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## ABSTRACT

We consider the effect of excluding government investment from the deficit subject to the limits of the European Stability and Growth Pact. In the model we consider, residents of a given country discount future costs and benefits of government spending more than efficiency would dictate, because they fail to take into account the portion that will accrue to people that have not yet been born or immigrated into the country. It is thus in principle desirable to design budget rules that favor long-term investment (by allowing more borrowing) over other government spending that only carries short-term benefits. However, given the low rates of population growth, mortality, and mobility across European countries, we find that the distortions arising from treating all government spending equally are likely to be modest. We also show that these modest distortions can be alleviated only if net government investment is excluded from the deficit computation; excluding gross investment may even be counterproductive, as it promotes overspending in government capital.

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# 1 Introduction

The European Stability and Growth Pact (SGP) is one of the most controversial pieces of the institutional reforms that led to the European Monetary Union. The pact stems from the concern that fiscal profligacy in some of the member countries would adversely affect all the others by undermining the independence of the European Central Bank or by generating instability in the Eurobond market at large. The SGP was adopted in 1997 to strengthen the provisions of the Maastricht treaty, and to ensure that the fiscal discipline required for entering into the European Currency Union would have to be maintained even after the adoption of the new currency.

The key provision of the SGP is a cap of 3 percent on the general government deficit to GDP ratio that each country is allowed to run in any given year. In its original form, the Pact set the cap to be independent of the mix of government spending (whether transfers, recurrent expenses, investment, or interest payments), and allowed for exceptions only in case of an unusual event outside of the state's control, or a severe recession.[1] From the outset, many criticized the SGP as imposing a straightjacket on fiscal authorities. In this article, we address a specific criticism: the argument in favor of special treatment for public investment (see e.g. Blanchard and Giavazzi [7], Buiter [8], and Monti [18]). The argument starts from the premise that the fiscal authorities have a bias toward projects that yield immediate gains and postpone the costs. Therefore, applying the 3 percent cap to both investment and other expenses would lead governments to neglect their historical role as providers of major infrastructure (such as roads, airports, and schools) in favor of spending that yields more immediate but less long-lasting benefits (for example, social insurance or crime prevention). According to this view, appropriate incentives could be restored if some of the costs of public investment were postponed as well. This would require more borrowing to pay for public investment than to pay for other expenses.

The notion that public investment ought to be treated differently from other government expenses is far from new. In fact, the prescription that the government should only be allowed to borrow to pay for public investment is known in public finance as the "golden rule." Many national governments adopted this rule in the eighteenth and nineteenth centuries (see, for example, the

[1]The pact defines an economic downturn as severe if there is an annual fall of real GDP of at least 2 percent.

quotations in Bassetto with Sargent [4]),[2] but the rule fell out of favor at the national level in the twentieth century, and very few countries adopt it nowadays (Germany being a notable exception). By contrast, this rule approximates well the behavior of most U.S. states: almost all of the states' constitutions provide for very strict borrowing limits, but many allow significant borrowing for public investment (National Association of State Budget Officers [19]).

In recent years, many countries have struggled to meet the strict deficit cap imposed by the SGP. When the core countries of France and Germany failed to meet it in 2002, 2003, and 2004, it became clear that the pact was unenforceable, at least in its original form. The pact was reformed in 2005.[3] This reform explicitly acknowledged the role of public investment as well as "policies to foster research and development and innovation" (European Council on the Stability and Growth Pact, [14], article 1). Such expenses are cited as one of the factors that should be taken into account in evaluating whether a deficit is truly excessive.

In this article, we analyze one rationale for the adoption of the golden rule: the conflict that arises among different generations when the current government policy has the potential to provide both benefits (through investment) and costs (through borrowing) to future, unborn cohorts. Given the low rates of population growth, mobility, and mortality in European countries, we find that including or excluding public investment from the computation of the deficit ceiling has only moderate implications for the allocation chosen by current generations. We also find that the distinction between excluding *gross* or *net* investment from the computation of the deficit is relevant.

In section 2 we describe the model we use to analyze efficiency of the government spending mix. This model is based upon a paper by Bassetto with Sargent [5] that analyzed the same issue in the context of the U.S. federal and state governments. In section 3 we discuss the data that we use to calibrate the key parameters of the model, with particular attention to mobility.

[2] Most of the early provisions distinguished between "extraordinary" and "ordinary" expenses, rather than between public improvements and other expenses. This distinction is relevant, since the largest extraordinary expenses were wars, rather than major infrastructures.

[3] These reforms are widely considered to have significantly watered down the pact (see, for example, Calmfors [9]), by giving leeway to postpone sanctions under a wide array of attenuating circumstances.

In section 4 we present our main results and contrast the cases of the European countries with the findings in Bassetto with Sargent [5] for the U.S. federal and state governments. Section 5 concludes.

# 2 Model

We describe here the salient features of the model, referring to Bassetto with Sargent [5] for a complete description.

We consider a country populated by a large number of people of different ages. For simplicity, we abstract from the effects of demographic change, and we assume that the demographics of each country are in a steady state, characterized by a growth rate of the population $n$ and a given distribution of the population by age.[4]

Each person can live at most $N+1$ periods (years). Conditional on having survived until then, each household faces a probability $1-\theta_s$ of death in its $s$th period of life.

People consume a private good and enjoy the services of two public goods, one nondurable ("government consumption"), the other durable ("government capital"). By their nature, the same amounts of public goods are available to everyone, and nobody can be excluded from these services; hence, these goods cannot be paid by user fees, but must instead be produced using tax revenues.

A household born in year $t$ has preferences ordered by the following:[5]

$$\sum_{s=t}^{N+t} \beta^{s-t} \left( \prod_{j=0}^{s-t-1} \theta_j \right) [c_{s-t,s} + f(G_s) + v(\Gamma_s)],$$

where $\beta$ is a discount factor, $\prod_{j=0}^{s-t-1} \theta_j$ is the probability of survival until age $s-t$, $c_{s-t,s}$ is consumption of the private good in period $s$ by a person age $s-t$ (born in period $t$), $f$ and $v$ are strictly concave utility functions, $\Gamma_s$ is the per capita stock of public capital in period $s$, and $G_s$ is the amount of public consumption per capita in period $s$.

[4]The model could be solved by taking into account demographic changes as well, but the results would not be affected significantly.

[5]We adopt the convention $\left(\prod_{j=0}^{-1} \theta_j\right) \equiv 1$.

Our analysis is greatly simplified by assuming that utility is linear in private consumption. This implies that a person's wealth will not affect that individual's relative preferences for private versus public consumption and allows us to focus on differences in the survival probabilities as the sole source of political conflict. This assumption is a useful approximation here because we are particularly interested in the decision of *public consumption versus public investment*, a margin that is less directly affected by differences in wealth.[6]

In each period, each person alive produces $y$ units of output, which can be either consumed as a private good or turned into government consumption or investment.[7] Public capital depreciates at a rate $\delta$. The economy-wide resource constraint is thus

$$C_t + G_t + \gamma_t \leq y, \tag{1}$$

where $C_t$ is private consumption per capita and $\gamma_t$ is government gross investment per capita in period $t$.[8]

The country has a government that is empowered to levy taxes and produce public goods. Taxes and spending are chosen by majority vote each period, subject to exogenous restrictions on government indebtedness that are described by two parameters:

- $d$, a deficit ceiling (expressed in per-capita terms); and
- $x$, a fraction of public investment that is not counted for the purposes of the deficit ceiling.

The government budget constraint in period $t$ can thus be written as

$$B_t = G_t + \gamma_t - T_t + (1+r)\frac{B_{t-1}}{1+n}, \tag{2}$$

$$B_t - \frac{B_{t-1}}{1+n} \leq d + x\gamma_t, \tag{3}$$

where $B_t$ is government debt per capita at the end of period $t$, $T_t$ are taxes per capita in period $t$, and $r$ is the interest rate.[9]

[6] Simulations with more general preferences are discussed in the appendix of Bassetto with Sargent [5].

[7] Private capital and a more complete description of production could be introduced with no effect on the results.

[8] We thus have $\gamma_t = \Gamma_t - (1-\delta)\Gamma_{t-1}/(1+n)$.

[9] In equilibrium, if a market for annuities exists, as we assume, $r = (1-\beta)/\beta$.

In the original version of the SGP, $d$ was equal to 3 percent of GDP ($y$) and public investment was not excluded, so $x = 0$. While the 2005 reform does not explicitly exclude public investment, it does mention it as one of the factors that should be taken into account in assessing any breach of the 3 percent ceiling, suggesting that $x > 0$ (if not equal to 1) under the current interpretation.

Equation (3) assumes that the investment that can be excluded from the deficit computation is gross of capital depreciation. Blanchard and Giavazzi [7], among others, recommend excluding *net* investment. In our numerical results, we establish that this is an important distinction. We thus also consider a version of equation (3) where net investment is potentially excluded:

$$B_t - \frac{B_{t-1}}{1+n} \leq d + x\left(\gamma_t - \delta\frac{\Gamma_{t-1}}{1+n}\right).$$

We assume that the government finances its operations through lump-sum taxes levied equally on each person alive. We thus abstract from the distortionary effects of taxation analyzed by Barro [3] and Lucas and Stokey [16], among many others.

In each period, we assume that the households alive choose the level of public consumption, public investment, and taxes, subject to the deficit ceiling. In all of the numerical simulations that follow, the generations alive will unanimously support running the maximum allowable deficit, since this will shift the burden of taxation to future generations. This means that effectively the generations alive will vote over public consumption and investment, with the understanding that taxes will be set so as to hit the deficit ceiling exactly in each period. The actual experience of euro countries suggests that this result is less far-fetched than one would expect, since many of them have consistently stayed very close to the upper limit throughout the existence of the pact.[10] If tax distortions were explicitly accounted for, countries would have an incentive to stay away from the ceiling in favorable periods, but this would not affect the main economic forces analyzed here.

[10] In principle, the SGP provides that countries should strive for a budget "close to balance or in surplus" over the medium term. ([13], art. 3). However, this provision is effectively not enforced.

## 2.1 Some general intuition

A formal definition of an equilibrium is contained in the appendix. We discuss here the salient features of the equilibrium.

The environment described in the previous section delivers a particularly simple notion of the efficient size of the government, since all households alive share a common valuation of the public good.

An efficient allocation of public goods $(G^*, \Gamma^*)$ is given by the solution to the following two equations:[11]

$$f'(G_t) = 1, \tag{4}$$

$$v'(\Gamma_t) = 1 - \beta(1 - \delta). \tag{5}$$

Consider (4) first. We chose units so that producing one unit of public consumption per capita requires sacrificing one unit per capita of the private good (see equation (1)). The utility cost of the sacrifice is constant and equal to 1. Equation (4) states that, in an efficient allocation, government spending should be set so that the benefit of an additional unit of public consumption is equal to its cost.

In the case of government investment, the cost of an extra unit in terms of foregone private consumption is again 1. The benefit is now twofold. First, the additional government capital yields immediate benefits, captured by $v'(\Gamma_t)$. Second, government capital is durable, and $1 - \delta$ units will survive into the next period; these units can be used to save on next year's investment, thereby yielding a utility gain $1 - \delta$ tomorrow. These gains are discounted at the market discount factor, which in equilibrium is $\beta = 1/(1 + r)$.

Throughout this article, the equilibrium features unanimous support for the efficient provision of government consumption; that is, equation (4) will always hold. This happens because all generations alive agree on the benefits of this spending and they also equally share the costs. Furthermore, since there is unanimous agreement for setting taxes so that the deficit constraint $d$ is binding, independent of the level of spending, extra spending must be matched by extra tax revenues to keep the deficit at $d$, and no costs can be passed to future generations (at the

[11]For a formal derivation, see Bassetto with Sargent [5].

margin). The goal of this article is to discuss whether government consumption and government investment should be treated differently in the design of constitutional deficit restrictions. For this reason, we rely on an environment that abstracts from all the potential distortions that could in practice lead to inefficiency in static decisions (such as the provision of public consumption), and we concentrate instead on the conflict among different generations that arises when the government is called upon to make choices that have dynamic implications.

To further illustrate the conflict among people of different ages over the provision of public investment, consider the simple case in which government investment cannot be excluded from the computation of the deficit, so that $x = 0$. In this case, an extra unit of public investment generates in equilibrium the following costs and benefits:

1. The utility from consuming public capital increases in period $t$ by $v'(\Gamma_t)$;

2. To pay for the investment, taxes increase in period $t$ by 1; and

3. In period $t+1$, an additional $(1-\delta)/(1+n)$ units of capital per capita are available: this is smaller than 1 both because capital depreciates and because the same capital is spread over a larger population. The political equilibrium is such that investment will decrease exactly by $(1-\delta)/(1+n)$, so taxes decrease by this amount as well.[12]

While the first two effects accrue to all generations alive equally, the last one will depend on the probability of being alive and present in the same country in period $t+1$. A person of age $s$ will support public investment up to the point at which

$$v'(\Gamma_t) = 1 - \frac{\theta_s}{1+n}\beta(1-\delta). \tag{6}$$

Comparing (5) and (6), we see that they coincide in the special case in which people are infinitely lived, immobile, and there is no population growth. These conditions lead to what is known more generally as *Ricardian equivalence* – the principle of irrelevance of the debt and deficit policy.[13]

[12]For a proof, see Bassetto with Sargent [5].

[13]Barro [2] explains that the result survives if people are part of dynasties where different generations are connected by altruism and intergenerational transfers. We assume this is not the case, although in our environment, international mobility would generate a separate channel that breaks down Ricardian equivalence.

In this case, borrowing shifts costs into the future, but the same people will be alive and paying taxes into the future; thus, sooner or later, they will have to pay for the government spending. Since it will always be the same people that benefit from the public investment and pay the taxes, and those people agree in each period on costs and benefits, the case of Ricardian equivalence yields the efficient level of investment, independent of $x$.

In general, we see that $x = 0$ always leads people to favor underinvestment.[14] The magnitude of the underinvestment is related to three factors:[15]

- Population growth. The more new people are born (or immigrate), the more it is possible to shift costs to them by borrowing. This effect leads (alive) cohorts of all ages to discount future benefits excessively.

- Survival probabilities. The smaller the probability of surviving, the more people discount future benefits. Since the probability of dying in a given year is very small at most ages, this channel will not be as important, except for the very old.

- Mobility. When people move from one country to another, they leave behind that country's public capital. At the same time, they stop paying that country's taxes[16] and thus leave behind debt as well. For the purpose of the model, moving to a different country is identical to dying in the first country and being "reborn" (at an age greater than 0) in the new one. Since the young are more mobile than the middle-aged and the old, mobility will lead the young to discount future benefits and costs relatively more. As a consequence, when $x = 0$, the voting pattern will usually pit the relatively impatient young and old against

[14] This is true as long as the population is not shrinking.

[15] As pointed out by Weil [24], the main driver behind all three factors is the influx of new people into the economy. As an example, for a given level of population growth, higher mortality also implies that more people must either be born or immigrate. Nonetheless, distinguishing between the influx of people and mortality/mobility is important when considering the conflict among different cohorts that are alive at the same time: the old will discount future benefits much more heavily than the young because they have a lower probability of survival.

[16] Even in countries that tax their citizens on income earned worldwide regardless of residence (for example, the United States) a credit for taxes paid to foreign governments is allowed, so that in many instances no tax is due.

the relatively patient middle-aged.

When some borrowing for public investment is allowed ($x > 0$), current investment may bear consequences for more than two periods, and the preferences of each cohort depend on its entire prospects for mobility and survival over the longer period. In principle, this could generate very complicated patterns of voting by age. In practice, the simple intuition of the case with $x = 0$ carries over to the specific parameters of our numerical simulations.

The big countries of the eurozone are characterized by very low population growth and low (international) mobility. These factors suggest that their demographics will be close to Ricardian equivalence; therefore, according a special treatment to government investment in the SGP is unlikely to generate large efficiency gains, as our numerical analysis confirms.

Our previous discussion focused entirely on the parameter $x$, which measures the amount of public investment that is not counted in the computation of the deficit subject to the ceiling. The budget rule (3) contains a second parameter, $d$, the maximal deficit level allowed. As it turns out, the deficit level has no effect on government efficiency in our model economy. The intuition for this result is straightforward. We already observed that current generations will set taxes so as to hit $d$ exactly. Combining equations (2) and (3) we get

$$T_t = G_t + r\frac{B_{t-1}}{1+n} + (1-x)\gamma_t - d. \tag{7}$$

Raising the ceiling is equivalent to a pure transfer of resources from future generations to the current ones: it allows current generations to cut their tax payments, leaving more debt to be repaid in the future. However, this does not affect the trade-offs that current generations face at the margin. As an example, consider the trade-off between taxes and public consumption. While the current generations can now afford smaller taxes or higher public consumption, even under the new ceiling they still need to trade off one fewer dollar of taxes for one more dollar spent on the public good. This will lead them to choose $G_t$ according to equation (4), exactly as before. A similar argument holds for government investment; while its level in general will not be efficient, it will not change with $d$.

## 2.2 Efficiency Wedge

Given a level of public capital $\Gamma_t$, we measure departures from efficiency by a wedge $\tau$ defined as follows:

$$\tau = \frac{v'(\Gamma_t) - v'(\Gamma^*)}{v'(\Gamma^*)}.$$

Here, $\tau$ measures the percentage deviation of the value of the marginal public investment project from what it would be in the efficient allocation. As an example, if $\tau = 30$ percent, it means that the government will only undertake projects whose benefits exceed $1.30 per $1 of cost.[17] Hence, positive (negative) values of $\tau$ indicate underprovision (overprovision) of public capital. As discussed in Bassetto with Sargent [5], we choose this measure because it is particularly robust to changes in assumptions on the preferences, and it does not require us to take a stand on the specific form of the utility function $v$.

# 3 Data

We set one period in the model to be one year, in line with the budgeting cycle of all the countries considered here. The model has two parameters that we set the same for all countries:

- The agents' discount factor. We set $\beta$ to the most commonly used number of 0.96, which yields a yearly discount factor of approximately 4 percent.

- The depreciation rate of capital ($\delta$). We use two values; we set it at 6 percent in line with commonly used estimates of the depreciation of private capital (we call this case "generic capital"), and we also experiment with the lower depreciation rate of 3 percent to capture investment in major infrastructure.

For each country[18], we need four additional inputs:

1. The population growth rate.

[17] The cost is measured netting out the undepreciated value left for the subsequent period.

[18] We consider the 12 countries that were part of the eurozone as of 2006.

2. The distribution by age of the population.

3. The mortality rate by age.

4. The gross mobility out of the country by age, that is, the probability that a person of a given age will emigrate to a different country within the next year.

A slight complication lies in the distinction between a country's taxpayers and its citizens. The growth rate of the population matters for tax receipts, and is thus related to taxpayers (a population that would include noncitizens), while the other variables enter into the model because they affect the distribution of voters (only citizens).

Our baseline calibration is based on Eurostat data. Unfortunately, we do not have data on the number of citizens and the number of emigrant citizens by age for the same year. We thus rely on data for the total population of the country. This is not a quantitatively important issue.[19] As pointed out by Eurostat [23], "frontier and immigration controls are often minimal or non-existent for persons leaving a country, and there is a tendency for persons to remain recorded in administrative systems even after they have left the country."[20] It is thus likely that these data are somewhat underestimated, which is why we use an alternative source for a robustness check. Our emigration rates are significantly higher than those reported by the European Commission ([11], annex II), which states that only 0.1 percent of the EU population moves from one country to another in any given year,[21] this further reassures us that we are not relying on grossly understated emigration rates.

[19] We use the average annual population growth rate between 1995 and 2005. We use the latest available year for emigration rates: this is 2005, except for Belgium (1999) and Italy (2003). The population distribution by age is for the same year. We do not have data for four of the countries. We use piecewise linear interpolation of five-year aggregated migration numbers to obtain the emigration rate for each year of age. We thank Anna Lööf for assistance in getting more updated data than those in Eurostat [23]; this also allowed us to include Germany and Spain. All of these statistics are computed on the population aged 18–90.

[20] If immigration data were reliably estimated, we could use data about changes in population combined with data on deaths and immigration to infer emigration. However, this procedure yields negative numbers in several cases, presumably because immigration is underestimated as well.

[21] Martí and Ródenas [17] discuss why this number is severely underestimated.

To check for robustness, we use the 2005 Eurobarometer survey (Papacostas [20]) as an alternative. The survey covers a representative sample of EU residents aged 15 and above. One of the questions in the survey asks whether the interviewee is likely to move to a different country within the next five years.[22] The survey also contains information about citizenship, so we can restrict our sample to citizens residing in their home country. To strive for an upper bound, we assume that anyone that answers yes will move, even though some express intent to move both within the country and abroad; we attribute one fifth of this fraction to mobility in each given year (to account for the five-year window). This measure yields larger numbers for most countries.[23]

Table 1 presents summary statistics about population growth and mobility rates (averaged across all age groups). For comparison with Bassetto with Sargent [5], we also include some U.S. data. This table shows that emigration rates from European countries are higher than those for the whole of the United States, but much lower than they are for individual U.S. states. Population growth tends also to be lower in Europe.[24]

# 4 Numerical results

Table 2 includes our numerical results for the baseline calibration. We also include the values that apply to the U.S. federal government, to the median of the U.S. states, and to the state of Illinois.[25]

[22] Specifically, the question asks: "Do you think that in the next five years you are likely to move...?" The possible answers are: 1. In the same city/town/village; 2. To another city/town/village but in the same region; 3. To another region but in the same country; 4. To another country in the European Union; 5. To another country outside the European Union; 6. You don't think you will move; 7. Don't know. Interviewees are allowed multiple responses, and we sum up all people that include options 4 or 5, according to their population weights.

[23] A notable exception is Luxembourg, where the discrepancy between citizens and other nationals plays an important role.

[24] U.S. data are from the 2000 U.S. Census; for details, see Bassetto with Sargent [5].

[25] Details of the calibration are contained in Bassetto with Sargent [5]. Note that the federal data used do not take into account emigration from the U.S., so that the magnitude of the distortions is very slightly understated (emigration from the U.S. is exceedingly small).

| | Population growth rate | Emigration rate (percent) | |
|---|---|---|---|
| | (percent) | (baseline) | (Eurobarometer) |
| Austria | 0.5 | 0.9 | 0.5 |
| Belgium | 0.4 | 0.4 | 0.7 |
| Finland | 0.5 | 0.2 | 1.0 |
| France | 0.7 | n/a | 1.0 |
| Germany | 0.3 | 0.8 | 0.5 |
| Greece | 1.0 | n/a | 0.6 |
| Ireland | 2.1 | n/a | 1.5 |
| Italy | 0.4 | 0.1 | 0.6 |
| Luxembourg | 1.1 | 2.6 | 0.7 |
| Netherlands | 0.5 | 0.5 | 0.9 |
| Portugal | 0.9 | n/a | 0.8 |
| Spain | 1.4 | 0.2 | 0.5 |
| Median of the countries above | 0.6 | 0.5 | 0.7 |
| Median U.S state | 1.0 | 2.1 | |
| USA | 1.2 | 0.1 | |
| Illinois | 0.8 | 2.0 | |

Table 1: Descriptive statistics

First, we consider what happens under a strict interpretation of the SGP, which does not allow exclusion of public investment. With the exception of Luxembourg, the magnitude of the distortion is limited. In the worst-case scenario, the predicted benefit of the marginal public investment in Austria and Spain is $1.24 for $1 in costs. Comparing the magnitude of the predicted wedge across countries, we confirm that it is bigger for countries with higher population growth (such as Spain) or higher emigration rates (Luxembourg and Austria), whereas it looks particularly small for Italy, a country with very low population growth and mobility. Most of the variation across countries is driven by aggregate forces that shift up and down the incentives of all

| Country | SGP, no exclusions | Excluding gross investment | Excluding net investment |
|---|---|---|---|
| | | Generic capital | |
| Austria | 16 | -24 | -1.8 |
| Belgium | 11 | -22 | -1.2 |
| Finland | 10 | -22 | -1.1 |
| Germany | 14 | -23 | -1.5 |
| Italy | 6 | -20 | -0.7 |
| Luxembourg | 35 | -34 | -3.8 |
| Netherlands | 13 | -22 | -1.4 |
| Spain | 16 | -25 | -1.7 |
| Median of the above | 14 | -22 | -1.5 |
| Median U.S state | 33 | -32 | -3.5 |
| USA | 14 | -24 | -1.5 |
| Illinois | 30 | -30 | -3.2 |
| | | Major infrastructure | |
| Austria | 24 | -17 | -1.8 |
| Belgium | 16 | -16 | -1.2 |
| Finland | 15 | -16 | -1.1 |
| Germany | 21 | -16 | -1.5 |
| Italy | 9 | -14 | -0.7 |
| Luxembourg | 51 | -25 | -3.8 |
| Netherlands | 19 | -16 | -1.4 |
| Spain | 24 | -18 | -1.7 |
| Median of the above | 20 | -16 | -1.5 |
| Median U.S state | 48 | -24 | -3.5 |
| USA | 20 | -18 | -1.5 |
| Illinois | 43 | -22 | -3.2 |

Table 2: Efficiency wedge $\tau$ in the baseline calibration (percent)

generations at the same time; a much less prominent role is played by differences in the nature of the conflict within generations, stemming from a different age structure or a differential mobility by age. The efficiency wedges are somewhat similar to those predicted for the U.S. federal government. The similarity comes from two forces that roughly compensate each other. First, lower population growth in Europe relative to the U.S. decreases the distortion that is coming from the anticipation of lower future per capita taxes with higher population growth. Second, small but nonetheless somewhat higher emigration from the European countries than from the U.S. increases the wedge, as voters discount the future more heavily. The table also shows that the magnitude of distortions is much bigger in the case of individual U.S. states. This happens because the migration across U.S. states is significantly higher than across European countries. The case for treating public investment differently is thus much stronger at the U.S. state level (where this is standard practice) than at the European national level.

A second important observation arises from looking at the effect of excluding gross investment from the computation of the deficit. The distortions in this case are mostly as large as or larger than those in the original interpretation of the SGP, albeit in the opposite direction: countries are encouraged to significantly overspend, particularly when borrowing is allowed for investments that are not as long-lived, such as equipment. This result stands in stark contrast to Bassetto with Sargent [5], who find that the golden rule achieves a desirable allocation. The key difference is the repayment schedule of debt. In Bassetto with Sargent [5], states are required to repay a fraction of the debt each period. This is meant to capture the practice of U.S. states, where debt issued to pay for capital improvements is gradually repaid and not rolled over indefinitely. The SGP does not contain a provision that ensures such gradual repayment; from equation (7), we see that the government is only raising taxes to repay interest on its past debt and it is rolling over the principal.[26] This strategy moves costs too far into the future compared with the dates at which the bulk of the benefits of investment will be reaped; hence, current generations will be tempted to overspend. One possible solution is to set $x < 1$, that is, to allow only a

[26]The SGP also contains a separate provision stating that the debt-to-GDP ratio of a country should be below 60 percent or moving towards that goal. This provision is weakly enforced, and it would also not be sufficient to generate the repayment schedule that is needed for distortions to vanish.

portion of investment to be excluded from the deficit computation. Alternatively, excluding *net* investment from the deficit subject to the ceiling performs really well. Table 2 shows that the value of the marginal investment is very close to efficiency in this case, supporting Blanchard and Giavazzi's [7] recommendation.

Excluding net investment forces a faster repayment of debt, and brings closer costs and benefits for most generations alive. To see why, consider what happens if people vote to raise public investment by 1 in period $t$. Whether gross or net investment is excluded, government debt $B_t$ increases by 1. In the Markov equilibrium, the effect of the extra investment is reversed in period $t+1$, which implies that gross investment drops by $(1-\delta)/(1+n)$ and net investment drops by $1/(1+n)$. When gross investment is excluded, substituting this pattern into equation (3) results in an extra amount of government debt in period $t+1$ given by $\delta/(1+n) > 0$; the additional debt subsequently decays at the (very slow) rate $1/(1+n)$. When net investment is excluded, all of the additional debt is repaid in period $t+1$, and $B_{t+1}$ is unaffected. Simple algebra shows that in this case the wedge is given by $-(1-\text{median}(\theta_s)/(1+n))$, which is independent of the depreciation rate of capital and is close to 0 for the relevant processes for mortality, mobility, and population growth.

In practice, excluding net investment is significantly more complicated than excluding gross investment, since it requires knowledge of the appropriate depreciation rate of public capital. Each additional complication generates new opportunities for governments to game the accounting,[27] and such a complication is only justified when the magnitude of the distortions involved is sufficiently large.

Figure 1 picks Germany as an example to illustrate how the political decision emerges from the conflict across different generations alive in the case of generic capital. The figure plots the wedge $\tau$ that would be preferred by each cohort; a larger (more positive) $\tau$ means that the cohort favors more severe underinvestment, whereas a more negative $\tau$ implies that the cohort favors more severe overinvestment. We can see that all people alive are unanimous in supporting underinvestment if no exclusion is allowed ($x = 0$) and overinvestment when gross investment

[27] See also the discussion in Balassone and Franco [1].

| Country | SGP, no exclusions | Excluding gross investment | Excluding net investment |
|---|---|---|---|
| | | Generic capital | |
| Austria | 12 | -22 | -1.3 |
| Belgium | 14 | -23 | -1.6 |
| Finland | 21 | -24 | -2.2 |
| France | 17 | -25 | -1.9 |
| Germany | 14 | -22 | -1.5 |
| Greece | 19 | -24 | -2.1 |
| Ireland | 34 | -32 | -3.6 |
| Italy | 13 | -23 | -1.4 |
| Luxembourg | 19 | -25 | -2.1 |
| Netherlands | 18 | -24 | -1.9 |
| Portugal | 21 | -26 | -2.3 |
| Spain | 21 | -25 | -2.3 |
| | | Major infrastructure | |
| Austria | 17 | -16 | -1.3 |
| Belgium | 21 | -17 | -1.6 |
| Finland | 30 | -18 | -2.2 |
| France | 25 | -18 | -1.9 |
| Germany | 21 | -16 | -1.5 |
| Greece | 28 | -18 | -2.1 |
| Ireland | 49 | -24 | -3.6 |
| Italy | 20 | -16 | -1.4 |
| Luxembourg | 28 | -18 | -2.1 |
| Netherlands | 26 | -18 | -1.9 |
| Portugal | 31 | -19 | -2.3 |
| Spain | 31 | -18 | -2.3 |

Table 3: Efficiency wedge $\tau$ in the Eurobarometer calibration (percent)

is excluded from the deficit ceiling. When net investment is excluded, most generations favor an allocation that is extremely close to efficient. In two of the three cases, the vote pits the young and old against the middle-aged, as we remarked earlier. In the case of excluding gross investment, the prospect of pushing taxes further into the future becomes particularly relevant, and a different split emerges, with the young on the patient side against the old on the impatient side.

Table 3 shows the results when emigration is calibrated to the intentions revealed in the Eurobarometer survey.[28] For the large countries with low population growth and mobility, notably Germany and Italy, the results are similar to those of the baseline calibration; the distortion arising from treating government consumption and investment in the same way (that is, no exclusions) is not very large, albeit not entirely trivial.

# 5 Conclusion

Two main conclusions stand out from the analysis we carried out.

- The demographics and mobility rates for European countries do not justify drawing a sharp distinction between the financing of government consumption and investment in the same way those factors for the U.S. states do.

- To the extent that a distinction is approved, it is important to exclude only *net* investment from the deficit count, since excluding gross investment could actually worsen distortions.

We analyzed the efficiency implications of the SGP from the perspective of an individual country. For this article, it does not matter whether the deficit restrictions follow from a multilateral agreement, such as the SGP, or are self-imposed by the constitutions of individual entities, as is the case for U.S. states. Many authors have discussed the externalities that justify the adoption of a multilateral pact that covers fiscal policy in a monetary union; among them are Beetsma and Uhlig [6], Dixit and Lambertini [12], Chari and Kehoe [10], and Lindbeck and Niepelt [15].

[28] For the countries for which we had no Eurostat data on emigration rates, we use the population structure by age as of 2005, except for France (2004).

Their insights provide conditions under which it is desirable to restrict the independence of an individual government in running its fiscal affairs, but they do not bear implications for setting common or different rules for government consumption and investment.

Our model captures some forces that lead voters to discount future costs and benefits excessively, but does not entertain the possibility that elected politicians may act as if they were even more short-sighted than voters. Some of these alternatives are briefly discussed in Bassetto with Sargent [5]; while it is easy to generate reasons why the current government might be tempted to overspend if deficit restrictions are not imposed, it is harder to devise environments where overspending would affect public consumption more than investment, at least without appealing to myopic behavior on the part of the voters.

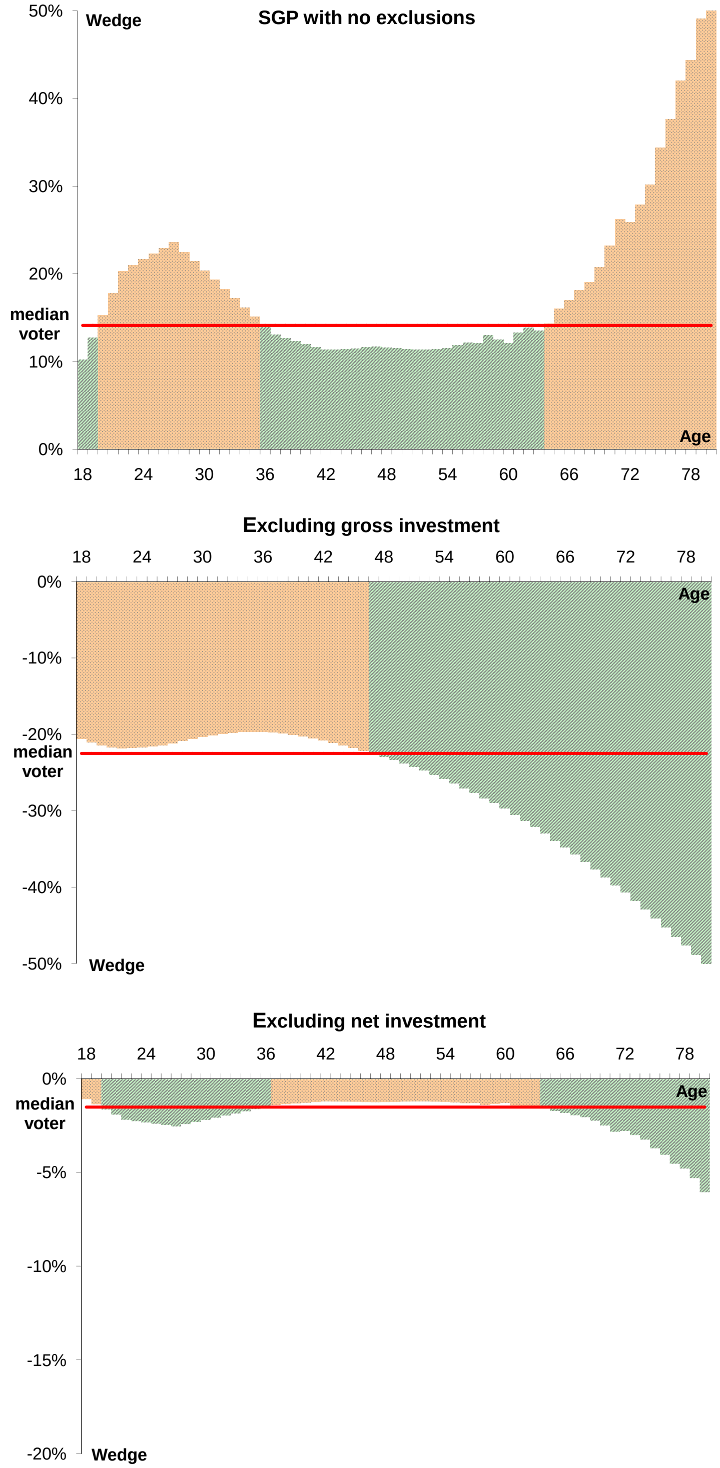


Figure 1: Preferred efficiency wedge by age, Germany, generic capital, baseline scenario.

# A Appendix

In this appendix we define the equilibrium concepts that we use, and we construct a Markov political-economic equilibrium;[29] we then provide an expression for the efficiency wedge for public capital ($\tau$) when *net* investment is excluded from the government deficit constraint (for gross investment, the expression is in Bassetto with Sargent [5], equations (22) and (24) with $\alpha = 0$).

## A.1 Competitive Equilibrium

A household born in period $t \geq 0$ chooses a private consumption allocation $\{c_{s-t,s}\}_{s=t}^{N+t}$ and an asset allocation $\{b_{s-t,s}\}_{s=t}^{N+t}$ to maximize

$$\sum_{s=t}^{N+t} \beta^{s-t} \left( \prod_{j=0}^{s-t-1} \theta_j \right) c_{s-t,s} \tag{A.1}$$

subject to the budget constraints

$$c_{s-t,s} + b_{s-t,s} \leq y - T_s + \frac{(1 + r_{s-1}) b_{s-t-1,s-1}}{\theta_{s-t-1}} \tag{A.2}$$

and $b_{N,N+t} \geq 0$, taking as given the tax sequence $\{T_s\}_{s=t}^{N+t}$, interest rates $\{r_s\}_{s=t}^{N+t-1}$, and the initial condition $b_{-1,t-1} = 0$. The budget constraints embody an insurance agreement in which assets of the households that die are redistributed to alive households of the same age in proportion to their asset holdings. Households that are born in period $t < 0$ solve a similar maximization problem from date zero, taking as given an exogenous initial condition $(1 + r_{-1}) b_{-t-1,t-1}$.

A *competitive equilibrium* is a real allocation $\{\{\hat{c}_{s,t}\}_{s=0}^{N}, \hat{\gamma}_t, \hat{G}_t, \hat{\Gamma}_t\}_{t=0}^{\infty}$, an asset allocation $\{\{\hat{b}_{s,t}\}_{s=0}^{N-1}\}_{t=0}^{\infty}$, a tax-debt policy $\{\hat{T}_t, \hat{B}_t\}_{t=0}^{\infty}$, an interest rate sequence $\{\hat{r}_t\}_{t=0}^{\infty}$, and initial conditions $\{\Gamma_{-1}, B_{-1}, \{b_{-s-1,-1}\}_{s=-N}^{-1}, r_{-1}\}$ such that:

(i) given the interest rates, the tax policy, the initial conditions, and the transfers, the private consumption and asset allocation are optimally chosen by the households;

[29] These definitions are very similar to those in Bassetto with Sargent [5], except that we use here one-period debt that is rolled over rather than consols that are repurchased. The results are independent of the debt instrument as long as the rates at which debt is rolled over or repurchased match (e.g., full roll-over of principal is equivalent to no repurchases of consols; immediate repurchases are equivalent to no roll-over of short-term debt).

(ii) at any time $t$, the real allocation satisfies the feasibility conditions (1) with $\hat{C}_t = \sum_{s=0}^{N} \lambda_s \hat{c}_{s,t}$, where $\lambda_s$ is the fraction of households of age $s$, and $\hat{\Gamma}_t = \frac{1-\delta}{1+n}\hat{\Gamma}_{t-1} + \hat{\gamma}_t$;

(iii) at any time $t \geq 0$, the asset market clears:[30]

$$\hat{B}_t = \sum_{s=0}^{N} \lambda_s \hat{b}_{s,t}; \tag{A.3}$$

(iv) the government budget constraint (2) holds.

The necessary conditions of the household maximization problem imply that in a competitive equilibrium $\hat{r}_t = (1-\beta)/\beta$ for $t \geq 0$,[31] so the interest rate is constant (as written in the main text).

## A.2 Political-Economic Equilibrium

We define a political-economic equilibrium in which households collectively choose public spending and investment in each period. To evaluate those choices, households must form expectations about the evolution of the economy. A *history* of the economy is a sequence $h^t \equiv \{G_j, \Gamma_j\}_{j=0}^{t}$, for any $t \geq 0$. We define a political-economic equilibrium in terms of a mapping $\Psi$ that associates to each history $h^t$ a time-$t$ allocation (other than public spending and capital, which are already included in $h^t$) $(\{c_s(h^t)\}_{s=0}^{N}, \gamma(h^t))$, a time-$t$ tax-debt policy $(B(h^t), T(h^t))$, a time-$t$ asset allocation $\{b_s(h^t)\}_{s=0}^{N-1}$, and a time-$t+1$ choice of government consumption and capital $(G(h^t), \Gamma(h^t))$. To obtain the time-0 values of government consumption and capital, we associate two values $G(\emptyset)$ and $\Gamma(\emptyset)$ with the null history. Given any history $h^j$, each mapping $\Psi$ recursively generates a history from $h^j$ as $h^t = (h^{t-1}, G(h^{t-1}), \Gamma(h^{t-1}))$. Each mapping $\Psi$ and its associated history induce an allocation and a tax-debt policy from initial conditions $\Gamma_{j-1}$ and $\{b_s(h^{j-1})\}_{s=0}^{N-1}$.[32]

A *political-economic equilibrium* is a mapping $\tilde{\Psi} \equiv (\{\tilde{c}_s\}_{s=0}^{N}, \{\tilde{b}_s\}_{s=0}^{N-1}, \tilde{\gamma}, \tilde{B}, \tilde{T})$ that has the following properties:

[30] In addition, the initial condition must be consistent, so $B_{-1} = \sum_{s=0}^{N} \lambda_s b_{s,-1}$.

[31] We normalize $r_{-1}$ to the same value.

[32] $h^{j-1}$ is the predecessor of the history $h^j$. When we consider an initial history $h^0$, $b_s(h^{-1})$ is $b_{s,-1}$, the initial level that is exogenously given; the same applies to other variables.

(i) (*Competitive equilibrium*) Given any history $h^j$, including the null history, the real and asset allocations and the tax-debt policy induced by $\tilde{\Psi}$ form a competitive equilibrium from the initial conditions $(\Gamma_{j-1}, \tilde{B}(h^{j-1}), \{\tilde{b}_s(h^{j-1})\}_{s=0}^{N-1})$, together with the constant interest rate $r = (1-\beta)/\beta$.

(ii) (*Self-interested voting*) Given any history $h^{j-1}$, including the null, $(\tilde{G}(h^{j-1}), \tilde{\Gamma}(h^{j-1}))$ is a Condorcet winner over any alternative proposal $(G, \Gamma)$, assuming that in the future the economy will follow the path implied by $\tilde{\Psi}$. That is, given any alternative $(G, \Gamma)$, the following inequality holds for more than 50 percent of the people alive at time $j$:

$$\begin{aligned} &\tilde{c}_s(\tilde{h}^j_{G,\Gamma}) + f(G) + v(\Gamma) + \\ &\sum_{t=1}^{N-s} \beta^t \left( \prod_{m=s}^{s+t-1} \theta_m \right) \left[ \tilde{c}_{s+t}(\tilde{h}^{j+t}_{G,\Gamma}) + f\Big(\tilde{G}(\tilde{h}^{j+t-1}_{G,\Gamma})\Big) + v\Big(\tilde{\Gamma}(\tilde{h}^{j+t-1}_{G,\Gamma})\Big) \right] \leq \\ &\sum_{t=0}^{N-s} \beta^t \left( \prod_{m=s}^{s+t-1} \theta_m \right) \left[ \tilde{c}_{s+t}(\tilde{h}^{j+t}) + f\Big(\tilde{G}(\tilde{h}^{j+t-1})\Big) + v\Big(\tilde{\Gamma}(\tilde{h}^{j+t-1})\Big) \right], \end{aligned} \tag{A.4}$$

where $\{\tilde{h}^{j+t}_{G,\Gamma}\}$ and $\{\tilde{h}^{j+t}\}$ are defined recursively as follows:

$$\tilde{h}^j_{G,\Gamma} = (h^{j-1}, G, \Gamma),$$

$$\tilde{h}^{j+t}_{G,\Gamma} = \left( \tilde{h}^{j+t-1}_{G,\Gamma}, \tilde{G}\Big(\tilde{h}^{j+t-1}_{G,\Gamma}\Big), \tilde{\Gamma}\Big(\tilde{h}^{j+t-1}_{G,\Gamma}\Big) \right), \quad t \geq 1,$$

$$\tilde{h}^{j-1} = h^{j-1},$$

$$\tilde{h}^{j+t} = \left( \tilde{h}^{j+t-1}, \tilde{G}\Big(\tilde{h}^{j+t-1}\Big), \tilde{\Gamma}\Big(\tilde{h}^{j+t-1}\Big) \right), \quad t \geq 0.$$

Here $\tilde{h}^{j+t}$ is the history induced by $\tilde{\Psi}$ from $h^{j-1}$; $\tilde{h}^{j+t}_{G,\Gamma}$ is the history induced by choosing $(G, \Gamma)$ in period $j$ and following $\tilde{\Psi}$ afterwards.

(iii) (*SGP restriction*) Given any non-null history $h^t$, either

$$\tilde{T}(h^t) = r\frac{\tilde{B}(h^{t-1})}{1+n} + G_t + (1-x)\tilde{\gamma}(h^t) - d, \tag{A.5}$$

or

$$\tilde{T}(h^t) = r\frac{\tilde{B}(h^{t-1})}{1+n} + G_t + \tilde{\gamma}(h^t) - x\left(\tilde{\gamma}(h^t) - \delta\frac{\Gamma_{t-1}}{1+n}\right) - d, \tag{A.6}$$

where $G_t$ and $\Gamma_{t-1}$ are the appropriate elements of the history $h^t$. Whether (A.5) or (A.6) applies depends on whether gross or net investment is excluded according to the rule. Notice that we impose that taxes are chosen so that the deficit limit binds. This is without loss of generality for the equilibria and parameter values we are interested in (households alive would anyway vote for lowering taxes as much as possible), and it greatly simplifies notation.[33]

## A.3 Markov equilibria

We define a Markov equilibrium as one where $G$ and $\Gamma$ are independent of past variables. As proven in Bassetto with Sargent [5], Markov equilibria exist, and they all share the same level of $G_t$, $\Gamma_t$, and welfare for all generations (for given parameters $d$, $x$). For the case in which gross investment is excluded from the deficit count, Markov equilibrium allocations are constructed in Bassetto with Sargent [5].[34] The construction in the case of net investment is essentially identical; we present here only the crucial step of determining government investment, referring to the appendix of Bassetto with Sargent [5] for the rest.

Within the equilibrium, an increase in the time-$t$ provision of public capital will be reversed in period $t+1$. The marginal value of the extra provision is $v'(\Gamma_t)$. On the cost side, equations (2) and (A.6) imply that an additional unit $\gamma_t$ increases time-$t$ taxes by $1-x$ units and leads to a reduction in $\gamma_{t+1}$ of $(1-\delta^\Gamma)/(1+n)$ units, but has no further effect on public investment. This implies that time-$t+1$ taxes change by

$$\frac{rx}{1+n} + \frac{x-(1-\delta)}{1+n}$$

where the first component is due to higher debt $B_t$, and the second component results from the decrease in net investment that occurs in period $t+1$. Unlike in the case of gross investment,

[33]When debt principal can be rolled over, as in the SGP rule, $n > 0$ is a sufficient condition for all households alive to support the highest possible deficit in each period in a Markov equilibrium, even when an independent choice over taxes is allowed.

[34]The SGP restriction allows the government to roll over debt, paying only interest. The appropriate value of $\alpha$ to apply in Bassetto with Sargent's equations is thus 0.

when net investment is excluded the adjustments to taxes in periods $t$ and $t+1$ leave debt at the end of period $t+1$ unaffected. Hence, no further adjustment occurs after period $t+1$.

To a person of age $s$, the expected present value of taxes per unit of public investment is therefore

$$Q_s \equiv 1 - x + \frac{\beta\theta_s}{1+n}\left[\frac{rx}{1+n} + \frac{x-(1-\delta)}{1+n}\right]. \tag{A.7}$$

The indirect utility function over government expenditure policy for this person is

$$v(\Gamma) - Q_s\Gamma. \tag{A.8}$$

The equilibrium value of $\Gamma$ is such that $v'(\Gamma) = \text{median}(Q_s)$.[35]

Substituting for the interest rate, the equilibrium efficiency wedge can be computed as:

$$\tau = \frac{\text{median}(Q_s) - (1-\beta(1-\delta))}{1-\beta(1-\delta)} = -\frac{x-\beta(1-\delta)}{1-\beta(1-\delta)}\left[1 - \frac{\text{median}(\theta_s)}{1+n}\right].$$

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