

Special Feature B

Public Investment as a Stimulus Policy

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This Special Feature reviews the recent literature on public investment and highlights several findings about its effectiveness as a countercyclical policy tool, from theoretical and empirical perspectives. First, the size of the public investment multiplier has been shown to be larger at the effective lower bound of monetary policy than under regular economic conditions. Second, in a low interest rate environment, public investment should be more effective than general government spending as a stimulus tool, as it boosts output via both private demand and aggregate supply channels. Third and finally, in the context of a small open economy like Singapore, the effects of public investment on output depend strongly on the reaction of the real exchange rate to the initial stimulus.

1 Introduction

In the national accounts of developed economies, government spending on goods and services is usually broken down into two categories: government consumption and public investment. The first category includes public servants' salaries and day-to-day operating expenditures. The second usually consists of spending on public infrastructure. In the context of Singapore, examples include the development of new MRT lines, water processing capabilities and seaport infrastructure. In addition, the government has recently announced a plan to issue public debt in the form of Singapore Government Securities to finance public investment in infrastructure, including coastal protection initiatives for climate resilience.

One can think of government consumption as having shorter-term effects than public investment, which generates benefits in the medium to long run. Yet, despite its focus on the long run, public investment has historically been used to stimulate an economy in the short run. This idea to use government spending as short-term stimulus dates back to John Maynard Keynes. Indeed, in Keynes' *General Theory of Employment, Interest and Money*, he famously pushes forward the idea to use government spending as an alternative tool to combat a recession. Back then, this was quite controversial: the consensus was that a recession cannot last forever as prices will fall enough to induce an aggregate demand rebound. This policy of *laissez-faire* was followed during the early stages of the Great Depression, with a dismal track record: up to 25% of the working-age population ended up unemployed. In this context, Franklin D. Roosevelt's creation of the Public Works Administration marked a turning point, as it led to one of the strongest GDP expansions recorded in US history. Notably, Roosevelt's stimulus consisted mostly of public investment in infrastructure (e.g., roads, dams, bridges).

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In this Special Feature, we will review what the economics literature has to say about the effects of public investment as a stimulus tool. The two most recent surges in public investment in developed economies occurred in the context of the Great Recession and the COVID-19 pandemic. In both cases, public investment was increased against a low-interest rate environment. Perhaps more relevant is the fact that these low interest rates were not expected to react to the increase in public investment. This perspective is interesting for Singapore as well, as short-term interest rates in Singapore closely track global interest rates, and as such, one would not expect market interest rates to react after an increase in public investment in Singapore.

We will first see how public investment affects the economy in theory using a standard New Keynesian model as our guiding framework. More specifically, we will describe how the effects of public investment are expected to be different in a low versus normal interest rate environment. We will then move on to what the empirical literature has to say about the effects of public investment. Finally, we will point out that in a small open economy, the focus on fixed interest rates only goes so far: one has to consider the reaction of real exchange rates as well.

2 Public Investment: Theory

In the analysis of the impact of public investment on aggregate macroeconomic variables, greater progress has been made on the theoretical than empirical front, following the observation made by Prescott's (1986) celebrated paper. The seminal reference on the topic is Baxter and King (1993), who studied the theoretical effects of public investment in a standard Real Business Cycle model. They found that public investment has a sizeable multiplier effect, which was later put into perspective in Leeper *et al.* (2009) who showed that the necessary tax adjustments would greatly dampen the long-run effects of better public infrastructure. In that paper, they assume that government investment is financed by a mix of debt, transfers and various distortionary taxes. The common point of these two contributions is that they work with a model that has no role for monetary policy or (endogenous) aggregate demand developments. In the aftermath of the Great Recession and the COVID-19 recession where public investment stimulus policies occurred at the zero lower bound (ZLB) of monetary policy, it has become more difficult to argue that these features can be overlooked.

We set out to fix this shortcoming in Bouakez *et al.* (2017). In that paper, we instead work with a New Keynesian model that features a non-trivial role for both aggregate demand and monetary policy. The government finances its spending via lump-sum taxes. The key result from the paper is that the stance of monetary policy matters a great deal for the size of the public investment multiplier. In fact, we find that if a government tries to stimulate economic activity through public investment in normal times, the effects would be rather disappointing: an additional dollar of public investment would yield strictly less than that in terms of increased GDP. To understand why, we need to dig a bit deeper into the mechanisms associated with public investment.

In a typical New Keynesian model where firms have some degree of market power, higher public investment generally increases aggregate demand. To be more precise, let me define aggregate demand as the sum of private demand (consumption plus investment) and government demand. The government needs to buy goods (say concrete, machinery, etc.) and pay workers to build a new road. This generates higher incomes for suppliers of the goods and workers enjoy a positive income boost. In turn, inflation increases through the aggregate Phillips curve. Whether or not this increase in government demand translates into

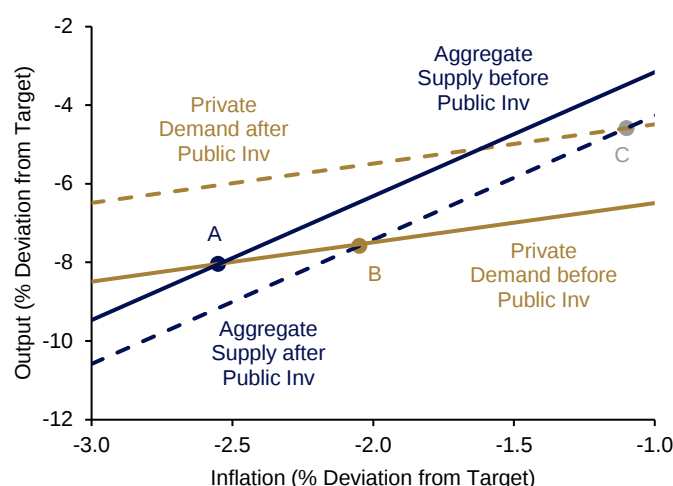
a more than proportional increase in aggregate demand depends on how private demand reacts. This is where the stance of monetary policy comes in. Responding to the higher inflation, the central bank will increase interest rates and thereby dampen the expansionary effects of public investment through a decrease in private demand. The end result is an underwhelming multiplier effect.

Public Investment at the Zero Lower Bound

The story is very different when central banks are stuck with zero interest rates. Indeed, this happens because their desired interest rate is too negative. Increases in public investment will raise inflation and thus push up their desired interest rate. However, in the midst of a deep recession, central banks are highly unlikely to lift their interest rates from zero. As such, the central bank interest rate can be considered as fixed. In this situation, the increase in public demand and inflation that we explained in the preceding paragraph will work to increase private demand as well: aggregate demand increases more than proportionally. Under fixed interest rates, some inflation will reduce the real interest rate. This will push consumers to consume even more given that the real returns on saving have decreased. In turn, firms will increase their prices, which further reduces the real interest rate.

The effects of public investment stimulus at the ZLB are illustrated in **Chart 1**, where we plot both the aggregate supply and private demand lines. Notice that in contrast to a typical supply/demand diagram, the private demand line is upward-sloping. This follows from the fact that an increase in inflation under a fixed nominal interest rate (at the ZLB) reduces the real interest rate, which incentivises households to consume more. As a result, higher inflation is associated with more consumption in this specific context. Note that the private demand curve would normally slope downward in a context where the central bank is able to adjust its interest rate.

Chart 1 Private demand and aggregate supply before and after public investment at the ZLB



Source: Cai and Rouleau-Pasdeloup (2023)

In **Chart 1**, at the onset of a deep recession, the economy finds itself with private demand being 8% below target (point A). After an increase in government spending, the aggregate supply line shifts to the right due to the higher costs of production for firms. Indeed, higher government spending calls for an increase in labour demand. In equilibrium, to induce the

necessary labour supply, the real wage has to go up, which is the main cost of production in this model. As a result, the economy moves to point B. The economy now features higher inflation and private demand compared to its situation in point A. Given a simple economy where GDP equals private demand plus government spending, we know that GDP increases more than one for one if consumption increases. If we were to stop here, we would be describing the typical Keynesian stimulus.

Supply and Demand Effects of Public Investment

In economics, we like to categorise macroeconomic policies into two buckets, differentiated by whether they operate via demand or supply channels. Public investment policies act on both. The private demand channel of public investment comes from higher incomes for workers and suppliers of goods, who then increase their consumption spending. The increase in aggregate supply comes later, such as when a road is eventually ready for use. In the economics literature, we usually say that there is a “time-to-build delay”. As a result, the effects of the delayed aggregate supply expansion are largely anticipated: households and firms in this model anticipate that firms will be more productive and thus the economy will feature stronger growth in future. In addition, households will come to expect higher incomes in the future. Going back to the short run, the anticipated increase in future incomes adds to the initial private demand boost from government spending.

The fact that public investment has a productive use means that it does not simply operate via the shift in the New Keynesian model’s aggregate supply curve along the private demand curve (moving from point A to B in **Chart 1**). The anticipated income effect manifests itself through a further upward shift of the private demand line: for a given inflation rate, households want to consume more. As a result of this shift, the economy moves from point B to point C. Given that both private and public demand increase, aggregate demand necessarily increases more than one for one. Moreover, one can see that, at the ZLB, public investment has a much higher multiplier compared to a typical Keynesian stimulus.

This analysis is based on a very simple model and invites a few questions: would the results hold in a model with private capital? After all, the main counter-argument relative to the effectiveness of public investment is that it potentially crowds out private capital (Eden and Kraay, 2014). Do we find a big multiplier for public investment in the data?

In Bouakez *et al.* (2017), we extend our analysis to a medium-scale model that has relevant features such as unemployment and private investment, among others. In that case, private demand also includes private investment, which might fall after an increase in public investment. We find that this is not the case, and the presence of private capital does not dampen the effects of public investment on GDP when the interest rate is stuck at zero. In fact, the opposite happens: we find that private investment increases after an expansion in public investment. In a follow-up project (Bouakez *et al.*, 2020), we studied the optimal path of government consumption/investment following a large negative aggregate demand shock. We found that if monetary policy is limited by the ZLB, then raising public investment relative to government consumption is the optimal policy.

We now turn to a review of what the empirical literature on public investment has to say about this.

3 Public Investment: Empirics

Given that exogenous variation in public investment is hard to come by, there is somewhat limited empirical literature on the effects of public investment. Nonetheless, the literature points to evidence that is largely in line with what the models reviewed predict. Public investment seems to have limited effects in normal times and a much larger impact when there is a deep recession with a binding lower bound (Boehm, 2020).

What about the mechanisms at play? Bachmann and Sims (2012) delve deeper into the question and point to a central mechanism: confidence. Consistent with the models and the literature already cited, they find a limited impact of government spending shocks in normal times. However, they do find a larger impact in recessions. In addition, they find that government spending shocks in recessions predict productivity improvements through a persistent increase in the ratio of (productive) public investment relative to (unproductive) government consumption.

The picture that emerges is then the following: government spending is usually tilted towards productive public investment in recessions. This change in composition is usually accompanied by a relative increase in measured confidence. The result is a government spending multiplier that is higher in recessions. Like the models reviewed before, households and firms seem to react by spending more based on their improved earnings expectations. Most of the evidence for the effects of public investment is based on the US which, to a first approximation, can be considered a closed economy (i.e., most of its GDP is composed of domestic investment/consumption). To tie the story back to Singapore, let us finally review what the economics literature has to say about the effects of government spending in a small open economy.

4 Public Investment in a Small Open Economy

The key deciding factor of the impact of public investment in a closed economy is whether the central bank's interest rate will react to the increase in public investment. In a small open economy with a managed exchange rate such as Singapore, the average overnight interest rate closely tracks global interest rates. One might then think that the results reviewed before apply to a small open economy, and that one should expect a sizeable multiplier. That is only partially true in a small open economy as there is another important factor to consider: the real exchange rate. What then does the theory and data say about the interplay between government spending and the real exchange rate?

There are two views about the effects of government spending in a small open economy. According to the seminal Mundell-Fleming model, if the exchange rate is fixed, then an increase in government spending will generate a sizeable increase in GDP. This is due to price and wage stickiness, so that the real exchange rate does not change much. In comparison, the classical view contends that, given more flexible nominal variables, the real exchange rate should appreciate by a comparatively large amount. In that case, the external demand for local goods decreases so that domestic GDP barely rises.

In a recent contribution, Born *et al.* (2023) set out to tease these two competing narratives apart. They study a small open economy New Keynesian model in which wages are downwardly rigid but upwardly mobile. Interestingly, they find that the impact of government spending on GDP depends on whether fiscal policy is contractionary or expansionary. In response to a decrease in government spending, the Mundell-Fleming view applies: after a

fall in government spending, the economy experiences a relatively large decrease in GDP as wage rigidities limit the extent of real exchange rate depreciation. However, when fiscal policy is expansionary, the classical view applies: an increase in government spending is mostly absorbed by an appreciation of the real exchange rate. As a result, government spending may not have as large a stimulative effect in a small open economy compared to a closed economy as the real exchange rate tends to appreciate and counteract the effects of expansionary fiscal policy. The authors find that that predictions from the model were supported by data from the European Union and a set of small open economies with fixed exchange rates.

These results apply to government spending in general, not specifically to public investment. In a recession, even if public investment is not expected to increase GDP much by stimulating aggregate demand directly, there is still room for the expected income effect to play a role. In this case then, increasing public investment can be an attractive policy option for two reasons: (1) it will be more efficient in stimulating economic activity compared to a standard expansion in government consumption and (2) it will result in improved total factor productivity in the medium to long run.

5 Conclusion

Is public investment an attractive policy option? As usual, the answer from the economics literature is that it all depends on what the objective is. If the objective is to stimulate an economy in the short run, then the theory and empirics say that this works only in a large recession for a closed economy. For small open economies, where one would not expect the interest rate to react, the increase in public investment could be almost completely absorbed by an appreciation of the real exchange rate. If the objective is to promote total factor productivity growth in the medium to long run, then public investment is an attractive policy option.

For both closed and small economies, however, one fact is clear: decreasing public investment, especially when monetary policy is constrained, will have a significantly negative impact on GDP in the short run. Further, it is also likely to dampen total factor productivity growth in the medium to long run. Here, the answer is not “it depends”: decreasing public investment in a recession is not a good option regardless of the objective.

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