

**EVALUATION OF PUBLIC PRIVATE
PARTNERSHIP FOR INFRASTRUCTURE
PROVISION**

**A Synopsis of the Thesis
Submitted to Jadavpur University
For the Degree of
Doctor of Philosophy (Arts)**

Bara Aman Appolinus

SUPERVISOR
Professor Bidisha Chakraborty

Department of Economics
Jadavpur University
Kolkata-700032, India

2022

A well-functioning infrastructure network is the backbone of an economy and an inadequate supply of infrastructure could lead economies to decelerate in growth and development. Therefore, the study of the infrastructure-growth nexus is important. Governments around the world are struggling to achieve faster economic growth and development by improving their basic infrastructure sector. With traditional or the pure public provision of infrastructure, the governments built, owned and managed infrastructure capital themselves. However, in the traditional mode of provision, several inefficiencies were reported that included the delay in the provision of infrastructure, under-supply of finances to build infrastructure, cost overruns or white elephants, poor maintenance of crippling infrastructure, corruption and use of out-of-date technology, etc. The infrastructure health seemed to have been crumbling for many nations and pure provision has not been able to set it right and bring in the solution for this. The qualitative and quantitative shortages increased more and more with the reliance on the traditional mode of infrastructure provision. But, while the economies struggled with the infrastructure bottlenecks, the need for adequate good quality infrastructure for both the developed and developing nations never stopped growing. To meet such enormous demand became impossible for the financing capacities of many governments. The nature of infrastructure investment is such that it requires large upfront sunk cost and good maintenance costs in the long run. Governments realised that the participation of the private sector in the provision of infrastructure could lessen the burden on the public budget and public funds could be released to the other priority sectors of the economies. The private players were also asked and encouraged to participate in the provision of infrastructure. Hence, the role of the state changed from producer to subsidy provider to the financier of the partial cost of infrastructure production. The underperforming economies, those who suffered infrastructure bottlenecks and had the quality of infrastructure far below the international level increasing adopted the PPP (Public-Private Partnership) projects in the infrastructure

sector with much enthusiasm in the 1990s. PPP had been adopted by the governments of world economies with the hope to bridge the gap between demand and supply and to remove the backlogs in the infrastructure provision. Such that, PPPs have either complemented the public provisions or replaced them in the highways, railways, airports, energy and electricity, hospitals and schools, etc. Thus, with the help of PPP, the financially constrained governments can indulge in the provision of qualitative impure public goods even with their own budgetary constraint, which was impossible under public provision because of the credit constraint. A PPP is a partnership effort by a private party and the public entity. Here, the public entity is the decision-maker, who engages the private sector to a greater degree in the functions which were entirely handled by them previously and now the latter merely provide different types of support, such as financial support, regulatory laws, etc while protecting the interest of both producers and consumers. In a PPP, the private firm provides the resources, management skills and technology. However, it was asserted in a report by the Public-Private-Partnership Legal Resource Centre, World Bank Group that very few PPP projects are viable without some form of government support. Without any government intervention, private provision of infrastructure may also lead to the under-provision of the infrastructure capital.

The requirement of a quality infrastructure asset at affordable costs is much more needed for a developing country, but the question remains whether the increased participation of private players in the provision of infrastructure is good or bad for the developing economies. However, the infrastructure provision by the PPP mode is regarded as a viable option if not a superior alternative mode of provision of infrastructure. Despite the opposing views in the developing economies regarding the provision of infrastructure through PPP mode, there exists a negligible engagement in the academic literature by the economists about the issues

related to PPP. Bennet and Iossa (2006), Besley and Ghatak (2001), Iossa and Martimort (2015) and others have studied the PPP mode of infrastructure provision in a microeconomic framework. This thesis aims to fill the gap in the literature and evaluate the performance of PPP from the macroeconomic policy point of view and thus study the functionality of PPP in the infrastructure-growth nexus in the long run. According to Lee et al. (2018), the infrastructure-growth link becomes stronger due to the better maintenance and delivery of infrastructure services on time and within budget in the case of PPP projects. The provision of infrastructure by PPP mode gained popularity from not just fiscal and macroeconomic policy considerations but also because it offers productive efficiency translating into higher economic growth. In a PPP, the current government saves in investment outlays, but either relinquishes future user fee revenue or future tax revenues.

Barro (1990) was the earliest of the paper in the endogenous growth theory that studied the infrastructure-growth nexus for the conventional public provision of infrastructure. Barro's main theoretical prediction showed that an increase in government expenditures on infrastructure was associated with higher long-run growth rates and an increase in resources devoted to non-productive government consumption was associated with lower per-capita growth. Many authors like Greiner and Hanusch (1998), Mourmouras and Lee (1999), Turnovsky and Fischer (1995), Engen and Skinner (1992), Futagami et al. (1993), Tsoukis and Miller (2003), Ghosh and Mourmouras (2002), etc have extended Barro (1990). However, none of these papers has evaluated the PPP provision of infrastructure. To fill the gap in the literature, this thesis focuses on the supply-side economics of the infrastructure provision in the endogenous growth theory. We exclude labour as a factor of production because infrastructure is a capital-intensive sector and the inclusion of labour will only complicate the model without giving a valid conclusion from the study.

Chapter 1: Introduction and literature survey

Chapter one presents the introduction, literature survey and motivation underlying the assumptions made in the models of the present thesis. This chapter entails the need for an efficient quality and quantity of infrastructure goods and the requirement for evaluating the excludable impure public goods such as infrastructure provided through the PPP mode. A rich literature on the public provision of infrastructure has been explored in chapter one. Here, we give an extensive survey of the existing pieces of literature on the topics such as: PPP mode of provision in microeconomic frameworks, a comparative study between the PPP and traditional mode of provision, infrastructure-growth nexus and public provision of infrastructure in the endogenous growth theories, varying degree of substitutability between the public capital and private capital, public goods as stock and flow, financing of the public provision of infrastructure - especially under the balanced budget and debt policies of the government, foreign assistance and FDI acquired for the provision of infrastructure and impact of corruption in the provision of infrastructure. In section 1.8, we present the outline of the present thesis.

Chapter 2: Is Public-Private Partnership an optimal mode of provision of infrastructure?

Chapter two is an extension of Barro (1990) and like Barro, we consider infrastructure good as a flow variable. Here, an endogenous growth model includes both the private capital and the public capital to study their role in the infrastructure provision and consequently their impact on the growth of the economy. Chatterjee and Morshed (2011), Barro and Sala-i-Martin (1992), both, made a comparative study of the public provision and private provision of infrastructure but the focus of their study was not PPP mode of provision. Here, in this chapter we do a comparative study of two cases where private capital and public capital are used as complementary goods and substitutes goods in infrastructure production. A growth-maximizing and optimal fiscal policy are found in a balanced budget framework. Finding the right mode of infrastructure provision is a difficult task for the governments of most countries. Therefore, the evaluation of the optimal mode of provision of infrastructure could be an important subject of study to close the gap between the demand and supply of infrastructure. Hence, chapter two has tried to find whether the financing of infrastructure provision through the PPP mode of provision is optimal or not. Barro (1990), Futagami et al. (1993), Fischer and Turnovsky (1998), Devarajan et al. (1998), Bucci and Bo (2012) have considered the private and public capital in the production of final output but they did not find the growth maximizing tax rate and optimal tax rate in a command economy and have not compared the competitive and command economies.

Bom and Ligthart (2014), Chen and Guo (2016) also studied the dynamic macroeconomic effects of public infrastructure investment under a balanced budget fiscal rule. However, these previous works have not considered the possibility of PPP investment for infrastructure provision. We studied the steady state growth paths for competitive and command economies

for both complementary and substitute cases under the balanced budget fiscal rule assumption in this chapter. We have also analysed the transitional dynamics properties for both substitute and complementary case which were studied by none previously. We also do a comparative static analysis for the properties of steady-state growth equilibrium of competitive economy and command economy for both the complementary and substitute cases. We obtain a few important results from our models in this chapter. Similar to Dasgupta (1999), we found that the command economy growth rate may be less than that of a competitive economy for the complementary relation between private and public capital. But, in the case of a perfect substitute relationship between public and private investment, the command economy growth rate is always higher than the competitive economy growth rate. However, when private capital and public capital are perfect substitutes for each other, the growth-maximizing tax rate is zero. We find a unique, interior growth-maximizing tax rate and an optimal tax rate for the complementary relationship between private investment and public investment. The crux of the model shows that PPP is always an optimal solution for financing infrastructure no matter the relationship between the private capital and public capital are substitute or complements but PPP is not growth maximizing in the case when public capital and private capital are perfect substitutes.

Chapter 3: Why should the government provide the infrastructure through the public-private partnership mode?

In chapter 3, we reflect upon the public financing problem of the infrastructure provision because public funds are not freed in the case of PPP, even when private player finances the major portion of a PPP project. Engel et al. (2013) noted in their paper that PPP is closer to the conventional public provision of infrastructure than it is to the privatization because the government's exchequer is not completely relieved even with the participation of private investors for the provision of infrastructure. PPPs affect the intertemporal public budget in much the same way as public provision with public debt. Therefore, infrastructure being a public-policy issue, its evaluation from the macroeconomic perspective is important.

To reverse the declining trend in infrastructure investment, many nations have relied on public debt financing along with tax financing. However, such financing comes with a cost, therefore, the choice of debt policy and the growth performance of nations are affected. History is the witness of nations like the UK and the USA who took a very long time to convert from being borrower to lender (Ueshina (2018), Wijnbergen (1989)). If a nation keeps on accumulating debt, then it may soon find itself in a debt trap and the incapability to pay back its debt has a far damaging effect on growth and development. Therefore, the sustainability of public debt is of utmost importance. In chapter three, following Greiner (2008, 2012) and Kamiguchi and Tamai (2012) we apply the primary surplus rule. In a primary surplus rule, it is assumed that while the government runs a deficit budget, it must set the primary surplus as a positive linear function of public debt, which guarantees that the public debt is sustainable. The crux from the papers who applied the primary surplus rule, such as Greiner (2008, 2012, 2014), Kamiguchi and Tamai (2012), and others reveals that when the debt ratio was smaller, the growth rate was higher and a balanced budget yielded a

higher long-run growth rate than an accumulating debt budget policy. However, none of these papers studied the sustainability of public debt in the PPP provision of infrastructure.

Chapter 3 develops an endogenous growth model with the non-rival but excludable public goods. We seek to answer the question that whether this kind of infrastructure should be provided by a pure private firm or purely by the state or by Public-Private Partnership (PPP). This chapter also addresses the question that if the government invests in this type of infrastructure, how should it finance the manufacturing cost - through accumulating debt or by imposing a tax or charging user fees? Also, we study the public and PPP provision under the three budgetary regimes of the government: (a) zero debt (b) constant debt and (c) accumulating debt regimes.

Our model finds that pure private provision of infrastructure yields higher growth rate compared to pure public provision. In this chapter, we find that the growth rate under the pure private provision is higher compared to that in pure public provision. We also find that under the balanced budget when the government charges user fees and imposes tax to finance the infrastructure cost, the growth maximizing tax rate is zero. However, under the accumulating debt regime, the growth maximizing tax rate is positive. It is also found that the maximum growth rate in the public provision of infrastructure under the accumulating debt regime is greater than the growth rate in the pure private provision or pure public provision of infrastructure under the balanced budget regime if primary surplus does not react to changes in GDP and changes in public debt strongly. This result contradicts the result found by Greiner (2014) that says the growth rate obtained under a balanced budget is always greater than that obtained under a deficit budget. When the government provides infrastructure charging user fees, imposing tax and also issuing the bond, the steady-state equilibrium

involves high public debt. The interest payment of the past accumulated public debt has a positive effect on the growth of public debt and has a negative effect on the GDP growth rate. The sustainable public debt for the provision of the impure public good justifies the adoption of PPP mode for the infrastructure provision. We also find that PPP yields a higher growth rate compared to public provision of infrastructure for both, under a balanced budget and accumulating debt. In the numerical example, we find that the PPP projects with more than 50% of investment by the private firm yield the highest growth rate.

Chapter 4: Does corruption affect the inflow of foreign capital in the Public-Private Partnership provision of infrastructure in a small open economy?

FDI has been well received in the infrastructure sector of the host countries through the PPP mode to build efficient and good quality infrastructure. The foreign inflow of capital through the PPP mode are considered to bring in the host countries, the financial resources and superior technology. According to Germaschewski (2016), domestic firms lag behind in technology and do not have financial resources to build the infrastructure of the international standards. The World Bank PPI database shows that foreign capital and domestic private capital are indeed found to be complementary goods in the infrastructure sector in developing countries. We find that corruption is a frequent occurrence for international investors (World Bank Study (1999)). Corruption could not have a favourable effect on growth and FDI. However, we find that authors have a different opinion regarding the effect of corruption on the FDI inflow. D'agostino et al. (2016), Cieslik & Goczek (2018) and Fredriksson et al. (2003), etc found that corruption had a negative effect on growth and FDI. On the other hand, Banerjee et al. (2006), Habib and Zurawicki (2002) and Alemu (2012) found that highly corrupt nations like India, China, Brazil, Philippines, Thailand, Nigeria and Mexico were found to be doing well in attracting the FDI in infrastructure. According to Belgibayeva and Plekhanov (2015), most investors view corruption as an obstacle, but some see it as a helpful tool for getting around the rules and regulations. However, it cannot be denied that corruption tolerable level of investment has a quality-adjustment effect on the infrastructure of the host country, if not an entry deterring effect on the foreign investors. But, the relationship between FDI and corruption together in a PPP project in infrastructure and its effect on growth was never studied by the previous authors. Germaschewski (2016) contribute to the literature of PPP in an endogenous growth framework by exploring the economic impact of PPP provision with foreign capital inflow and PPP with domestic financed infrastructure investment.

However, he does not discuss the possibility of corruption in such type of PPP model which might have a possible deleterious effect on the economy. According to Monte and Papagni (2001), the PPP model can spawn corruption when both corrupt parties in the PPP model benefit but in the process, the economy is harmed. Therefore, in our model, we assume that when an infrastructure project contract is issued out of the corrupt deal, the foreign investor compromises on the quality of the infrastructure production. It has been found for the traditional mode of provision of infrastructure that, when a government is engaged in corruption, it compromises the quality of goods and services it delivers (Coppier et al. (2013), Monte and Papagni (2001), Aghion et al. (2016)). In this chapter, the corrupt government and corrupt bureaucrats are subsumed into a single entity as a non-benevolent government. Literature on corruption suggests that bureaucratic corruption reduces the amount, efficiency and quality of public capital (Coppier et al. (2013), Monte and Papagni (2001), Lin and Zhang (2009)). But, are developing countries reaping the benefits from the joint venture between foreign and domestic investors? Does corruption cause any hindrance to the inflow of foreign capital? And, what effect corruption has on the growth rate in the presence of FDI in infrastructure?

In chapter 4, we build a theoretical model comprised of the corruption-inherent quality-adjusted or the quality-compromised investment in a PPP model with flow and stock concepts of infrastructure services. This chapter suggests that in a small open economy, there is a positive relationship between fraction of domestic capital used in corruption free final output sector and corruption in infrastructure sector. We also find that corruption in the infrastructure sector has a damaging effect on the growth rate and also on foreign capital inflow through the PPP projects in infrastructure sector for both the stock and flow concept of infrastructure provision of host country. This result is similar to the results found for the

relationship between corruption and foreign capital inflow by Cuervo-Cazurra (2008), Fredriksson et al. (2003), Coppier et al. (2013), and Cieslik and Goczek (2018).

We also obtain an optimal bribe for which the consumption of the non-benevolent government relative to the host country's final output is maximized when infrastructure capital is a stock capital. We also find that there exists a positive relationship between corruption and the host country's aggregate output relative to the foreign capital inflow for the PPP mode of provision of infrastructure in a small open economy. However, for the domestic output to be positive, a bribe must be less than a critical level.

Chapter 5: Conclusion

Chapter 5 is the last chapter of this thesis, where the results and findings are discussed and summarized. This chapter also gives an account of the limitations of this thesis and suggests a few other research options relating to the PPP mode of infrastructure provision to be considered for future research.