levels and business cycles can affect the number of passengers traveled and the amount of freight transported. Public opposition against toll roads can disrupt toll collection. Global economic crises can weaken local currency vis-à-vis others. While a typical private company can hardly influence these conditions, the government might be able to stabilize exchange rates to a certain extent through monetary policies. It is also able to partly influence traffic demand by planning the overall transportation network, as well as enacting regulations favoring certain modes of transportation.

On the other hand, it can be argued that the private sector possesses distinct advantages in influencing the sensitivity of a project to traffic, collection, and exchange rate risks. Companies might be able to employ sophisticated forecast techniques before making investment decisions. During the operation phase, their innovative services can help improve customer satisfaction and minimize collection issues. Additionally, when suitable financial instruments are available at a reasonable cost, the private sector might be able to hedge revenue collected in local currencies against exchange rate risk.

Finally, the financial capacity of a government is often larger than a single private investor, which might give the former an advantage in terms of its ability to absorb the risk of a single project. On the other hand, the government’s actual capacity is limited by the fact that it may be expected to provide financial support in many infrastructure projects, of which potential cumulative losses might become fiscally unaffordable. Large institutional investors, however, might be able to diversify risks within a global portfolio of infrastructure investment. As a result, depending on specific project circumstances, either the public sector or the private sector can potentially have an advantage in absorbing revenue risk.

Exhibit 10
The private sector is not the best party to manage all components of revenue risk

<table>
<thead>
<tr>
<th></th>
<th>Traffic Risk</th>
<th>Collection Risk</th>
<th>Exchange Rate Risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Influencing the risk factor</td>
<td>Government (limited)</td>
<td>Neither</td>
<td>Government (limited)</td>
</tr>
<tr>
<td>Influencing the sensitivity of the project to the risk factor</td>
<td>Private sector</td>
<td>Private sector</td>
<td>Private sector (limited)</td>
</tr>
<tr>
<td>Absorbing the risk</td>
<td>Both</td>
<td>Both</td>
<td>Both</td>
</tr>
</tbody>
</table>

Source: Author’s analysis.

In Vietnam’s context, the government’s ability to influence traffic and exchange rate risks is constrained by its limited foreign exchange reserves and the pressure to pursue multiple socio-economic objectives with the same monetary and fiscal tools. Nonetheless, it is important to note that the private sector cannot directly influence such risks either. Moreover, in past BOT projects, domestic investors have shown a lack of technical capability to influence the sensitivity of projects to these risks and a lack of financial capacity to absorb them. For foreign investors, their capability to hedge against exchange rate risk is limited by Vietnam’s nascent derivatives market. As the private sector is unable to manage well all components of revenue risk, the government should consider sharing some of the burdens.

“The ultimate risk, that of traffic, cannot be controlled solely by a private concessionaire; it is especially critical in a greenfield project where demand is most difficult to forecast.”

Chiaki Kuranami et al., Asian Toll Road Development Program (1999)

53 Irwin, Government Guarantees.
Support mechanisms should be assessed based on the government’s key objectives

Like many other developing countries with budget constraints, Vietnam’s first and foremost objective has been attracting private investment, especially from foreign investors who can finance large infrastructure projects. This is understandable given that public provision is hardly a viable alternative in many cases. However, it is difficult to maximize private investment and minimize public spending at the same time, as foreign investors are often hesitant to enter new markets without concrete assurances from local governments. Therefore, balancing the private sector’s concerns with public interests is key to successful PPP programs around the world. In addition to Investment Attractiveness, the Vietnamese government should, therefore, pursue three other important objectives: Fiscal Sustainability, Value for Money, and Political Support (see Exhibit 11). Among these objectives, Investment Attractiveness and Value for Money are key impact criteria, while the others are essential elements of policy feasibility.

Revenue risk-sharing mechanisms often entail either direct or contingent support, which can help the private sector better manage revenue risk and ensure favorable rates of return. However, the more financial support provided to the private sector, the more pressure is typically exerted on the government’s budget. The long-term sustainability of government support hinges upon not just the ability to accurately quantify its fiscal effect, but also effective public financial management during policy implementation.

In supporting the private sector, the government should also avoid moral hazards and potential erosion of PPP’s benefits associated with transferring risks and efficiency gains. A critical question that the government needs to ask is whether PPP with revenue risk-sharing mechanisms remains superior to public procurement. The Value for Money analysis, in which a hypothetical publicly procured project is constructed as a benchmark, is helpful for the government to make such a comparison.

Finally, generating buy-in from stakeholders both inside and outside the government is critical for a policy decision to be politically feasible. PPPs are typically complex transactions involving multiple parties, including government agencies, private partners, and public users. In order to ensure a successful policy rollout, it is important to identify the different interests of these stakeholders, where consensus might be existing and where it still needs to be built.

Exhibit 11
Effective support for Public-Private Partnerships requires the government to go beyond public spending minimization and private investment maximization

<table>
<thead>
<tr>
<th>Objectives</th>
<th>Description</th>
<th>Key questions</th>
</tr>
</thead>
</table>
| Impact           | Investment Attractiveness Level of attractiveness of Vietnam’s PPP projects in the perception of capable foreign investors | • What kinds of risk are most relevant to investors?  
• How can government support help mitigate such risks? |
|                  | Value for Money How government support potentially affects the value of PPPs over traditional public procurement | • What is the value of PPP compared to public procurement, with or without government support? |
| Feasibility      | Fiscal Sustainability How quantifiable forms of support can be provided without causing long-term fiscal risk to the public sector | • What is the fiscal impact of government support?  
• How should the government manage direct and contingent liabilities? |
|                  | Political Support Level of political support from key stakeholders for the government’s choice of policy and its implementation | • Who are the key stakeholders and their relevant interests?  
• How can the government maximize political support for its policy choice? |

Source: Author’s analysis.
Step 2: Risk measurement

Without revenue risk-sharing, the Mai Son-QL45 expressway project is unattractive to investors

According to an economic benefit-cost analysis approved by the Ministry of Transportation, the Mai Son-QL45 expressway project’s Economic Internal Rate of Return is 12.7%, which makes the project worth pursuing from the Ministry’s perspective. An accompanied Financing Scenario also shows that the project can be financially feasible. However, this Financing Scenario caps senior debt’s interest rate (Rd) at 1.5 times of the risk-free rate, which is below the typical market rates offered by domestic lenders. It also estimates the cost of equity (Re) based on the average expected rates of return of domestic investors, which is below the rate typically demanded by foreign investors. As discussed earlier, this risk premium is likely due to two main concerns expressed by foreign investors which are regulatory uncertainty and revenue risk.

After adjusting for more realistic costs of capital (see Appendix 5), the project turns out to be financially infeasible under the base case scenario, with negative Net Present Value (NPV) and Internal Rate of Return (IRR) being lower than the Weighted Average Cost of Capital (WACC) (see Exhibit 12).

Exhibit 12
Project financial summary under the base case scenario

<table>
<thead>
<tr>
<th>Funding Requirement</th>
<th>VND (bils)</th>
<th>%</th>
<th>Funding Sources</th>
<th>VND (bils)</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction costs</td>
<td>8,074</td>
<td>90.7</td>
<td>Equity</td>
<td>1,950</td>
<td>23.2</td>
</tr>
<tr>
<td>Transaction costs</td>
<td>829</td>
<td>9.3</td>
<td>Debt</td>
<td>6,472</td>
<td>76.8</td>
</tr>
<tr>
<td>Investors’ total base cost</td>
<td>8,903</td>
<td>100</td>
<td>Total investors’ fund</td>
<td>8,422</td>
<td>100</td>
</tr>
<tr>
<td>Land acquisition costs</td>
<td>1,901</td>
<td>14.4</td>
<td>Construction VAT refund</td>
<td>752</td>
<td>5.7</td>
</tr>
<tr>
<td>Contingencies</td>
<td>1,539</td>
<td>11.7</td>
<td>Government subsidy</td>
<td>3,169</td>
<td>24.1</td>
</tr>
<tr>
<td>Rolled-up interest</td>
<td>824</td>
<td>6.3</td>
<td>Rolled-up interest</td>
<td>824</td>
<td>6.3</td>
</tr>
<tr>
<td>Total Requirement</td>
<td>13,167</td>
<td>100</td>
<td>Total Sources</td>
<td>13,167</td>
<td>100</td>
</tr>
</tbody>
</table>

Financial feasibility

<table>
<thead>
<tr>
<th>VND (bils)</th>
<th>%</th>
<th>Cost of funding</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equity IRR</td>
<td>7.1</td>
<td>Equity (Rd)</td>
</tr>
<tr>
<td>Debt IRR</td>
<td>9.9</td>
<td>Senior debt (Rd)</td>
</tr>
<tr>
<td>Project IRR</td>
<td>8.3</td>
<td>WACC</td>
</tr>
<tr>
<td>Project NPV</td>
<td>(2,467)</td>
<td>Risk-free rate (Ri)</td>
</tr>
</tbody>
</table>

Note: Government subsidy is expected to cover all land acquisition costs. Rolled-up interest during the construction phase is calculated monthly but compounded quarterly according to the original Financing Scenario. This leads to debt holder’s Internal Rate of Return (IRR) being slightly lower than the cost of debt (Rd).

Source: Transport Engineering Design Inc (TEDI), “Mai Son-QL45 Expressway Project Feasibility Study”; Author’s analysis.

Under the base case scenario, due to the low level of toll revenue from 2022-2028, equity holders are assumed to contribute additional funding in order to service debt obligations, taxes and other costs (see Exhibit 13 and Appendix 6). Since equity holders are exposed to a higher level of risk than debt holders, it is important to specifically focus the analysis of private sector perspective on equity holders. Under the assumptions that the concession period is 26 years and the expected equity return is 16% (see Appendix 5), the resulting low equity IRR and negative equity NPV would make the project unattractive to equity investors. With revenue risk-sharing mechanisms, the government might expect debt and equity holders to provide capital at a lower cost as a result of lower risk premium, which can help improve the project’s financial feasibility.

There are six relevant policy options with different revenue risk-sharing profiles

There are various types of support that the government can provide in order to help PPP projects in Vietnam succeed. At the broadest level, the government can ensure macroeconomic stability, improve the clarity and comprehensiveness of regulations, and expand the size and sophistication of its capital market. These are general objectives that the government is pursuing regardless of its PPP program, yet can indirectly reduce country risk and increase the confidence of investors.

At the project level, the Vietnamese government has been providing some direct subsidy to PPP projects. For example, the government has allocated VND 3,169 billion in subsidy for the Mai Son-QL45 expressway project, which can be used to cover land acquisition costs as well as some initial preparation costs. Additionally, this greenfield project is eligible for a special corporate tax rate of 10% for 15 years, during which corporate tax can be exempted for 4 years and reduced by 50% for 9 years.56 On the other hand, other forms of support such as mezzanine debt or equity contribution, loan guarantees, and 3rd party political risk guarantees have been less common.

These measures can increase the financial viability of a project through mitigating risks, enhancing credit, and reducing costs of capital. Moreover, they can be used in various combinations depending on the resources and constraints faced by the government. However, as revenue risk is a top concern for foreign investors, it is important to focus on measures that specifically target revenue risk.57 A survey of past literature and common practices around the world suggests that there are six common policy options with different levels of revenue risk-sharing between the government and the private sector: Full Concession, Least Present Value of Revenue, Public Toll Collection, Exchange Rate Guarantee, Revenue Guarantee, and Availability Payment (see Exhibit 14).

At the extreme ends of the risk-sharing spectrum are Full Concession and Availability Payment. In the Full Concession option, the public sector typically transfers all traffic, collection, and exchange rate risks to the private sector. On the other hand, in the Availability Payment option, the private sector is paid a fixed amount annually in return for the availability of the expressway. The payment level guarantees a

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55 Transport Engineering Design Inc (TEDI).
57 “It should be noted that VGF per se will not function to mitigate demand risk and revenue risk of the project, because VGF amount is fixed and the risks of demand fluctuation and tariff change still rest with the private sector. For example in a toll road project, a project company has to bear the risk of demand uncertainty and fluctuation, even if they receive a fixed amount of VGF from the public sector.” Japan International Cooperation Agency, “VGF Survey for PPP Projects in Viet Nam Final Report” (Vietnam Ministry of Planning and Investment, 2017), http://open_jicareport.jica.go.jp/pdf/12292850.pdf.
certain rate of return and is subjected to performance measures. Since the Vietnamese government is facing a budget constraint, it is likely that the government would still collect tolls and thus would bear both traffic and collection risks.\^58

The closest option to Full Concession in terms of the risk-sharing level is Least Present Value of Revenue,\^59 in which the government allows the concession period to be extended or shortened according to the actual level of revenue collected. In this option, the concession ends when the private sector reaches a target Net Present Value of revenue set in the initial contract. While collection and exchange rate risks still reside with the private sector, traffic risk is “converted” to a concession period risk that is shared by the public and private sectors. This risk can arise in jurisdictions where there is a maximum concession period restriction, in which case the concession might be forced to end before the target revenue is reached.

In the Public Toll Collection option, the private sector is paid directly by the government according to the level of actual traffic. While in some countries no actual toll is collected from the users (“shadow toll”), given the current budget constraint, it is likely that the Vietnamese government would still collect tolls. As a result, collection risk is fully retained by the government, while the private sector bears traffic risk.

In the Exchange Rate Guarantee option, the government typically shares exchange rate risk by compensating the private sector when the local currency depreciates by a certain amount. In order to prevent excessive returns to the private sector, the government can also receive payment from the private sector when the local currency appreciates. Similarly, in the Revenue Guarantee option, the private sector is compensated for the difference between the actual revenue and a predetermined revenue “floor” in the case of low traffic, assuming toll rates are fixed. This guarantee can also come with the condition that the government is compensated when actual revenue increases beyond a certain threshold. While the government may decide to cover the full expected revenue in the original forecast, doing so may lower investors’ incentives to maintain operational efficiency. As a result, it has been common to “keep some investors exposed to revenue risk” by setting the floor level below the original forecast, as practiced in South Korea, Mexico, South Africa, and Chile.\^60

### Exhibit 14
Relevant policy options have different revenue risk-sharing profiles

<table>
<thead>
<tr>
<th>Key features</th>
<th>Full Concession</th>
<th>Least Present Value of Revenue</th>
<th>Public Toll Collection</th>
<th>Exchange Rate Guarantee</th>
<th>Revenue Guarantee</th>
<th>Availability Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained risk by public sector</td>
<td>None</td>
<td>Concession period (shared)</td>
<td>Collection</td>
<td>Exchange Rate (shared)</td>
<td>Traffic (shared)</td>
<td>Traffic Collection</td>
</tr>
<tr>
<td>Transferred risk to private sector</td>
<td>Traffic Collection</td>
<td>Exchange Rate</td>
<td>Concession period (shared)</td>
<td>Collection Exchange Rate</td>
<td>Traffic Collection Exchange Rate</td>
<td>Exchange Rate</td>
</tr>
</tbody>
</table>

**Note:** For Exchange Rate Guarantee and Revenue Guarantee, the relative level of risk-sharing between the public and private sectors depends on the specific level of guarantee set in the initial contract.

**Source:** Author’s analysis.

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\(^{58}\) In Availability Payment, foreign investors would still bear exchange rate risk without a separate Exchange Rate Guarantee.

\(^{59}\) Also called the Flexible Term Contract in some contexts.

\(^{60}\) Irwin, *Government Guarantees*. 
To understand the impact of these policy options on revenue risk, the originally deterministic projection of annual traffic volume is replaced by a model with uncertain variables. According to standard literature, traffic volume can be assumed to follow a geometric Brownian motion, in which a particular year’s traffic volume ($x_t$) is driven by the previous year’s traffic volume ($x_{t-1}$), traffic growth rate ($\mu$), volatility rate ($\sigma$) (which is assumed to be constant in time), and a random factor ($z$) according to the following equations (see Appendix 7):

$$x_t = x_{t-1}e^{\left((\mu-\frac{\sigma^2}{2})+\sigma z\right)}$$

$$x_t = x_0e^{\left((\mu-\frac{\sigma^2}{2})t + \sigma \sqrt{t} z\right)}$$

The traffic level for each year is multiplied by the toll rate specified for that year, according to the original Financing Scenario. Using the Monte Carlo simulation technique, traffic level and thus revenue can be projected iteratively, each time with different values of the uncertain variables underlying the model (see Exhibit 15). Since by providing support to the private sector the government is taking on a different risk profile, there is an ongoing debate among researchers whether a risk-adjusted discount rate should be used. Determining the appropriate discount rate in Vietnam’s context is an interesting topic for future research. However, since Monte Carlo simulation “has the advantage of taking into consideration risks and uncertainties in the probability distribution definition,” one reasonable solution is to discount the simulated streams of cash flows at the risk-free rate and record them in the form of a probability distribution of their Net Present Values (NPV).

Exhibit 15

The traffic model’s base case scenario follows the general trend of the originally deterministic projection, while simulated projections can vary based on underlying variables.

![Traffic model's base case scenario](source: Transport Engineering Design Inc (TEDI), “Mai Son-QL45 Expressway Project Feasibility Study”; Author’s analysis.)

Similarly, the exchange rate (USD/VND) can be modeled to follow the geometric Brownian motion, in which a particular year’s exchange rate ($x_t$) is driven by the previous year’s exchange rate ($x_{t-1}$), depreciation/appreciation rate ($\mu$), volatility rate ($\sigma$) (which is assumed to be constant in time), and a random factor ($z$) (see Appendix 7). The revenue for each year in VND can be converted to USD using the simulated exchange rate for that year, discounted at the risk-free rate, and recorded in the form of a probability distribution.

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62 Irwin, *Government Guarantees*.
65 Carbonara, Costantino, and Pellegrino.
1. Fiscal Effect

From the point of view of the government, a critical part of evaluating fiscal sustainability is quantifying the fiscal effect of policy options, if there is any. This is especially important for contingent support mechanisms, which can become “very onerous to the government if not adequately quantified.” In doing so, specific assumptions are made regarding each policy option in order to follow common international practices and ensure the comparability of analysis results (see Exhibit 16 and Appendix 8).

Exhibit 16
The fiscal effect of policy options depends on the extent of support provided and risk retained by the public sector

<table>
<thead>
<tr>
<th>Key features</th>
<th>Full Concession</th>
<th>Least Present Value of Revenue</th>
<th>Public Toll Collection</th>
<th>Exchange Rate Guarantee</th>
<th>Revenue Guarantee</th>
<th>Availability Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Assumptions</td>
<td>Private sector bears all revenue risk</td>
<td>Flexible concession period based on agreed revenue target</td>
<td>Government collects tolls and pays private sector based on actual traffic</td>
<td>Guaranteed compensation in extreme exchange rate fluctuations</td>
<td>Guaranteed compensation in extreme revenue fluctuations</td>
<td>Government collects tolls and pays private sector fixed annual amount</td>
</tr>
</tbody>
</table>

Note: All policy options assume that toll revenue is collected for 23.5 years. For Least Present Value of Revenue, concession period risk is quantitatively negligible but may still have qualitative implications. For Exchange Rate Guarantee, the private sector (government) receives compensation when VND depreciates (appreciates) against USD by more than 1.42% compared to the previous year. For Revenue Guarantee, the private sector (government) receives compensation when actual revenue in local currency is less (more) than the base case figure by more than 23.2%.

Source: Author’s analysis.

The fiscal effect can be represented by different statistical measures. Expected payments or maximum/minimum values can be concise, yet they do not give a clear sense of the level of uncertainty inherent in contingent liabilities. On the other hand, standard deviation and variance can better answer that question, but they may not help clarify the difference between upside and downside risks.

From the Vietnamese government’s point of view, it is important to have a clear sense of how unfavorable the potential fiscal effect can be, given the current political pressure to limit fiscal spending. As a result, cash flow at risk (CFaR), which is used in developed PPP markets like Chile and South Africa, is chosen as the key measure of fiscal effect. Defined as “the smallest payment that the government can expect, with a particular degree of confidence, not to pay more than,” a CFaR at 95% confidence level can be understood as the worst amount of payment that the government can expect to pay 95% of the time. In this analysis, 10,000 iterative results from a Monte Carlo simulation are ranked, with the 9,500th worst result being the CFaR at 95% confidence level (see Appendix 9).

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66 Carbonara, Costantino, and Pellegrino.
68 Irwin, Government Guarantees.
Among the identified policy options, Full Concession and Least Present Value of Revenue do not require the public sector to provide any type of financial support, either contingent or direct. As a result, it is safe to assign the value of 0 to the fiscal effect associated with these policy options.

For the Public Toll Collection option, even though the government collects tolls, it is assumed that collection risk is negligible thanks to the automatic toll collection system adopted in the North-South expressway project. However, it is reasonable to assume that the government would have to bear the direct cost of the automatic toll collection system, which is estimated to be **VND 263 billion** based on project cost data from the original Financing Scenario.

At the other end of the spectrum, Availability Payment can be considered a form of direct support from a budgetary viewpoint, as the annual amount provided to the private sector is fixed regardless of the variability in traffic. Since equity holders are the focus of this analysis as explained earlier, the payment amount should give them the same equity IRR under the base case scenario. Using Excel’s Solver tool, this amount is determined to be VND 1,268 billion in order to guarantee an equity IRR of 7.1% for equity holders. From the government’s perspective, discounting the payment cash flows at the risk-free rate of 5.2% gives the NPV of total availability payment of VND 15,558 billion.

However, the government also collects tolls from users, which are subjected to traffic risk. As such, the fiscal effect of this option is the net amount of cash available to the government (toll revenue - automatic toll collection cost) less the availability payment amount. With Monte Carlo simulation of traffic risk, the CFaR of the fiscal effect associated with the Availability Payment option is **VND -6,791 billion**.

Exchange Rate Guarantee and Revenue Guarantee are both contingent support from the budgetary viewpoint. In evaluating the fiscal effect of the Exchange Rate Guarantee, traffic is assumed to follow the base case scenario’s projection. With Monte Carlo simulation of exchange rate risk, the CFaR of the fiscal effect associated with the Exchange Rate Guarantee option is **VND -629 billion**.

While the fiscal effect of an Exchange Rate Guarantee varies based on the movements of the VND relative to the USD, the uncertainty of the fiscal effect associated with Revenue Guarantee is derived from the variability in traffic. Using Monte Carlo simulation of traffic risk, the result of the financial model shows that the CFaR of the Revenue Guarantee’s fiscal effect is **VND -4,069 billion**.

### Exhibit 17

**Revenue Guarantee and Availability Payment might incur relatively large fiscal costs to the public sector**

<table>
<thead>
<tr>
<th>Preference</th>
<th>Full Concession</th>
<th>Least Present Value of Revenue</th>
<th>Public Toll Collection</th>
<th>Exchange Rate Guarantee</th>
<th>Revenue Guarantee</th>
<th>Availability Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Retained risk by public sector</td>
<td>None</td>
<td>None</td>
<td>None</td>
<td>Exchange Rate (shared)</td>
<td>Traffic (shared)</td>
<td>Traffic</td>
</tr>
<tr>
<td>Public sector’s cash flow at risk (CFaR)</td>
<td>VND 0 billion</td>
<td>VND 0 billion</td>
<td>VND -263 billion</td>
<td>VND -629 billion</td>
<td>VND -4,069 billion</td>
<td>VND -6,791 billion</td>
</tr>
</tbody>
</table>

**Note:** From the government’s perspective, cash flow at risk (CFaR) represents the maximum fiscal effect of a policy option at 95% confidence level. Different confidence levels may apply depending on the government’s risk preference. Negative CFaR means a payment from the government to the private sector. For Public Toll Collection, while the public sector does not retain any risk, its CFaR is assumed to be the cost of the automatic toll collection system.

**Source:** Author’s analysis.

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70 NPV of cash flows is another common criterion used by equity investors. However, the discount rate is likely to be different under the Availability Payment option as compared to the base case scenario, and there is a lack of reliable information on what this rate would be in Vietnam’s context.
2. Investment Attractiveness

Similarly, Monte Carlo simulations are conducted to assess the investment attractiveness of the project under different policy options. Both traffic risk and exchange rate risk are considered when running simulations for Full Concession, Exchange Rate Guarantee, Public Toll Collection, and Revenue Guarantee. However, only exchange rate risk is considered for Least Present Value of Revenue and Availability Payment. This methodology follows the types of risk that are expected to be transferred to the private sector under these policy options (see Exhibit 18).

Investment attractiveness can be represented by many measures. While equity NPV and IRR are common investment criteria, it is reasonable to assume, in the context of analyzing revenue risk-sharing mechanisms, that foreign equity investors would especially seek to minimize the variability around their expected NPV of equity cash flows. As a result, in comparing results from Monte Carlo simulations, the standard deviation of equity NPV is chosen as the key criterion for investment attractiveness (see Appendix 11).

The simulation results demonstrate that investors would likely find Full Concession, Public Toll Collection, and Exchange Rate Guarantee relatively riskier than the other options. From the government’s perspective, Least Present Value of Revenue, Revenue Guarantee, and Availability Payment are thus most preferable policy options if it wants to attract foreign equity investors.

Exhibit 18
Least Present Value of Revenue, Revenue Guarantee, and Availability Payment are most effective in reducing financial outcome uncertainty for foreign equity investors

<table>
<thead>
<tr>
<th>Preference Level</th>
<th>Full Concession</th>
<th>Least Present Value of Revenue</th>
<th>Public Toll Collection</th>
<th>Exchange Rate Guarantee</th>
<th>Revenue Guarantee</th>
<th>Availability Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transferred risk to private sector</td>
<td>Traffic Exchange Rate</td>
<td>Exchange Rate</td>
<td>Traffic Exchange Rate</td>
<td>Traffic (shared) Exchange Rate</td>
<td>Traffic (shared) Exchange Rate</td>
<td>Exchange Rate</td>
</tr>
<tr>
<td>Standard deviation of equity NPV</td>
<td>$277 million</td>
<td>$91 million</td>
<td>$277 million</td>
<td>$274 million</td>
<td>$113 million</td>
<td>$30 million</td>
</tr>
</tbody>
</table>

Note: From foreign equity investors’ perspective, a higher standard deviation of equity NPV represents higher uncertainty and lower preference.

Source: Author’s analysis.

3. Value for Money

In comparison with traditional public procurement, the PPP model might generate stronger incentives to “minimize not the initial construction cost but instead the life-cycle cost of the project.”71 This is because the return to the private sector can be tied to the quality of their work not only during the construction phase but also in the operation phase. As a result, PPP might be viewed as superior to public procurement solely from this perspective. However, this benefit should be weighed against the private sector’s high cost of capital and PPP’s transactional complexity. Moreover, not all PPP alternatives are equal, as revenue risk-sharing mechanisms may reduce the private sector’s efficiency drive and increase the total amount of risk retained by the government. A Value for Money (VfM) analysis can help quantify the impact of such policies on any net benefit that PPP might have over public procurement.

The UK’s Treasury (2006) defined VfM as “the optimum combination of whole-of-life costs and quality (or fitness for purpose) of the good or service to meet the user’s requirement.” A VfM analysis is typically used to compare different PPP alternatives with the Public Sector Comparator (PSC), which includes the risk-adjusted life-cycle costs and revenues of a hypothetical, comparable project carried out using the traditional procurement method. A PSC typically consists of four main components: base cost (including the cost of financing), transaction cost, base revenue, and retained risks (see Exhibit 19). The value of a PPP alternative with a particular revenue risk-sharing mechanism is also computed from these components, but the quantity of each component can vary according to factors such as the contract type, level of risk transferred, etc.

Exhibit 19

Base cost, transaction cost, retained risks, and base revenue are key components of the Public Sector Comparator

Note: O&M - operation and maintenance.
Source: Author’s analysis.

The base cost can include “construction, maintenance, and lifecycle costs as applicable.” In the case of the Mai Son-QL45 expressway project, land acquisition, construction, operation and maintenance (O&M) costs are the most significant components of the base costs of both PSC and PPP options. Infrastructure Ontario (2015) suggested that there is typically 10-15% of cost saving in PPP compared to the PSC due to potential efficiency and innovation factors introduced by the private sector. In the Mai Son-QL45 expressway project, since land acquisition cost is covered by government subsidy, 10% cost saving is applied to construction and O&M costs under PPP.

It is important to note that in PPP, the private sector helps finance these costs but ultimately the public still has to fund them, either through the government’s payments or the toll fees collected from users. Since the private sector typically borrows capital at a higher cost than government borrowing, PPP
financing cost can be higher than the cost of public debt. In this analysis, the financing cost for PPP alternatives is assumed to be the senior debt’s interest obligation at the rate of 10.9%. For PSC, it is assumed that the government can access the same loan but at the risk-free rate of 5.2%.\textsuperscript{77} Despite potential savings due to efficiency and innovation, the higher financing cost of PPP alternatives can often make their overall base costs higher than that of the PSC.\textsuperscript{78}

The transaction cost typically consists of “legal, financial, and technical advisory costs.”\textsuperscript{79} According to the original Financing Scenario, the transaction cost approved by the Ministry of Transportation for the Mai Son-QL45 expressway project is VND 829 billion, which is assumed to be the transaction cost for the PSC in this analysis. While the transaction cost for PPP tends to be higher than for traditional procurement due to the higher level of complexity, the actual difference is likely to be project specific. Following past estimates in literature, the hypothetical transaction cost under PPP is assumed to be 10% of the project’s total funding requirement.\textsuperscript{80,81}

In some instances, VfM analyses may consist solely of the costs incurred. However, for the Mai Son-QL45 expressway project, toll revenue can be treated as a reduction to the costs. As a result, the base case revenue can be subtracted from the total costs of both the PSC and PPP alternatives to arrive at the net project cost.\textsuperscript{82}

In terms of retained risks, cost overrun and revenue risk, in general, are often considered the most relevant risks for transportation projects. Ansar et al. (2016) estimated that the average cost of road projects in China is about 28% over the planned budget and that there is no significant difference internationally.\textsuperscript{83} Following this estimate, the PSC in this analysis includes 30% risk of construction and O&M cost overrun. For PPP’s revenue risk, the cost incurred to the government under each revenue risk-sharing mechanism is assumed to be the cash flow at risk (CFaR) calculated earlier (see Step 2: Risk Measurement, Section 2: Fiscal Effect). Under the PSC, the government’s CFaR is represented by the difference between the base revenue and the actual revenue subjected to traffic risk.

Finally, the cash flows of different components of the PSC and PPP alternatives can be discounted to obtain their comparable present values. The choice of discount rate is extremely important as “even small changes in the discount rate applied will vary the outcome as to which scheme is the best VfM.”\textsuperscript{84} Unfortunately, there is currently no clear international consensus on this matter. For example, the UK has been using a common “social time preference rate” for both the PSC and PPP options.\textsuperscript{85} On the other hand, Australia calculates different discount rates according to the level of systematic risks transferred in each option.\textsuperscript{86}

\textsuperscript{77} Ideally, PPP financing cost should also include equity return, which may vary based on the level of risk-sharing between the public and private sector. Debt financing cost can also vary based on other factors such as leverage, time to maturity, number of tranches, etc. While these factors have not been considered in this analysis for simplicity purpose, future research on this topic is recommended when Vietnam’s PPP market is more developed.


\textsuperscript{80} Yescombe, Principles of Project Finance.

\textsuperscript{81} Dudkin and Vällilä, “Transaction Costs in Public-Private Partnerships.”


Instead of adjusting the discount rate to reflect the risks retained by the public sector under either the PSC or PPP alternatives, risky cash flows can be converted into their “certainty equivalents” and discounted by the risk-free rate. Given that Vietnam’s financial market is still developing, the lack of reliable data to estimate risk premiums makes this approach preferable to adjusting discount rates. As a result, cash flows are converted as much as possible to their certainty equivalents in this analysis, with the public sector’s retained risks being measured based on Monte Carlo simulation results. The certainty equivalent cash flows are then discounted at the risk-free rate for both the PSC and the PPP options.

In order to calculate VfM, base cost, transaction cost, and retained risks are added together to calculate the total project cost. As the same base revenue is subtracted from the total project cost to arrive at the net project cost, VfM is essentially the difference in total project costs between the PSC and PPP alternatives. For the Mai Son-QL45 expressway project, the results suggest that VfM is achieved for all PPP alternatives, but Revenue Guarantee and Availability Payment are less preferable than others due to their lower VfM (see Exhibit 20).

Exhibit 20
Despite the higher base cost and transaction cost, Value for Money (VfM) is achieved for all Public-Private Partnership (PPP) alternatives, with Revenue Guarantee and Availability Payment being less preferable than others

In Vietnam, the Politburo typically sets the overall strategic direction of the public sector, including how the government should work with the private sector in the area of infrastructure. Following this general guidance, the implementation of PPP projects involves the work of multiple government agencies, with the Ministry of Transportation (and provincial governments in some cases) typically working directly with

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the private sector. Additionally, as infrastructure projects also affect the country’s budget and economic development plan, the Ministry of Finance and the Ministry of Planning and Investment are also key stakeholders. The National Assembly often plays a supervisory role in ensuring that the government is fiscally responsible and that the citizens’ concerns are addressed by the government.

**Exhibit 21**
There are areas of overlapping interests among key stakeholders in the public sector, private sector, and citizens

In this context, stakeholders within the public sector may prioritize the interests of the citizens and the private sector differently. For example, as the agencies working most closely with the private sector, the Ministry of Transportation and provincial governments are likely to be most supportive of government guarantees in order to facilitate private financing of infrastructure projects. On the other hand, the Ministry of Finance and the National Assembly may have reservations about the same measures on the ground of avoiding fiscal risk. Additionally, recent public outcries related to issues such as high toll rates, unreasonable locations of toll booths, opaque toll collection processes, etc. have also generated strong political pressure against giving investors too much preferential treatment. These dynamics can influence the decision of the Politburo in choosing the policies that are most politically feasible.

“Accepting possible profits and losses is the principle of investment and doing businesses, so there should neither be exchange rate guarantees nor minimum revenue guarantees.”

National Assembly Vice Chairman Phung Quoc Hien on the Ministry of Transportation’s proposal to provide guarantees for the North-South expressway project.
In Vietnam’s context, Least Present Value of Revenue is the policy option that most resembles the status quo in BOT toll road projects. The uniquely flexible nature of the project’s concession period under this option can counteract the negative impact of low traffic level. This theoretically translates to a lower need for financial support from the government, as the project’s concession period can be extended to help investors collect enough revenue to meet their return target. Since this mechanism also helps simplify the evaluation of bids to one single criterion and reduce the need for complex renegotiations, it might not require a high level of public sector’s technical capability.

However, there are several reasons why extending the concession period in reality may not be politically popular among investors. For example, it brings little benefit to debt holders if the actual revenue is too low to cover debt obligations. Equity holders, who might lose all of their investment in the case of project default, are not rewarded beyond a net present revenue threshold. Moreover, as cash flows further in the future are discounted more heavily, extending the contract’s concession period might not significantly improve equity return in the case of extremely low traffic volume. As investors can be particularly averse to this risk in greenfield projects in developing countries, this option might not be suitable for the North-South expressway project. For these reasons, Vassallo (2006) pointed out that despite the policy’s conceptual attractiveness, it was implemented in only 2 out of 26 PPP road projects in Chile.89

From the Vietnamese government’s perspective, the inability to predict and justify the concession period of BOT projects has posed significant political challenges. Internally, this issue can be a source of tension between various government agencies, as concession period extension can be used as a convenient fix for poor project planning. For example, in 2016, the People’s Committee of Quang Binh province repeatedly requested the Ministry of Finance and the Ministry of Transportation to reduce toll rates and extend the toll collection period for two toll booths.90 In 2016 and 2017, Vietnam’s State Audit Office issued two reports proposing a total reduction of 227 years in toll collection time for 61 audited BOT projects under the Ministry of Transportation’s PPP program.91

Externally, decisions to extend a project’s concession period without appropriate justifications can be a cause for strong public opposition, as in the case of the An Suong-An Lac project in late 2018.92 In the case of the Cai Lay project, public opposition persisted as the Ministry of Transportation decided to reduce toll rates but extend the concession period.93 Moreover, given that the State Bank of Vietnam is increasingly restricting commercial banks from providing long-term loans using short-term deposits, it will become harder for investors to raise domestic funds with uncertain repayment period.94 As such, it is necessary to consider alternatives to this current approach.

For the Ministry of Finance and the National Assembly, Full Concession and Public Toll Collection might be superior for their minimized impact on the public budget, as project revenue comes from the users instead of the government. From the perspective of potential investors, however, Full Concession and Public Toll Collection are likely to be unappealing as they would have to bear most traffic and exchange risks in these cases.

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At the other end of the spectrum, Availability Payment is likely to receive the strongest political support from the private sector due to the guaranteed level of return and a minimal amount of risk. However, the Ministry of Finance is likely to be concerned most about this option due to its apparent upfront impact on the public budget. This concern would likely be shared by the National Assembly, given its pressure on the government to avoid exceeding the public debt ceiling. Given the current public sentiment against giving investors too much preferential treatment, Availability Payment is likely to receive less support from the citizens than Full Concession and Public Toll Collection.

Exchange Rate and Revenue Guarantees would likely receive strong political support from investors, as they address specific components of revenue risk. At the same time, they do not create as much of an apparent impact on the public budget as Availability Payment. However, they are both contingent upon deviations of actual exchange rates and traffic volumes from predicted figures. This uncertainty makes it harder for their impact to be accurately reflected in the long-term public budget. Moreover, these guarantees can accentuate the impact of financial crises on developing countries, as the traffic level tends to decrease and the local currency tends to depreciate during difficult economic times.  

As Exchange Rate and Revenue Guarantees often require sophisticated risk management techniques, countries that lack this technical capability may find them difficult to implement. In Vietnam’s context, a lack of experience in managing contingent liabilities associated with PPP projects has led to a general preference for simplicity and certainty. For example, the Ministry of Finance has expressed its reservation towards guarantees due to their potential risks to the government and the lack of a comprehensive legal framework on budgetary accounting of contingent liabilities in Vietnam. The downside of this aversion to contingent liabilities is that the government might miss an opportunity to attract private investment with potentially minimal public resources.

Exhibit 22
Guarantees might be the best options to balance key stakeholders’ interests if the public sector can enhance its technical and legal capabilities

Source: Author’s analysis.

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95 Irwin, Government Guarantees.
Step 3: Risk governance

In addition to evaluating different policy options based on predetermined criteria, the government should consider potential implementation risks. Risk governance involves identifying potential difficulties that the government might face in monitoring and controlling risks once a policy is carried out. It also complements feasibility analyses, since the level of fiscal sustainability and political support for a policy is often affected by the prospect of successful implementation by the government.

Difficulties in the implementation of proposed policy options can arise from many sources, including bureaucratic complexity, incentive and responsibility misalignments among different government agencies, etc. While administrative hurdles are common in any policy implementation, in the context of revenue risk-sharing, ineffective public financial management can be particularly detrimental. For example, in the absence of clear reporting requirements, contracting authorities may rush to approve unnecessary projects, thinking that Public-Private Partnership (PPP) is a way to obtain “free” or “cheap” infrastructure. The eventual pressure on the public sector to either buy back failed projects or increase subsidies can threaten macroeconomic stability, intensify public backlash, and take away precious resources for other important development goals. On the other hand, good public financial management can contribute to a virtuous cycle, in which the government can both efficiently utilize public resources and attract more private investment.97

A holistic public financial management framework involves determining policy affordability, how to budget for it, and how to report the impact of fiscal commitments.98 In Vietnam’s context, the government should also consider the whole portfolio of projects at both national and provincial levels.

Among the proposed policy options, Availability Payment involves direct fiscal liabilities, in which payments to the private sector are largely expected. On the other hand, Exchange Rate Guarantee and Revenue Guarantee involve contingent liabilities, which are triggered only in certain events. In the risk measurement step, direct fiscal liabilities are measured by their expected cash flows, while contingent liabilities are measured by cash flows at risk. In the risk governance step, the government should first compare the potential size of liabilities with its budget to determine the affordability of revenue risk-sharing mechanisms. Additionally, it should follow clear budgeting, reporting, and portfolio management principles based on international best practices and Vietnam’s specific context (see Exhibit 23).

The most difficult issue with PPP in terms of budgetary planning is the long-term nature of its cash flows. While investment is typically concentrated in the first few years of a publicly procured project, PPP arrangements like Availability Payment may require the government to make a fiscal expenditure commitment for decades. Given that the maximum public funding appropriation horizon in Vietnam is 5 years,99 such arrangements are hardly feasible under the current legal framework. As a result, in the North-South expressway project, financial support is currently limited to a subsidy for land acquisition, project preparation, and some initial construction costs.100 A possible remedy is to recognize long-term PPP payment commitments as public debt liabilities that can automatically be appropriated.101

Exchange Rate Guarantee and Revenue Guarantee are more difficult to budget since their associated liabilities are uncertain. While a few countries explicitly budget for them, others like Chile leave a contingency line in their budgets for small guarantee payments.102 On the other hand, Colombia, Brazil,

98 PPP Knowledge Lab, “PPP Reference Guide 3.0.”
99 The 5-year public investment plan was first implemented in 2016. National Assembly of Vietnam, Resolution 26/2016/QH14
100 Government of Vietnam, Resolution 20/2018/NQ-CP.
101 PPP Knowledge Lab, “PPP Reference Guide 3.0.”
Indonesia, and South Korea have established contingent liability funds, which can achieve the dual objectives of enhanced credibility and greater fiscal discipline.\textsuperscript{103}

In terms of financial reporting, the Ministry of Finance has committed to bringing the Vietnamese Accounting Standards (VAS) closer to the International Public-Sector Accounting Standards (IPSAS), though the transition process may take some time.\textsuperscript{104} The IPSAS’s accrual accounting basis, as opposed to the traditional cash accounting basis, would require PPP assets and liabilities to be explicitly accounted for in the balance sheets of either the public or the private sector. The decision of where to allocate these assets and liabilities may be based on which party has the most control or is subjected most to the risks and rewards of the projects.\textsuperscript{105} Unfortunately, there is currently no international consensus on the best practice, and the decision applied in specific projects may not always be clear-cut. Nonetheless, in both cases there is a potential tendency of contracting authorities to excessively transfer risks and project ownership to the private sector, compromising Value for Money in order to avoid reporting project liabilities as public debt.\textsuperscript{106} As a result, it is critical that the Vietnamese government establishes clear and consistent reporting guidelines that minimize such incentives.

When it comes to contingent liabilities, there is a greater need to increase the availability and variety of information disclosures. For example, Chile publishes an annual report on contingent liabilities, in which it discusses “not only expected cash flows from revenue guarantees but also the variability of those cash flows.” Australia makes signed contracts together with key contract terms available to the public.\textsuperscript{107} These practices are critical for the government to build internal accountability, foster public trust, and minimize potential public opposition in the unfortunate event that large payments are required.

Finally, public funding should be used to support not just any single project but the whole portfolio of projects at both national and provincial levels. Having a clear plan of where and how much support to provide can help the public sector focus on the best projects. In countries with a good track record of fiscal prudence, the Ministry of Finance is typically responsible for keeping a centralized registry of PPP fiscal commitments.\textsuperscript{108} Additionally, an explicit cap on the total subsidy amount across all PPP projects at both national and provincial levels can help the government gather more political support for its PPP program, since other budget items are less likely to be affected when a clear boundary is drawn.

\textbf{Exhibit 23}

\textbf{Risk governance requires the government to establish clear public financial management processes and principles}

<table>
<thead>
<tr>
<th>Direct liabilities</th>
<th>Contingent liabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Affordability check</strong></td>
<td>Measure expected cash flows</td>
</tr>
<tr>
<td><strong>Budgeting</strong></td>
<td>Recognize payment liabilities as part of public debt</td>
</tr>
<tr>
<td><strong>Reporting</strong></td>
<td>Establish clear and consistent guidelines on reporting PPP assets and liabilities</td>
</tr>
<tr>
<td><strong>Portfolio management</strong></td>
<td>Centralize registry of PPP fiscal commitments in one government agency</td>
</tr>
</tbody>
</table>

\textit{Source: Author’s analysis.}

\textsuperscript{103} PPP Knowledge Lab, “PPP Reference Guide 3.0.”
\textsuperscript{105} Yescombe, \textit{Public-Private Partnerships for Infrastructure: Principles of Policy and Finance}.
\textsuperscript{106} Yescombe.
\textsuperscript{107} Irwin and Mokdad, “Managing Contingent Liabilities in Public-Private Partnerships.”
\textsuperscript{108} PPP Knowledge Lab, “PPP Reference Guide 3.0.”
RECOMMENDATIONS

The risk management process clarifies the degree of preference towards proposed policy options by breaking it down according to predetermined criteria. Although sophisticated scoring systems may be developed in future studies, a simplified ranking of 1-2-3 corresponding to low-medium-high preferences can be used to make a reasonable judgment. Additionally, since the client - the Ministry of Planning and Investment - is most interested in balancing public and private interests in PPP regulation, the score for each criterion has been weighted equally (see Exhibit 24). From the perspective of other stakeholders, however, certain criteria may be assigned more weight according to their own priorities.

Exhibit 24

Full Concession and Least Present Value of Revenue are superior options overall but not without significant flaws

<table>
<thead>
<tr>
<th>Preference</th>
<th>Full Concession</th>
<th>Least Present Value of Revenue</th>
<th>Public Toll Collection</th>
<th>Exchange Rate Guarantee</th>
<th>Revenue Guarantee</th>
<th>Availability Payment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Investment Attractiveness</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>Value for Money</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>IMPACT SCORE</td>
<td>4</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Fiscal Sustainability</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Political Support</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2.5</td>
<td>2.5</td>
<td>1.5</td>
</tr>
<tr>
<td>FEASIBILITY SCORE</td>
<td>5</td>
<td>4</td>
<td>4</td>
<td>4.5</td>
<td>3.5</td>
<td>2.5</td>
</tr>
</tbody>
</table>

Source: Author’s analysis.

For the Mai Son-QL45 expressway project, the result suggests that Full Concession and Least Present Value of Revenue are the most preferred policy options when considering both Impact and Feasibility scores. However, they are not without significant flaws. While Full Concession scores lowest in terms of Investment Attractiveness and average in terms of Political Support, Least Present Value of Revenue has low Political Support and average Investment Attractiveness.

At the other end of the spectrum, Availability Payment is the most inferior policy option compared to the rest. Despite its appeal to investors due to the minimal level of risk transfer, this policy option has low Value for Money, low Fiscal Sustainability (high fiscal cost and budgeting difficulty), and medium-low Political Support.

While Public Toll Collection scores relatively better among the rest, its distinct advantage essentially lies in the ability of the government to control the toll collection process. With automated toll collection systems becoming mandatory, public opposition with regards to the transparency of PPP revenue should decline considerably. If this technology is implemented successfully, Public Toll Collection becomes effectively redundant as the government might as well choose Full Concession in order to avoid the cost of toll collection.

Exchange Rate Guarantee and Revenue Guarantee are similar to Full Concession and Least Present Value of Revenue in terms of Impact scores. However, they are potentially superior in terms of Political Support. This is because they help demonstrate to investors that the government is sharing some
revenue risk, while at the same time do not generate as strong public opposition in terms of apparent fiscal effect as Availability Payment. However, guarantees can be fiscally costly in the long run, as the government's cash flows at risk can be substantial in the case of extremely adverse traffic or exchange rate movements.

A potential implementation roadmap towards a robust Public-Private Partnership market

The analysis of the Mai Son-QL45 expressway project demonstrated the difficulty of any policy option to satisfy all of the government's objectives. As a result, a promising topic for future research is how they might be implemented sequentially or in different combinations within Vietnam's PPP program. In designing a suitable implementation roadmap, the government might want to consider developing a robust PPP market as one of its guiding principles.

It has been identified earlier that the two key concerns for foreign investors are regulatory and revenue risks. While the upcoming PPP Law can hopefully improve regulatory certainty, investors’ perception of revenue risk might be influenced as much by the lack of information as the actual risk level. This is because the lack of precedent in terms of foreign investment in Vietnam’s PPP projects might make foreign investors overly averse to country risk and demand excessive returns, despite Vietnam’s strong economic performance over the last decades. If future research supports this hypothesis, the government might want to consider limited use of guarantees in the short run.

South Korea’s experience in managing revenue guarantee

South Korea established its first substantial legal framework for PPP in 1994. At the beginning, the bidding process was hardly competitive, with more than two-thirds of projects having only one bidder. One of the key reasons was that investors were hesitant to be exposed to demand risk. In order to attract more investors and promote greater competition, the South Korean government established a Minimum Revenue Guarantee (MRG) scheme in the country’s 1999 PPP Basic Plan.

Under this scheme, the government initially guaranteed the private partner 80-90% of the projected revenue for the whole concession period. A specific schedule of guarantee rate reduction was later introduced, and the guarantee coverage period was also shortened. To reduce fiscal risk, no MRG was provided when the actual revenue was less than 50% of the projected level.

During 10 years of the scheme’s implementation, 36 out of 145 signed PPP projects had guarantee clauses. The Korea Development Institute reported that toll rates in PPP projects were converging with those in government-financed projects. Additionally, investors’ return premium over government bond rates was declining as the number of bidders per project was increasing over time.

Despite these benefits, the scheme was not without flaws. Public criticisms were directed at how the government was bearing most demand risk while allowing the private sector to enjoy high returns. Additionally, large payments were incurred in projects like the Incheon International Airport Expressway, in which the actual traffic was substantially lower than expected.


In South Korea’s experience, a revenue guarantee scheme can encourage the participation of capable investors in a new PPP market. As they seek to acquire better knowledge of local market conditions, their risk preferences can also become more available to the government. Over time, as the lack of information no longer acts as a barrier to entry, better credit rating systems and hedging instruments could emerge. Country risks might be more reasonably assessed and foreign investors might better manage risks themselves.
However, the South Korean case also demonstrated potential pitfalls of excessive guarantees. In order to minimize fiscal risk and prevent moral hazards, the government would need to make a good judgment about the prospect of the socio-economic environment and the extent of guarantee provision. The risk associated with making this judgment could be managed by applying techniques such as those demonstrated in this Policy Analysis Exercise. As the initial Key Performance Indicator (KPI) is the number of bids from capable investors, the government should be selective in terms of projects that can receive guarantees. Additionally, the most generous guarantee level might be limited to the first few years of a project when there is a high chance of revenue shortfall.

As the effectiveness of the risk management process is significantly influenced by its key assumptions, the government should continuously review the accuracy of base case traffic forecasts, cost projections, economic growth rates, etc. Moreover, public finance management principles proposed in the risk governance step should be enforced on the whole portfolio of PPP projects. These steps would likely require a significant enhancement of both technical and organizational capabilities to ensure analytical rigor and coordination effectiveness among different agencies.

As capable foreign investors become comfortable investing in Vietnam’s PPP projects, a more competitive market could gradually emerge. With a more comprehensive database of PPP projects, the government could measure the progress of transition with KPIs such as the quantity and quality of bids, investors’ expected returns, and the toll rates in PPP projects compared to government-financed ones.

When a robust PPP market is achieved, investors might even choose not to receive government guarantees in order to improve the competitiveness of their bids. At this point, guarantees could be replaced by Full Concession and similar types of arrangement. The government could then focus on its regulatory role in ensuring projects’ Value for Money and quality of outcomes.

**Exhibit 25**

A potential implementation roadmap towards a robust PPP market

<table>
<thead>
<tr>
<th>Public Sector Goals</th>
<th>Public Sector Priorities</th>
<th>Key Performance Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td>Availability of market information to investors</td>
<td>Gradually reduce guarantee level and coverage</td>
<td>Number of bids from capable foreign investors</td>
</tr>
<tr>
<td>Awareness of investors’ risk perception</td>
<td>Monitor progress with data</td>
<td>Quantity/quality of bids</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Investors’ expected returns</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Toll rates</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Projects’ Value for Money</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Quality of infrastructure</td>
</tr>
</tbody>
</table>

**Note:** Timeline follows Vietnam’s 5-year medium-term public investment plan. Actual timeline may vary. Future research should be conducted to confirm the current characteristics of Vietnam’s PPP market.

**Source:** Author’s analysis.

Vietnam is at a critical juncture where the availability and quality of infrastructure can make or break its path to prosperity. In order to realize its vision, the public sector would need to tap into the potential of PPP in major infrastructure projects like the North-South expressway. Effective risk management - the ability to identify, measure, and govern shared risks - plays a crucial role in that process. Additionally, different policies might need to be implemented at different stages as the PPP market evolves over time. By exercising prudence and setting the right priority at the right time, the government can work with the private sector in paving the road to Vietnam’s eventual success.
## APPENDICES

### Appendix 1. Vietnam socio-economic data

<table>
<thead>
<tr>
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<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Population, total</td>
<td>million</td>
<td>86.7</td>
<td>87.6</td>
<td>88.5</td>
<td>89.4</td>
<td>90.5</td>
<td>91.5</td>
<td>92.5</td>
<td>93.6</td>
<td>94.6</td>
</tr>
<tr>
<td>Population growth</td>
<td>% change</td>
<td>1.0</td>
<td>1.0</td>
<td>1.0</td>
<td>1.1</td>
<td>1.1</td>
<td>1.2</td>
<td>1.1</td>
<td>1.1</td>
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<tr>
<td>GINI index</td>
<td></td>
<td></td>
<td>35.6</td>
<td></td>
<td></td>
<td>35.6</td>
<td></td>
<td>34.8</td>
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<td>35.3</td>
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<tr>
<td>Macroeconomic Data</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GDP (current USD)</td>
<td>million USD</td>
<td>99,130</td>
<td>106,015</td>
<td>115,932</td>
<td>135,539</td>
<td>155,820</td>
<td>171,222</td>
<td>186,205</td>
<td>193,241</td>
<td>205,276</td>
</tr>
<tr>
<td>GDP (constant 2010 USD)</td>
<td>million USD</td>
<td>103,356</td>
<td>108,935</td>
<td>115,932</td>
<td>123,166</td>
<td>129,629</td>
<td>136,658</td>
<td>144,835</td>
<td>154,509</td>
<td>164,105</td>
</tr>
<tr>
<td>GDP growth</td>
<td>% change</td>
<td>5.7</td>
<td>5.4</td>
<td>6.4</td>
<td>6.2</td>
<td>5.2</td>
<td>5.4</td>
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<td>6.2</td>
</tr>
<tr>
<td>GDP per capita (current USD)</td>
<td>USD</td>
<td>1,143</td>
<td>1,211</td>
<td>1,310</td>
<td>1,515</td>
<td>1,723</td>
<td>1,871</td>
<td>2,012</td>
<td>2,065</td>
<td>2,171</td>
</tr>
<tr>
<td>GDP per capita, PPP (current USD)</td>
<td>USD</td>
<td>3,852</td>
<td>4,051</td>
<td>4,319</td>
<td>4,633</td>
<td>4,910</td>
<td>5,200</td>
<td>5,546</td>
<td>5,915</td>
<td>6,296</td>
</tr>
<tr>
<td>Total exports (current USD)</td>
<td>million USD</td>
<td>69,725</td>
<td>66,375</td>
<td>83,474</td>
<td>107,606</td>
<td>124,701</td>
<td>143,186</td>
<td>160,890</td>
<td>173,490</td>
<td>192,188</td>
</tr>
<tr>
<td>Total imports (current USD)</td>
<td>million USD</td>
<td>83,250</td>
<td>76,434</td>
<td>92,995</td>
<td>113,208</td>
<td>119,242</td>
<td>139,491</td>
<td>154,791</td>
<td>171,962</td>
<td>186,929</td>
</tr>
<tr>
<td>FDI, net inflows (current USD)</td>
<td>million USD</td>
<td>9,579</td>
<td>7,600</td>
<td>8,000</td>
<td>7,430</td>
<td>8,368</td>
<td>8,900</td>
<td>9,200</td>
<td>11,800</td>
<td>12,600</td>
</tr>
<tr>
<td>Unemployment rate (ILO estimate)</td>
<td>%</td>
<td>2.4</td>
<td>2.6</td>
<td>2.6</td>
<td>2.0</td>
<td>1.8</td>
<td>2.0</td>
<td>1.9</td>
<td>2.1</td>
<td>2.1</td>
</tr>
<tr>
<td>Total reserves (includes gold, current USD)</td>
<td>million USD</td>
<td>23,890</td>
<td>16,447</td>
<td>12,467</td>
<td>13,539</td>
<td>25,573</td>
<td>25,893</td>
<td>34,189</td>
<td>28,250</td>
<td>36,527</td>
</tr>
<tr>
<td>Total reserves in months of imports</td>
<td>months</td>
<td>3.2</td>
<td>2.6</td>
<td>1.6</td>
<td>1.4</td>
<td>2.5</td>
<td>2.1</td>
<td>2.5</td>
<td>1.9</td>
<td>2.3</td>
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</table>

### Rates and Inflation

<table>
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<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Exchange rate</td>
<td>USD/VND</td>
<td>17,676</td>
<td>19,158</td>
<td>20,729</td>
<td>20,623</td>
<td>21,090</td>
<td>20,957</td>
<td>21,973</td>
<td>21,916</td>
<td>22,351</td>
<td>23,311</td>
</tr>
<tr>
<td>Inflation rate, consumer prices</td>
<td>%</td>
<td>23.1</td>
<td>7.1</td>
<td>8.9</td>
<td>18.7</td>
<td>9.1</td>
<td>6.6</td>
<td>4.7</td>
<td>0.9</td>
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### Transportation

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<th></th>
<th></th>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of passengers carried</td>
<td>million</td>
<td>1,794</td>
<td>2,017</td>
<td>2,315</td>
<td>2,476</td>
<td>2,677</td>
<td>2,840</td>
<td>3,057</td>
<td>3,311</td>
<td>3,623</td>
<td>3,994</td>
</tr>
<tr>
<td>Volume of freight carried</td>
<td>million tons</td>
<td>653</td>
<td>716</td>
<td>801</td>
<td>886</td>
<td>961</td>
<td>1,010</td>
<td>1,079</td>
<td>1,147</td>
<td>1,255</td>
<td>1,379</td>
</tr>
</tbody>
</table>

**Note:** GDP - Gross Domestic Product. FDI - Foreign Direct Investment. ILO - International Labour Organization. GINI index measures the extent to which the distribution of income (or, in some cases, consumption expenditure) among individuals or households within an economy deviates from a perfectly equal distribution.

## Appendix 2. Assessment of the North-South expressway by provincial sections

<table>
<thead>
<tr>
<th>Code</th>
<th>Section</th>
<th>Length (km)</th>
<th>PCU (000/day)</th>
<th>Cost (US$ mil/km)</th>
<th>EIRR (%)</th>
<th>FIRR (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>H01</td>
<td>Ninh Binh-Thanh Hoa</td>
<td>75</td>
<td>80.1</td>
<td>11</td>
<td>15.3</td>
<td>8.3</td>
</tr>
<tr>
<td>H02</td>
<td>Thanh Hoa-Vinh</td>
<td>140</td>
<td>57.2</td>
<td>15.2</td>
<td>12.1</td>
<td>6.5</td>
</tr>
<tr>
<td>H03</td>
<td>Vinh-Ha Tinh</td>
<td>20</td>
<td>45.7</td>
<td>10.1</td>
<td>17</td>
<td>12.6</td>
</tr>
<tr>
<td>H04</td>
<td>Ha Tinh-Quang Tri</td>
<td>277</td>
<td>38.3</td>
<td>9.5</td>
<td>9.9</td>
<td>5.2</td>
</tr>
<tr>
<td>H05</td>
<td>Quang Tri-Hue</td>
<td>73</td>
<td>41.2</td>
<td>9.8</td>
<td>12.5</td>
<td>7.5</td>
</tr>
<tr>
<td>H06</td>
<td>Hue-Da Nang</td>
<td>105</td>
<td>37.5</td>
<td>16.9</td>
<td>10.3</td>
<td>3.5</td>
</tr>
<tr>
<td>H07</td>
<td>Quang Ngai-Quy Nhon</td>
<td>150</td>
<td>35.6</td>
<td>11.9</td>
<td>10.3</td>
<td>5.2</td>
</tr>
<tr>
<td>H08</td>
<td>Quy Nhon-Nha Trang</td>
<td>240</td>
<td>36.4</td>
<td>14.1</td>
<td>8.9</td>
<td>3.9</td>
</tr>
<tr>
<td>H09</td>
<td>Nha Trang-Phan Thiet</td>
<td>280</td>
<td>23.7</td>
<td>10.3</td>
<td>8</td>
<td>2.6</td>
</tr>
<tr>
<td>H10</td>
<td>Long Thanh-Nhon Trach-Ben Luc</td>
<td>45</td>
<td>30.2</td>
<td>16.4</td>
<td>15.9</td>
<td>5.4</td>
</tr>
<tr>
<td>H30</td>
<td>Ring Road No.4 in Ha Noi</td>
<td>90</td>
<td>7.7</td>
<td>15</td>
<td>14.5</td>
<td>8</td>
</tr>
<tr>
<td>H32</td>
<td>Ring Road No.3 in HCMC</td>
<td>83</td>
<td>47.2</td>
<td>14.8</td>
<td>13.7</td>
<td>10.9</td>
</tr>
<tr>
<td>CH01</td>
<td>Cau Gie-Ninh Binh</td>
<td>50</td>
<td>73.3</td>
<td>9</td>
<td>18.1</td>
<td>12.6</td>
</tr>
<tr>
<td>CH02</td>
<td>Da Nang-Quang Ngai</td>
<td>131</td>
<td>39.6</td>
<td>8</td>
<td>11.3</td>
<td>8</td>
</tr>
<tr>
<td>CH03</td>
<td>Phan Thiet-Gia Ray</td>
<td>100</td>
<td>39.6</td>
<td>19.1</td>
<td>11.9</td>
<td>6.8</td>
</tr>
<tr>
<td>CH04</td>
<td>HCMC-Long Thanh-Dau Giay</td>
<td>55</td>
<td>74.9</td>
<td>20.2</td>
<td>15.5</td>
<td>8.8</td>
</tr>
<tr>
<td>CH05</td>
<td>HCMC-Trung Luong</td>
<td>40</td>
<td>67.8</td>
<td>19.4</td>
<td>15.1</td>
<td>8.6</td>
</tr>
<tr>
<td>CH06</td>
<td>Trung Luong-My Thuan-Can Tho</td>
<td>92</td>
<td>39.1</td>
<td>16.4</td>
<td>11.3</td>
<td>2.8</td>
</tr>
</tbody>
</table>

**Note:** PCU - Passenger Car Unit. EIRR - Economic Internal Rate of Return. FIRR - Financial Internal Rate of Return.

**Source:** Almec Corporation, Oriental Consultants Co. Ltd., and Nippon Koei Co. Ltd., “The Comprehensive Study On The Sustainable Development Of Transport System In Vietnam (VITRANSS 2).”
Appendix 3. Map of the North-South expressway

Source: Lao Dong Online, “North-South Expressway: Where is the money?”; VnExpress, “8 North-South Expressway sub-projects about to be built.”
Appendix 4. Map of the Mai Son-QL45 expressway

**Location:** Ninh Binh and Thanh Hoa provinces  
**Length:** 63.4 km  
**Width:** 17 m  
**Number of lanes:** 4 (expandable to 6)

**Segment 1 (Mai Son - Dong Giao):** 5.5 km  
**Segment 2 (Dong Giao - Gia Mieu):** 15.8 km  
**Segment 3 (Gia Mieu - Ha Linh):** 11.0 km  
**Segment 4 (Ha Linh - Dong Xuan):** 21.1 km  
**Segment 5 (Dong Xuan - QL45):** 10 km

**Source:** Transport Engineering Design Inc (TEDI), “Mai Son-QL45 Expressway Project Feasibility Study.”
## Appendix 5. Adjustments to assumptions in the original Financing Scenario

<table>
<thead>
<tr>
<th>Category</th>
<th>Assumption</th>
<th>Original Financing Scenario</th>
<th>Adjusted value</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General</strong></td>
<td>Current year of study</td>
<td>2021</td>
<td>2020</td>
<td>2020 is when debt and equity funds start to be disbursed, according to the original Financing Scenario.</td>
</tr>
<tr>
<td></td>
<td>Construction period</td>
<td>2.5 years (1/2020-6/2022)</td>
<td>Same</td>
<td>Follow original Financing Scenario’s assumption.</td>
</tr>
<tr>
<td></td>
<td>Operation period</td>
<td>22.57 years (7/2022-1/2045)</td>
<td>23.5 years (7/2022-12/2045)</td>
<td>Adjustment made in order to make NPV calculations consistent.</td>
</tr>
<tr>
<td>Risk-free rate ($R_f$)</td>
<td>5.2%</td>
<td>Same</td>
<td>Follow original Financing Scenario’s assumption: Risk-free rate is average of government 20-year bond rates over the last 6 months.</td>
<td></td>
</tr>
<tr>
<td>Cost of debt ($R_d$)</td>
<td>7.8%</td>
<td>10.9%</td>
<td>The original value mandated by the Ministry of Finance is 1.5 times of the risk-free rate. This has been reported to be below the typical market rate of 10.8-11%. The middle value of 10.9% was adopted.</td>
<td></td>
</tr>
<tr>
<td>Cost of equity ($R_e$)</td>
<td>11.8%</td>
<td>16.0%</td>
<td>The original Financing Scenario estimated the cost of equity based on the average equity rate of return in 67 past BOT projects in Vietnam. However, foreign investors have asked for a higher range of 15-17%. This is consistent with the target IRR of greenfield infrastructure funds.</td>
<td></td>
</tr>
<tr>
<td>WACC</td>
<td>8.6%</td>
<td>12.1%</td>
<td>Calculated using the costs of debt and equity.</td>
<td></td>
</tr>
<tr>
<td>Debt IRR</td>
<td>7.4%</td>
<td>9.9%</td>
<td>Calculated based on cash flows to debt holders. Debt IRR is slightly lower than Cost of Debt because during the construction period, interests are calculated monthly but are compounded quarterly according to the original Financing Scenario (refer to the financial model for detailed calculations).</td>
<td></td>
</tr>
<tr>
<td>Equity IRR</td>
<td>10.6%</td>
<td>7.1%</td>
<td>Calculated based on cash flows to equity holders.</td>
<td></td>
</tr>
<tr>
<td>Project IRR</td>
<td>8.1%</td>
<td>8.3%</td>
<td>Calculated based on combined cash flows to both debt and equity holders.</td>
<td></td>
</tr>
<tr>
<td>Project NPV</td>
<td>VND -395 billion</td>
<td>VND -2,467 billion</td>
<td>Calculated based on combined cash flows to both debt and equity holders.</td>
<td></td>
</tr>
</tbody>
</table>

---


<table>
<thead>
<tr>
<th>Funding</th>
<th>Pre-construction</th>
<th>Government subsidy does not cover some small pre-construction costs</th>
<th>Does not consider these costs in NPV calculations</th>
<th>Adjustment made in order to make NPV calculations consistent.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total subsidy</td>
<td>VND 3,169 trillion</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
<td></td>
</tr>
<tr>
<td>Land acquisition cost</td>
<td>All land acquisition cost is covered by government subsidy</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
<td></td>
</tr>
<tr>
<td>Debt principal funding (D)</td>
<td>VND 6,472 billion</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
<td></td>
</tr>
<tr>
<td>Debt interest during construction period</td>
<td>Calculated based on the Ministry of Finance’s stipulated rate</td>
<td>Calculated based on market rate</td>
<td>Cost of debt adjusted to reflect more realistic rate (see above).</td>
<td></td>
</tr>
<tr>
<td>Initial equity funding (E)</td>
<td>VND 1,950 billion</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
<td></td>
</tr>
<tr>
<td>Construction VAT refund</td>
<td>VND 752 billion</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
<td></td>
</tr>
<tr>
<td>Disbursement schedule</td>
<td>Debt interest is calculated monthly and compounded quarterly</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
<td></td>
</tr>
<tr>
<td>Cost</td>
<td>Construction</td>
<td>Refer to the financial model for detailed cash flow</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
</tr>
<tr>
<td></td>
<td>Operation &amp; maintenance</td>
<td>Refer to the financial model for detailed cash flow</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
</tr>
<tr>
<td></td>
<td>VAT Tax</td>
<td>Currently at 10% as stipulated by Vietnamese law Refer to the financial model for detailed cash flow</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
</tr>
<tr>
<td></td>
<td>Corporate Tax</td>
<td>Tax exemptions and reductions stipulated by Vietnamese law Refer to the financial model for detailed cash flow</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
</tr>
<tr>
<td>Revenue</td>
<td>Traffic</td>
<td>Refer to the financial model for detailed base case projection</td>
<td>The base case of traffic is assumed to follow geometric Brownian motion</td>
<td>The base case projection is remodeled in order to introduce uncertain drivers.</td>
</tr>
<tr>
<td></td>
<td>Toll rate</td>
<td>Fixed toll rate schedule stipulated by Vietnamese law</td>
<td>Same</td>
<td>Follow original Financing Scenario's assumption.</td>
</tr>
<tr>
<td></td>
<td>Exchange rate</td>
<td>None</td>
<td>The base case of the exchange rate is assumed to follow geometric Brownian motion</td>
<td>A base case of the exchange rate was modeled to introduce exchange rate risk from the view of foreign investors.</td>
</tr>
<tr>
<td>Repayment</td>
<td>Repayment schedule</td>
<td>Debt and Equity holders are repaid concurrently based on initial Debt/Equity ratio</td>
<td>20-year senior debt with fixed principal repayment amount. If cash available is not enough to cover debt obligations, equity holders will have to contribute additional funding</td>
<td>Length of debt is typical of commercial loans available from domestic banks for past BOT projects and is aligned with the length of government’s long-term bond used to estimate the risk-free rate.</td>
</tr>
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</table>
## Appendix 6. Mai Son-QL45 expressway project cash flows under the base case scenario

<table>
<thead>
<tr>
<th>Project Year</th>
<th>Calendar Year</th>
<th>Preparation &amp; Construction Costs</th>
<th>Construction VAT refund</th>
<th>Toll Revenue</th>
<th>O&amp;M Costs</th>
<th>Taxes</th>
<th>Principal</th>
<th>Interest</th>
<th>Equity</th>
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<tbody>
<tr>
<td>1</td>
<td>2020</td>
<td>(3,149)</td>
<td>216</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1,700</td>
<td>72</td>
<td>1,231</td>
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<tr>
<td>2</td>
<td>2021</td>
<td>(4,494)</td>
<td>358</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>3,357</td>
<td>403</td>
<td>506</td>
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<tr>
<td>3</td>
<td>2022</td>
<td>(2,043)</td>
<td>260</td>
<td>249</td>
<td>(39)</td>
<td>(19)</td>
<td>1,009</td>
<td>(48)</td>
<td>743</td>
</tr>
<tr>
<td>4</td>
<td>2023</td>
<td></td>
<td></td>
<td>541</td>
<td>(83)</td>
<td>(42)</td>
<td>(405)</td>
<td>(751)</td>
<td>740</td>
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<tr>
<td>5</td>
<td>2024</td>
<td></td>
<td></td>
<td>665</td>
<td>(88)</td>
<td>(52)</td>
<td>(405)</td>
<td>(707)</td>
<td>588</td>
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<td>2025</td>
<td></td>
<td></td>
<td>721</td>
<td>(92)</td>
<td>(57)</td>
<td>(405)</td>
<td>(663)</td>
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<td>2026</td>
<td></td>
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<td>783</td>
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<td>(57)</td>
<td>(405)</td>
<td>(619)</td>
<td>455</td>
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<td>949</td>
<td>(103)</td>
<td>(77)</td>
<td>(405)</td>
<td>(574)</td>
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<td>2028</td>
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<td></td>
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<td>(437)</td>
<td>(54)</td>
<td>(405)</td>
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<td>(118)</td>
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<td>(405)</td>
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<td>(405)</td>
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<td>(148)</td>
<td>(172)</td>
<td>(405)</td>
<td>(265)</td>
<td>(656)</td>
</tr>
<tr>
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<td>2035</td>
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<td>(560)</td>
<td>(122)</td>
<td>(405)</td>
<td>(221)</td>
<td>(369)</td>
</tr>
<tr>
<td>17</td>
<td>2036</td>
<td></td>
<td></td>
<td>1,922</td>
<td>(906)</td>
<td>(107)</td>
<td>(405)</td>
<td>(177)</td>
<td>(327)</td>
</tr>
<tr>
<td>18</td>
<td>2037</td>
<td></td>
<td></td>
<td>1,957</td>
<td>(176)</td>
<td>(213)</td>
<td>(405)</td>
<td>(133)</td>
<td>(1,030)</td>
</tr>
<tr>
<td>19</td>
<td>2038</td>
<td></td>
<td></td>
<td>1,993</td>
<td>(180)</td>
<td>(274)</td>
<td>(405)</td>
<td>(88)</td>
<td>(1,046)</td>
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<tr>
<td>20</td>
<td>2039</td>
<td></td>
<td></td>
<td>2,256</td>
<td>(191)</td>
<td>(318)</td>
<td>(405)</td>
<td>(44)</td>
<td>(1,297)</td>
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<tr>
<td>21</td>
<td>2040</td>
<td></td>
<td></td>
<td>2,297</td>
<td>(200)</td>
<td>(464)</td>
<td>(405)</td>
<td>(44)</td>
<td>(1,633)</td>
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<tr>
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<td>(302)</td>
<td>(446)</td>
<td>(405)</td>
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<td>(1,592)</td>
</tr>
<tr>
<td>23</td>
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<td></td>
<td></td>
<td>2,700</td>
<td>(723)</td>
<td>(413)</td>
<td>(405)</td>
<td>(44)</td>
<td>(1,565)</td>
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<td>24</td>
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<td>(44)</td>
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<td></td>
<td></td>
<td>2,801</td>
<td>(243)</td>
<td>(566)</td>
<td>(405)</td>
<td>(44)</td>
<td>(1,992)</td>
</tr>
<tr>
<td>26</td>
<td>2045</td>
<td></td>
<td></td>
<td>2,852</td>
<td>(258)</td>
<td>(574)</td>
<td>(405)</td>
<td>(44)</td>
<td>(2,021)</td>
</tr>
</tbody>
</table>

**Note:** VAT - Value Added Tax. Numbers are in VND billion.

**Source:** Transport Engineering Design Inc (TEDI), “Mai Son-QL45 Expressway Project Feasibility Study”; Author’s analysis.
Appendix 7. Assumptions in traffic and exchange rate risk models

<table>
<thead>
<tr>
<th></th>
<th>Traffic risk</th>
<th>Exchange rate risk</th>
</tr>
</thead>
</table>
| **Initial value**   | $\mu = 915,724$
                      $\text{Standard deviation} = 25\%$                                      | $\mu = 23,203$
                      $\text{Standard deviation} = 2.25\%$

The expected value of the initial traffic in 2020 ($\mu$) was taken from original base case scenario,\(^{114}\) with uncertainty following a triangular probability distribution, in which standard deviation reflects typical of traffic forecast error in international toll road projects.\(^{115}\)

Annual growth rate/depreciation rate

|                     | 2022-2030: 8.20%  
                        | 2030-2045: 1.88% |
|---------------------|------------------|
|                     | Compound Annual Growth Rate of original base case traffic projection, incorporating any significant change in the overall trend |
|                     | 1.42% |
|                     | Compound Annual Growth Rate of USD/VND exchange rate after the 2008-10 financial crisis |

Volatility

<table>
<thead>
<tr>
<th></th>
<th>$\sigma = 3.09%$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>The standard deviation of original base case traffic annual growth rates</td>
</tr>
<tr>
<td></td>
<td>$\sigma = 2.25%$</td>
</tr>
<tr>
<td></td>
<td>The standard deviation of USD/VND volatility after the 2008-10 financial crisis</td>
</tr>
</tbody>
</table>

Random factor

<table>
<thead>
<tr>
<th></th>
<th>$z \sim N(0,1)$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Random factor follows a standard normal distribution</td>
</tr>
<tr>
<td></td>
<td>$z \sim N(0,1)$</td>
</tr>
<tr>
<td></td>
<td>Random factor follows a standard normal distribution</td>
</tr>
</tbody>
</table>

---

\(^{114}\) Transport Engineering Design Inc (TEDI), “Mai Son-QL45 Expressway Project Feasibility Study.”

\(^{115}\) Bain, “Error and Optimism Bias in Toll Road Traffic Forecasts.”

## Appendix 8. Assumptions in policy options

<table>
<thead>
<tr>
<th>Assumptions</th>
<th>Justification</th>
</tr>
</thead>
<tbody>
<tr>
<td>The private partner is a foreign equity investor</td>
<td>The government is specifically hoping to attract foreign investors, whose concern about exchange rate risk would need to be considered. While the perspective of debt investors is important, they are typically less vulnerable to revenue risk than equity investors due to the seniority of debt over equity.</td>
</tr>
<tr>
<td>For all policy options, collection risk is quantitatively negligible</td>
<td>While collection risk may have been significant for BOT projects in Vietnam over the past few years, there is currently a significant public pressure on the government to mandate the installation of automated toll collection systems. As the North-South expressway project is expected to utilize this technology, collection risk can be assumed to be relatively minimized compared to other revenue risk drivers.</td>
</tr>
<tr>
<td>For Least Present Value of Revenue, concession period risk is quantitatively negligible</td>
<td>For comparability among all policy options, the concession period needs to be fixed. For Least Present Value of Revenue, it is assumed that actual traffic follows the base case traffic projection within the given concession period.</td>
</tr>
<tr>
<td>For Exchange Rate Guarantee, the government compensates the private sector when VND depreciates against USD by more than 1.42%. On the other hand, the private sector compensates the government when VND appreciates against USD by more than 1.42%.</td>
<td>1.42% is Compound Annual Growth Rate of USD/VND exchange rate after the 2008-10 financial crisis.</td>
</tr>
<tr>
<td>For Public Toll Collection and Availability Payment, the government collects tolls and assumes the cost of the toll collection process</td>
<td>While in some countries there is no toll collection under these arrangements, it is likely that the Vietnamese government would still need to collect tolls to recover the cost of payments to the private sector, given the current budget constraints and the comparability with other policy options.</td>
</tr>
<tr>
<td>For Revenue Guarantee, the government compensates the private sector when actual revenue is less than the base case scenario by more than 23.2% of the base case scenario. On the other hand, the private sector compensates the government when actual revenue is more than the base case scenario by more than 23.2% of the base case scenario.</td>
<td>23.2% is the initial equity funding contribution ratio. This threshold follows the principle that the minimum revenue guarantee should cover debt holders but leave equity holders exposed to revenue risk in order to maintain their incentives for operational efficiency.</td>
</tr>
</tbody>
</table>
Appendix 9. Monte Carlo simulation results for Fiscal Effect

Net Present Value Fiscal Effect - Exchange Rate Guarantee

- Mean: -130
- Minimum: -1,549
- Maximum: 963
- CFaR (95% CI): -425
- Iterations: 10,000

Net Present Value Fiscal Effect - Revenue Guarantee

- Mean: 1,743
- Minimum: -8,351
- Maximum: 71,468
- CFaR (95% CI): -4,069
- Iterations: 10,000

Net Present Value Fiscal Effect - Availability Payment

- Mean: 2,716
- Minimum: -11,266
- Maximum: 76,218
- CFaR (95% CI): -6,791
- Iterations: 10,000
Appendix 10. Sensitivity analysis for Fiscal Effect

Net Present Value Fiscal Effect - Exchange Rate Guarantee

VND billion

Random exchange rate factor
Initial exchange rate

Mean = -133

Input high
Input low

Net Present Value Fiscal Effect - Revenue Guarantee

VND billion

Random traffic factor
Initial traffic

Mean = 1,743

Input high
Input low

Net Present Value Fiscal Effect - Availability Payment

VND billion

Random traffic factor
Initial traffic

Mean = 2,716

Input high
Input low

Note: Model variables are ranked by their effects on output mean.
Appendix 11. Monte Carlo simulation results for Investment Attractiveness

Net Present Value Equity - Full Concession / Public Toll Collection

- Mean: 91
- Minimum: 479
- Maximum: 3,580
- Standard Deviation: 277
- Iterations: 10,000

Net Present Value Equity - Least Present Value of Revenue

- Mean: 35
- Minimum: -89
- Maximum: 1,028
- Standard Deviation: 91
- Iterations: 10,000

Net Present Value Equity - Exchange Rate Guarantee

- Mean: 82
- Minimum: -532
- Maximum: 3,580
- Standard Deviation: 274
- Iterations: 10,000

Net Present Value Equity - Revenue Guarantee

- Mean: 22
- Minimum: -857
- Maximum: 1,130
- Standard Deviation: 113
- Iterations: 10,000

Net Present Value Equity - Availability Payment

- Mean: 11
- Minimum: -36
- Maximum: 306
- Standard Deviation: 25
- Iterations: 10,000
Appendix 12. Sensitivity analysis for Investment Attractiveness

**Net Present Value Equity - Full Concession / Public Toll Collection**

USD million

- Random traffic factor -197 → 570
- Random exchange rate factor -43 → -307
- Initial traffic -15 → 183
- Initial exchange rate 68 → 93

Mean = 81

**Net Present Value Equity - Least Present Value of Revenue**

USD million

- Random exchange rate factor -63 → 239
- Initial exchange rate 30 → 38

Mean = 35

**Net Present Value Equity - Exchange Rate Guarantee**

USD million

- Random traffic factor -195 → 573
- Random exchange rate factor -30 → 292
- Initial traffic -13 → 185
- Initial exchange rate 70 → 95

Mean = 83

**Net Present Value Equity - Revenue Guarantee**

USD million

- Random exchange rate factor -68 → 211
- Random traffic factor -49 → 102
- Initial traffic -18 → 62
- Initial exchange rate 17 → 26

Mean = 22

**Net Present Value Equity - Availability Payment**

USD million

- Random exchange rate factor -24 → 76
- Initial exchange rate 9 → 12

Mean = 11

**Note:** Model variables are ranked by their effects on output mean.


CPV Central Committee, Chủ Trưởng, Giải Pháp Cơ Cấu Lai Ngắn Sách Nhà nước, Quản Lý Nghi Công Để Bảo Đảm Nên Tài Chính Quốc Gia An Toàn, Bên Vững, Resolution 07-NQ/TW § (2016).


