6. An Empirical Application: The Growth Acceleration Program (GAP) in Brazil

For this and next chapters, the focus will move to assess quantitatively the macroeconomic effects of the *Programa de Aceleração do Crescimento* (PAC) – Growth Acceleration Program (GAP) –, an infrastructure improvement program implemented by the federal government of Brazil between 2007 e 2010. In a restricted calibration for the Brazilian economy, we analyze GDP, hours worked, private consumption and capital stock responses to the public investment shock associated to the government program. We do not intend to model all the GAP aspects, but, rather, to focus on the short and long run quantitative effects which are due to the rise in public investment in Brazil. In the theoretical approach, we incorporate to the standard neoclassical growth model the sluggish implementation of infrastructure government spending – the time-to-build process for public capital –, as well as endogenous distortive taxes, which adjust to the public debt-GDP ratio.

In fact, once these elements are introduced, the expansionary effects associated to public spending are drastically reduced, leading, actually, to falls in GDP of around 0.2% and 0.3% in an horizon of four years. The magnitude of the recession depends on the financing source (i.e. taxation of consumption, labor or capital), as well as on the extension of the time-to-build process. Moreover, aggressive fiscal adjustments, which reduce public debt in up to five years, may exert a significant role in the short run, reducing the output growth. Nevertheless, more importantly, in flexible adjustments, that undertake a correction of the debt path in up to fifteen years, the more prolonged higher taxation may decrease the growth of output for more than ten years in comparison to the first case. Finally, the welfare effects associated the program are small, and can be reduced in up to 30%, as the lags in infrastructure spending increase.

The intuition behind these results is exactly the same of the previous chapters. The recessive impact of public investment shocks is due to the agents' expectations of a higher stock of infrastructure in the future. Those expectations induce an intertemporal substitution effect on private investment, decreasing the private capital stock and the hours worked (and, thus, the output). Therefore, the

negative wealth-effect generated by the increase in the current government spending – which, as Barro (1989) argues, expands the labor supply – may be mitigated by the impact of a higher productivity expected in the future.

6.1. Isolating the Public Investment Associated to GAP

The Growth Accelerating Program (GAP) exemplifies how relevant the time-to-build process may be in reality. Launched in January of 2007 and concluded in 2010, the program increased the public investment from 1.8% of GDP (average of the ratios observed between 2002-2006) to 2.3% (the same, but for the period 2007-2010). In this same period, the average of the GAP obligations had been more than 2.5% of GDP, which means an increase of almost 10% in comparison to the previous ratio. The difference between the two measures reflects the technological constraint inherent to infrastructure projects, which includes both the institutional aspect (for instance, the variety and complexity of Brazilian laws) and the large amount of resources required to the completion of the physical construction itself.

In Table 2, we provide a brief description of the GAP execution process. The first line reports the annual public investment to GDP ratio. In the second, we calculate the same measure, but restricted to expenditures for the GAP projects. The third line is simply the difference between the first and second ones, and, thus, reports public investment without the GAP spending. In the fourth, we provide the value of the GAP obligations as a fraction of GDP. In the fifth, we sum the third and fourth lines. Therefore, the fifth line calculates the public investment associated to the GAP obligations (we call this measure as approved investment). Finally, the sixth line reports the ratio between public investment data (which we call implemented investment) and the approved investment.

In this way, the last line provides an imperfect measure of lags in government investment. It is imperfect because, from 2008 on, we cannot discriminate the GAP obligations in the current period from those incurred in previous years. Thus, the observed drop of the ratio until 2010 may have be caused by outlays of obligated federal grants in the past, and not by a more

prompted execution of projects over time. In the last case, we would observe a higher proportion of GAP obligations turning into outlays each year.

Table 2: Public investment according to GAP expenditures

	2007	2008	2009	2010
(1) Public Investment (%)	1,8	2,2	2,3	2,8
(2) Investments of GAP (%)	0,3	0,4	0,5	0,5
(3) GAP Expenditures Excluded (%)	1,5	1,9	1,8	2,3
(4) GAP Obligations (%)	0,6	0,6	0,7	0,7
(5) Approved Investment (%)	2,1	2,5	2,5	2,9
(6) Ratio: Line (5)/Line (1)	1,19	1,11	1,08	1,05

All variables correspond to fractions of GDP in the current year. Source: IPEA e SOF.

Anyway, in 2007, the approved investment had been almost 20% higher than the implemented investment. This reflects the complexity inherent to the execution of large infrastructure projects. In the third table, we report the GAP spending as a fraction of total public investment observed in the data. The share of GAP expenditures is of almost 20%, suggesting that the program was relatively important for the recent increase in Brazilian public investment. In the Appendix B, we provide a brief description of the GAP, as well as some projects that exemplify the time-to-build process associated to large infrastructure projects.

Table 3: GAP participation in the public investment to GDP ratio

	2007	2008	2009	2010
GAP Investments (%)	15	17	22	19
GAP Expenditures Excluded (%)	85	83	78	81

All variables correspond to fractions of GDP in the current year. Source: IPEA e SOF.