Economic Modelling xxx (2015) xxx–xxx

Contents lists available at ScienceDirect

Economic Modelling

journal homepage: www.elsevier.com/locate/ecmod

Public stimulus for private investment: An extended real options model☆

Diogo Barbosa [a], Vitor M. Carvalho [b], Paulo J. Pereira [b,*]

[a] Banco de Portugal and Faculdade de Economia, Universidade do Porto, Portugal
[b] CEF.UP and Faculdade de Economia, Universidade do Porto, Portugal

ARTICLE INFO

Article history:
Accepted 8 October 2015
Available online xxxx

Keywords:
Investment decisions
Public stimulus
Private investment
Real options

ABSTRACT

The recent global financial crisis and the European sovereign-debt crisis have put financial constraints on governments limiting their capacity to increase public investment and to promote economic growth. Also, in periods of high uncertainty firms tend to postpone the implementation of their projects, which has a negative impact on the economic growth. In this paper, we study different policies that can be set by governments in order to stimulate private investment. We develop an extended real options model that takes into account some relevant macroeconomic factors (namely, different types of taxes, asymmetric investment multipliers, and public inefficiencies) that do not appear in the related literature. The optimal incentives for the different types of *stimuli* are derived and discussed. We show that the optimal subsidy that prompts the private investment must be subject to a maximum that accounts for the government's incremental tax-related benefits. Additionally, the required optimal subsidy can be reduced if the government acts as a competitor fighting for the project. This would diminish the public spending while achieving the same objectives. We also show that a subsidy policy is always better than tax reductions. Finally, we illustrate the implementation of the model with an example that applies to the Portuguese economy.

© 2015 Elsevier B.V. All rights reserved.

1. Introduction

The advents of the global financial crisis in 2007 and more recently the European sovereign-debt crisis have curtailed the economic growth in Europe. After years of easily accessible credit, which led to high (in some cases unsustainable) levels of private and public sectors indebtedness, the crises increased the financial constraints for both sectors. The lack of credit, the need for deleveraging, and an uncertain economic outlook have forced private firms to reduce costs and defer investments (Cuerpo et al., 2015; Ruscher and Wolff, 2012). The gross investment rate of non-financial corporations in the EU has declined from 24.2% in 2007 to 21.6% in 2013. These decreases were even higher if we consider countries most directly affected by the sovereign-debt crisis: Greece (22.3% to 13.3%), Ireland (20.3% to 17.8%), and Portugal (28.7% to 19.4%).[1]

Given the reduction in private investment, the traditional Keynesian approach would suggest an increase in public spending and, particularly, in public investment. However, this is not happening in Europe. Due to the public debts accumulated over the prior years, some governments had to adopt austerity policies in order to ensure public finances sustainability, which are hindering the promotion of public investments. In the EU, between 2010 and 2013, general government gross fixed capital formation has been annually reduced, on average, for about 3.7% (once more, these figures are clearly worse in countries like Greece — 10.5 %, Ireland — 14.7 %, and Portugal — 20.9 %).[2]

Therefore, in a context of scarce governmental resources, it is necessary to find alternative and viable solutions to promote investment, and hence growth. Instead of the traditional direct public investment, governments can stimulate private investment. This can be achieved either by ensuring an adequate political and institutional environment, which in turn may reduce uncertainty, or by adopting a policy of public incentives, such as tax reductions or a subsidizing policy. In the cases where projects are important for the economy, public incentives may expedite their implementation.[3]

☆ We acknowledge the three reviewers and the Editor for the helpful comments and suggestions. We also acknowledge Gonçalo Faria, Kumar Ashok and the conference participants at EcoMod — International Conference on Economic Modeling, Prague, 2013. This research has been supported by National Funds through the FCT — Fundação para a Ciência e a Tecnologia (Portuguese Foundation for Science and Technology) within the project UID/ECO/04105/2013.

* Corresponding author at: Faculdade de Economia da Universidade do Porto, Rua Dr. Roberto Frias, 4200-464 Porto, Portugal.
E-mail address: pjpereira@fep.up.pt (P.J. Pereira).

[1] Source: Eurostat database (http://ec.europa.eu/eurostat/data/database); accessed in July 2015.

[2] Source: Eurostat database (http://ec.europa.eu/eurostat/data/database); accessed in July 2015.

[3] These alternative policies bear a smaller financial effort for the government and can produce the same, or, due to the presence of public inefficiencies, even more benefits than public investment. A practical example of public incentive policies, generally related with large-scale infrastructure investments, is the public–private partnerships (PPPs) that become common, at least in some European countries, in the last two decades. Another example is the investment incentives co-financed through European funds, such as the European Regional Development Fund (ERDF).

http://dx.doi.org/10.1016/j.econmod.2015.10.013
0264-9993/© 2015 Elsevier B.V. All rights reserved.

Please cite this article as: Barbosa, D., et al., Public stimulus for private investment: An extended real options model, Econ. Model. (2015), http://dx.doi.org/10.1016/j.econmod.2015.10.013

In this paper we analyze the interaction between firms and the government, and derive their optimal behavior, in the context of investment decisions, following a real options approach. In contrast to the traditional Net Present Value (NPV) rule, under which a project should be immediately implemented whenever the gross project value exceeds the investment cost, the real options theory suggests that uncertainty generates an option value for waiting, and tends to lead investors to postpone their investment decisions.[4] According to the real options theory, the value of an investment opportunity has, at least, two components: the intrinsic value (the NPV) and the time-value (the value of the option to defer). It can be shown that the optimal timing for implementing a project is when the option to defer becomes worthless, i.e., when its time-value disappears. Until that moment, the firm behaves optimally by postponing the investment decision. In fact, even when the NPV is positive, investing immediately in a project that can be postponed may represent an opportunity cost since the company loses the chance to invest later in the same project. Since the investment cost is mainly irreversible, and considering that firms can wait to obtain more information about the project, it may be optimal to defer the investment. Hence, the optimal timing to invest is highly dependent on the uncertainty surrounding the project. Everything else constant, the higher the uncertainty, the higher will be the optimal trigger to invest. Therefore, the real options approach seems to be more adequate for dealing with optimal investment decisions, particularly in the current European unstable and uncertain context, independently from being undertaken by the private or the public sector.

In this context, the government decision about when to invest, given the budget constraints that limit the choices, needs to consider whether the private sector has an incentive to undertake the project. So, the government should make a careful selection of projects and formulate policies that guarantee their implementation. The alternatives can range from the direct investment by the public sector, to alternative incentives that can be implemented by governments in order to promote private investment. For instance, governments can subsidize the projects (which reduces the investment costs), can decrease the corporate tax rate (which increases the after-tax cash flows), or can do both. Evidence shows that some governments, typically in developing countries, prefer specific investment subsidies (Bernstein and Shah, 1995), while others, namely when competing to attract foreign direct investment, provide a mix of investment subsidy and tax cut (Morisset and Pirnia, 2000). It is also possible to find governments that subsidize investment while keeping, at the same time, significant taxes on capital. According to Hansson and Stuart (1989, p. 549) this appears to be a “politically expedient way of taking with one hand and giving with the other”.

There has been some theoretical research on the relative efficiency of alternative public incentives to promote and speed up private investment. However, conclusions remain ambiguous. On the one hand, Pennings (2000) introduced in the standard real options model a profit tax rate and the hypothesis of a government subsidy to investment. He showed that the government can expedite the investment decisions under uncertainty with a zero expected cost stimulus. Specifically, the author proposes a subsidy policy that can decrease the trigger value to the current level of the profit flows. This means that, from the firm's point of view, it will be optimal to invest immediately, and so they will undertake the investment. At the same time, with a proper taxation of the project profit flows, the government can recover the subsidy being possible a zero expected cost for the state. In the same line, in order to attract foreign direct investment, both Pennings (2005) and Yu et al. (2007) concluded that the government should opt for subsidy, which is more effective and less costly than reducing taxes. On the other hand, Danielova and Sarkar (2011), by introducing in the standard real options model the possibility of debt financing for the private firms, showed that it could be optimal for the government to combine a tax cut with an investment subsidy. Similar conclusions were obtained by Sarkar (2012) when allowing for the government's discount rate to be different from the private firm's discount rate.

This paper contributes to this debate by developing an extended version of the real options model that differs from earlier studies (Danielova and Sarkar, 2011; Pennings, 2000, 2005; Sarkar, 2012; Yu et al., 2007) by taking into account some relevant macroeconomic factors. Our model incorporates two different types of tax rates (a profit tax rate and an income average tax rate on the economy), the investment multipliers (that may be different for public and private sectors), and parameters that capture public inefficiencies (regarding both the implementation of the project, as well as the capacity to extract profits from it). As far as we know, this is the first attempt to incorporate these multiple macroeconomic inputs in a real options setting. The optimal incentives for different types of *stimuli* are derived and discussed.

Our findings can be important for the policy makers in order to set the appropriate stimulus. We show that the optimal subsidy that prompts the private investment must be subject to a maximum that accounts for the government's incremental tax-related benefits, and that the optimal public subsidy can be reduced by the threat of public competition, which is an original result in this kind of analysis. In line with Pennings (2000, 2005) and Yu et al. (2007), we show that the investment subsidy policy always dominates tax cuts to promote private investment, even when considering the macroeconomic factors introduced in this paper. We illustrate the implementation of the model with an example that applies to the Portuguese economy.

This paper is structured as follows. In Section 2 we briefly present the relevant macroeconomic factors to be included in the model. In Section 3 we develop the different versions of the model, presenting the value-functions and the triggers, both for the private firm and for the government. The optimal incentive that prompts investment is derived. Section 4 explores the alternative stimuli for private investment, and Section 5 contains an application and a sensitivity analysis. Finally, in Section 6 we conclude.

2. The relevant macroeconomic factors

2.1. The investment subsidy and taxation

According to the real options theory, a way for promoting immediate private investment could be by managing some key aspects of the project, in order to eliminate the value of the option to defer. Even when the NPV is positive, a policy of public stimuli could be justified if the government seeks to incentivize the private firm for the immediate implementation of the project. These stimuli need to be sufficient to compensate the firm for loosing the option to defer (Armada et al., 2012; Mason and Baldwin, 1988).

Taking this into account, Pennings (2000) introduced in a real options model the hypothesis of a government subsidy to investment. The subsidy reduces the cost of the investment and turns the implementation of the project more attractive, by creating “a gap between the return as perceived by the private sector and the true return” (Warner, 2013, p. 5). Given its budget constraint, the government may increase taxation in order to offset the budget impact of the subsidy. This taxation may reduce firm's profits, but also may ensure the implementation of the project, because the ratio between the profits and the cost of the investment is higher than in the original situation.

Following, for example, Pennings (2000) and Sarkar (2012), our models consider a profit tax rate. However, differently from these previous studies, we also include a second important type of taxation: an income average tax rate on the economy. This type of taxation intends to capture those taxes collected on the other types of income, which are directly derived from the investment due to the possible multiplier effect on the economy.

---

[4] For further details please refer to McDonald and Siegel (1986), Dixit and Pindyck (1994) and Trigeorgis (1996).

Please cite this article as: Barbosa, D., et al., Public stimulus for private investment: An extended real options model, Econ. Model. (2015), http://dx.doi.org/10.1016/j.econmod.2015.10.013

Download English Version:

https://daneshyari.com/en/article/5053673

Download Persian Version:

https://daneshyari.com/article/5053673

Daneshyari.com