An Opportunistic Approach to Debt Reduction

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-Abstract-

This paper analyses alternative fiscal policy rules that would be useful if the government wanted to establish goals for the evolution of the debt-to-GDP ratio over time. It also examines the fiscal policy trade off, that is, how fiscal policy, with this particular goal in mind, balances three objectives: debt control, commitment to announced tax and spending measures (in real terms), and economic stabilisation.

Hostland and Matier (1999, 2001) have proposed a symmetric flexible rule whereby the fiscal authority aims to bring the debt-to-GDP ratio back on track at the same rate whether that ratio is above or below its target path. In this paper, we look at the potential advantages of waiting for the most opportune moments (when economic growth is strong) to reduce the debt burden. We refer to this asymmetric fiscal rule as an opportunistic approach to debt reduction.

The main policy question of the paper is whether the opportunistic approach to debt reduction improves the fiscal policy trade off under a symmetric rule. We examine this issue by comparing symmetric and asymmetric fiscal policy rules in a stochastic simulation model.

The intuition underlying an opportunistic approach seems compelling but upon closer examination there appears to be little in the way of an advantage (or disadvantage) relative to a symmetric rule. Both approaches trade-off the conflicting fiscal policy objectives in much the same way. We demonstrate this result by showing that the performance of an opportunistic approach can always be approximated by a carefully chosen symmetric fiscal policy rule. It is the fiscal authority's freedom to choose the degree of flexibility of the symmetric fiscal rule that permits it to approximate the fiscal policy trade-off delivered by an opportunistic approach to debt reduction.

1. Introduction

This paper pursues the analysis of medium term fiscal planning addressed in Hostland and Matier (2001). The focus remains the study of alternative fiscal policy rules that would be useful if the government wanted to establish goals for the evolution of the debt-to-GDP ratio over time. As in Hostland and Matier, we pursue the analysis of the fiscal policy trade off, that is, how fiscal policy, with this particular goal in mind, balances three objectives: debt control, commitment to announced tax and spending measures (in real terms), and economic stabilisation.

Hostland and Matier have proposed a symmetric flexible rule whereby the fiscal authority aims to bring the debt-to-GDP ratio back on track at the same rate whether that ratio is above or below its target path. In this paper, we look at the potential advantages of waiting for the most opportune moments (when economic growth is strong) to reduce the debt burden. We refer to this asymmetric fiscal rule as an opportunistic approach to debt reduction.[1]

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The plan of the paper is as follows. Section 2 briefly reviews key aspects of the paper by Hostland and Matier, in particular the fiscal policy trade-off and symmetric fiscal rules. Section 3 examines the framework of the opportunistic approach to debt reduction. In Section 4 we compare simulation results for both the symmetric and opportunistic approaches. Section 5 concludes.

2. Fiscal policy trade off and symmetric fiscal policy rules

Most existing studies on fiscal planning [(Boothe and Reid (1997), Dalsgaard and De Serres (1999), Robson and Scarth (1999)] are concerned with avoiding excessive deficit outcomes and/or have focused on strategies for implementing budget balance targets.

[1] Indeed, the paper has several parallels with the literature on the opportunistic approach to disinflation [e.g., Bomfim and Rudebusch (1997)] where the monetary authority waits for unforeseen shocks (recessions) to reduce inflation.

However these studies provide no insight into issues entailed in implementing a target for the debt-to-GDP ratio.

Hostland and Matier, on the other hand, focus on alternative strategies that would be useful if the government wanted to establish goals for the evolution of the debt-to-GDP ratio over time. Their paper also provides an extensive examination of the fiscal policy trade-off, that is, the trade-off between the objectives of debt control, economic stabilisation, and policy commitment.

The debt control objective in their paper refers to the performance of the fiscal authority in keeping, over several years, the debt-to-GDP ratio within a downward-sloping target range (floor and ceiling) centred on a target path. Figure 1 shows the distinction between target path (T-T) and target range. The target range is a probabilistic range in the sense that the government would tolerate, on average, only a small probability (of 5%) of being above the ceiling (C-C) or below the floor (F-F) each period.

Debt control has important implications for the credibility of the debt reduction plan. If the fiscal authority demonstrates that it can keep the debt-to-GDP ratio within a narrow target range, individuals will come to believe that the debt reduction plan will be successful and adjust their expectations accordingly. A policy rule that attains a high degree of debt control will enhance the credibility of the debt reduction plan.

According to the commitment objective ("avoidance of backtracking"), the fiscal authority wants to be able to commit to carry out announced tax and spending measures, even if economic conditions turn out to be significantly weaker than anticipated. Specifically, the fiscal authority would tolerate only a small probability of being below a floor for program spending or tax reduction measures (expressed in real terms). Hence, the fiscal authority is committed to limit the risk of having to "backtrack" on its announced fiscal measures to a low probability (say, 5%).

According to the economic stabilisation objective, the fiscal authority seeks to dampen business fluctuations by implementing a counter-cyclical overall policy stance. This entails moving the budget balance toward a surplus (deficit) position during expansionary (contractionary) periods. This is achieved in part through various spending programs and aspects of the tax system that are designed to provide automatic stabilisation. Discretionary changes can also be made to supplement automatic stabilisation to provide a more counter-cyclical overall policy stance.

The debt control objective conflicts with the objectives of commitment to fiscal measures and economic stabilisation, leading to a fiscal policy trade-off. For example, consider the case where economic growth turns out to be much weaker than projected in the budget. Program spending would be higher than anticipated and tax revenues lower than expected, causing the debt-to-GDP ratio to rise, say, above its target path (point 1 in Figure 1 illustrates this). Exercising debt control calls for reducing spending and/or increasing taxes to move the budget balance towards (but not necessarily into) a surplus position such that the debt-to-GDP ratio declines back to the desired level. This could

entail "backtracking" on announced fiscal measures. Moreover, this is in direct conflict with the stabilisation objective, which in this case calls for a fiscal expansion in the form of higher program spending and/or lower taxes, causing the debt-to-GDP ratio to rise even further above the target path.

The fiscal authority must therefore strike a balance between its objectives of debt control, avoidance of "backtracking" and economic stabilisation. Hostland and Matier demonstrate that a *symmetric flexible* fiscal rule provides a moderate amount of debt control without generating a strongly pro-cyclical stance or significantly raising the risk of "backtracking". They consider a class of policy rules that is *symmetric* in the following sense. The fiscal authority responds to unanticipated economic developments with fiscal measures that have equal intensity (but opposite direction) regardless of whether the shocks are favourable (observed debt-to-GDP ratio below target path) or unfavourable (observed debt-to-GDP ratio above target path). The adjustment paths A-A and D-D from points 1 and 2 in Figure 1 illustrate this.

The rule is *flexible* because the fiscal authority can choose the rate (or speed) "τ" (tau) at which the debt-to-GDP ratio is projected to revert back to the target path. (An appendix describes more technically how this rate τ is introduced in the fiscal rule.) Relative to A-A and D-D, paths B-B and C-C illustrate fiscal responses that embody a faster speed of reversion (a larger parameter "τ") to the target path. A faster speed of reversion results in tighter debt control, at the expense of a higher risk of backtracking, and a less overall counter-cyclical policy stance.[2]

3. The framework for an opportunistic approach to debt reduction

We now examine the opportunistic approach to debt reduction, so called because the fiscal authority would allow for more debt reduction during the most opportune moments (when economic growth is strong).

The objectives of avoidance of backtracking and economic stabilisation remain identical to those defined by Hostland and Matier. For the debt control objective, however, we consider only a ceiling. This is a probabilistic ceiling in the sense that the government would tolerate only a small probability (of 5%) of exceeding the ceiling each period. In terms of Figure 2, the fiscal authority seeks to confine fluctuations in the debt-to-GDP ratio below the ceiling C-C but makes no attempt to limit declines in the debt-to-GDP ratio.

The framework of the opportunistic approach to debt reduction can be described as follows. Unlike the symmetric approach that has *one* target path for the debt-to-GDP ratio, the opportunistic approach can be viewed as a *sequence* of "*interim*" target paths. Interim paths are *redefined* (or updated) according to the shocks observed each period. When the debt-to-GDP ratio declines *below* the current interim target path, the interim

[2] The fiscal policy reaction is more *pro-cyclical.* However, given the amount of automatic stabilisation in the stochastic simulation model used by Hostland and Matier, this shows up as a less overall *counter-cyclical* policy stance.

target path gets updated.[3] Otherwise, the interim path is kept unchanged. This is illustrated in Figure 2. If the debt-to-GDP ratio declines below the initial interim target path D-D (say to point 1), the fiscal authority redefines a new interim target path D'-D'. If the debt-to-GDP ratio subsequently declines below D'D' (say to point 2), the interim target path is redefined once again (as shown by D''-D''). Otherwise, the fiscal authority maintains the interim target path D'-D'.

Within this setting the fiscal authority is assumed to have an *asymmetric flexible* policy rule that confines the debt-to-GDP ratio below a ceiling. It is flexible because the rule entails setting the rate (τ) at which the debt-to-GDP ratio is projected to revert back to its *relevant* interim target path. Combined with the updating feature of interim paths, this rule is asymmetric in the sense that the authority responds to unanticipated economic developments with distinct fiscal intensities when shocks are favourable or unfavourable. This is illustrated in Figure 2 by the adjustment path leading to D'D' from point 3, and the updating of the interim paths (D'-D' with D"-D") from point 2.

When the debt-to-GDP ratio is above target (as is the case at point 3 above D'-D'), the adjustment path to D'D' embodies a pro-cyclical fiscal reaction similar to the one implied by the Hostland-Matier rule.[4] When the debt-to-GDP ratio is below its current interim target (as is the case at point 2), the fiscal authority *avoids* any deliberate pro-cyclical fiscal stance that would be needed for debt control under a symmetric fiscal rule. It does this by eliminating all deviation from target by simply redefining a new interim target path (D"-D") whose starting point coincides with the observed debt-to-GDP ratio.[5] Hence, the fiscal authority makes no attempt to move the budget balance toward a deficit position in reaction to favourable shocks as it would if it used a symmetric policy rule. This appears to permit a more counter-cyclical policy stance.

An opportunistic approach can also be motivated by the fact that it avoids deliberate *temporary* increases in the debt-to-GDP ratio. Such deliberate increases are a potential concern under a symmetric rule when the target path is declining over time. If a favourable shock brings debt sufficiently far below its *current* target value, the symmetric rule will cause the fiscal authority to try to *temporarily* increase the debt-to-GDP ratio and then resume reducing it. An asymmetric rule will avoid any such temporary deliberate increase in the debt-to-GDP ratio. Incidentally, this difference in the two approaches is what justifies defining debt control in terms of a target range under a symmetric policy rule and in terms of a ceiling under an asymmetric rule. For example, the policy response leading from point 3 in Figure 1 is appropriate in the case where the debt control objective is defined with reference to a *target range*. But such a temporary

[3] The starting point of each interim path is the *current* debt-to-GDP ratio whereas the end point remains the same long-term target, say, 30% for the debt-to-GDP ratio.

[4] The reaction is similar, but not identical, unless the interim target path of the opportunistic approach happens to be identical to the target path of the symmetric approach.

[5] Strictly speaking the fiscal stance will be slightly pro-cyclical because the new interim target path for the debt-to-GDP ratio represents an "easier drive" to the unchanged long-term objective of, say, a debt-to-GDP ratio of 30%. The consequence in terms of "flows" is an unconditional expectation path of smaller surpluses or larger deficits than those associated with the previous interim target path. This provides an opportunity for a slightly expansionary fiscal stance.

increase is not appropriate with a *debt ceiling* because, in that case, the fiscal authority has no desire to raise the debt-to-GDP ratio at any time.[6]

A contribution of the paper is to examine (in Section 4) whether stochastic simulation experiments provide empirical support to the intuitive appeal of the opportunistic approach to debt reduction.

4. Stochastic Simulation Experiments

4.1 Methodology

The stochastic simulation procedure operates as follows. A total of 10 shocks displace all the endogenous variables in the model each period [see Hostland (2001) for a description of the model]. Mutually independent shocks are drawn from a zero-mean normal distribution with variances calibrated to be roughly consistent with the historical data. The stochastic simulation process runs for 44 consecutive quarters (11 years) and is repeated 1250 times, resulting in a total of 55,000 simulated values for each variable in the model.

The first year of the stochastic simulation (year 0) is peculiar in the sense that the fiscal authority starts at a fiscal equilibrium (on target). In other words, it is assumed that there are no past shocks to which the fiscal authority needs to react. Therefore the fiscal plan for year 0, set at the start of the first quarter of that year, is the budget balance that is consistent with the target for the debt-to-GDP ratio. Stochastic shocks then impinge on this fiscal plan for four consecutive quarters, causing unanticipated fluctuations in the debt-to-GDP ratio and the budget balance. At the beginning of fiscal year 1 the authority makes its budget plans using either a symmetric or an asymmetric fiscal policy reaction rule. This permits the fiscal authority to reformulate its budget plan according to the fiscal approach to debt reduction that it initially decided on (symmetric or opportunistic approach) and to take into account the stochastic shocks of last year and its expectations about the future. The process is thereafter pursued to year 10.

4.2 Debt reduction "mean" paths in symmetric and opportunistic approaches

In Hostland and Matier, the stochastic shocks *and* the fiscal reaction are symmetric and hence all simulated variables are centred on their respective unconditional expected value. For example, the unconditional probability of being above or below the target path for the debt-to-GDP ratio is ½. The target path (T-T in Figure 1) can therefore be viewed as the mean (or expected value) path of the symmetric approach when it is repeated a large number of times (1250 runs).

In the opportunistic approach, the mean path need not coincide with the initial interim target path. Our simulation results show that setting τ at approximately 0.05 in the

[6] The fiscal authority would raise the debt-to-GDP ratio in the opportunistic approach only in those cases where the debt-to-GDP ratio falls below its long-term target (30%). According to our simulation experiments examined in the next section this never happens within a ten-year horizon.

asymmetric fiscal rule generates a mean path that is quite similar to the initial interim target path. Larger values for τ generate more front-loaded mean paths (*i.e.*, more of the debt reduction takes place in the earlier years), whereas smaller values generate less front-loaded mean paths.[7] Box 1 provides an intuitive explanation of the reason why we obtain these "more" or "less" front-loaded mean paths relative to the initial interim target path.

This feature of the opportunistic approach may suggest that it has the potential to "overachieve" or "underachieve" the debt reduction plan that is, to reduce the debt-to-GDP faster or slower than under a symmetric approach.[8] But this need not be the case. If we prefer the mean path generated by a particular opportunistic rule, we can always centre a symmetric fiscal rule on a target path that corresponds to that mean path.

To properly compare the symmetric and opportunistic approaches, however, we have to take into account the "more" or "less" front-loaded feature of the opportunistic approach. Therefore, in our simulation experiments, we ensure that both the opportunistic and symmetric approaches deliver, on average over 1250 runs, the same "mean" path for the debt-to-GDP ratio.

The "more" or "less" front-loaded feature of the opportunistic approach has another important implication for the distributions of the debt-to-GDP ratios. An asymmetric rule with a high rate of reversion (τ) to the interim target path will generate negative skewness, that is a distribution with a long tail to the left. (See box 1 for the relation between mean and median values of the debt-to-GDP ratio and skewness in an opportunistic approach.) On the other hand an opportunistic approach with a small rate of reversion to the interim target will generate a positive skewness, that is a distribution with a long tail to the right. According to our simulation a rate of reversion (τ) of about 0.05 generates a symmetric distribution. With this parameter value, the mean path generated under the opportunistic approach is approximately the initial interim target path, such that mean and median values for simulated debt-to-GDP ratio are equalised.

Figure 4a shows, for "year 5" of the simulation, the probability distributions of the simulated debt-to-GDP ratio under an opportunistic approach (blue dotted line) and a symmetric approach (red solid line) whose mean paths have been matched. The figure illustrates the case when the fiscal authority chooses the same high value τ (0.3) in both the symmetric or asymmetric fiscal rule. We observe three facts from this figure.

First, the symmetric approach generates a symmetric probability distribution for the debt-to-GDP ratio, whereas the probability distribution function under an opportunistic approach is slightly skewed to the left.

[7] By construction mean paths under an opportunistic approach all share the same mean in year 0 and share the same end-point as the one associated with interim target paths.

[8] It is implicitly assumed here that the symmetric fiscal rule would be directed to a target path equal to the initial interim target path of the opportunistic approach.

Box 1 The Mean Path Under an Opportunistic Approach

It was shown in Figure 2 that the opportunistic approach is a sequence of "interim" target paths (D-D, D'-D', D"-D", etc.). This figure may lead to believe that the mean path for the debt-to-GDP ratio will necessarily be "below" the initial interim target path (D-D). This comes from thinking that the mean value of the simulated debt-to-GDP ratio would correspond to the mean value of the interim targets at any point in time. This is not the case however, because this fails to recognise that simulated values for the debt-to-GDP ratios above their current interim target will prop up the mean value of simulated debt-to-GDP ratios above the mean value of interim targets at any point in time.

In this context we can show that that low values for the rate τ of reversion to the interim path could keep the mean value path of simulated debt-to-GDP ratio above the initial interim target path, whereas larger values for τ could push the mean path below the initial interim path. Figure 3 illustrates this point for the first year of the simulation.[1] Stochastic shocks in "year 0" generate a probability distribution for the debt-to-GDP ratio that is centred on point 0 on the initial interim target path (blue solid line). In fiscal year 1 the fiscal authority reacts to each negative shock above point 0 with adjustment paths leading to the initial interim target path and to each positive shock with new interim target paths (blue dashed lines). Figure 3a illustrates that a large value for τ, which implies a *fast* reversion to the initial interim target will push the mean of the debt-to-GDP ratio in year 1 at point 1, below the initial interim target and therefore the mean path (red line) below the initial interim target path. Figure 3b shows that the mean path for the debt-to-GDP ratio will be above the initial interim target for smaller values of τ because these values induce a *slow* reversion to the interim target.

The "more" or "less" front-loaded feature of the opportunistic approach has another important implication for the distributions of the debt-to-GDP ratios. Although point 1 in Figures 3a and 3b represents the mean of the simulated debt-to-GDP ratios, the median for that year is the value of the initial interim target because half the policy paths are above (adjustment paths), and half of them are below (new interim targets).[2] The implication is that an opportunistic approach with a high rate τ of reversion to the interim target path will generate negative skewness (mean smaller than median), that is a distribution with a long tail to the left. On the other hand an opportunistic approach with a small rate of reversion to the interim target will generate a positive skewness (mean exceeds median), that is a distribution with a long tail to the right.

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[1] The argumentation in this box is made in terms of policy paths after shocks in "year 0" have been observed but before the observation of shocks in year 1. Because shocks in year 1 will be centred on these policy paths, our conclusions would remain essentially unchanged (in average) even after the observation of shocks in year 1.

[2] In our repeated simulations, half the shocks will be positive in year 0, pushing the debt-to-GDP ratio above point 0, and half of them will be negative. Hence, at the start of year 1, the fiscal authority will respond to these shocks with policy paths, half of them being adjustment paths above the initial interim target, and half of them new interim targets below the initial target.

Second, we observe a smaller variance for the debt-to-GDP ratio under the symmetric approach. The difference in variance can easily be explained with the help of figure 5. In "year 0" shocks are identically distributed in both approaches. At the start of year 1 the fiscal authorities chooses a different response depending on the policy rule. Under an opportunistic approach, a negative shock will lead to an adjustment to the initial interim target path whereas a positive shock will imply a new interim target path. The consequence is a range of variation for the debt-to-GDP ratio as illustrated in Figure 5. Under a symmetric approach centred on the mean path of the opportunistic approach (red solid line), the fiscal authority will respond to positive shocks with adjustments paths leading to this unchanged *mean path*. This leads to the smaller range of variation for the debt to-GDP ratio as shown in Figure 5. Thus, using the same high (> 0.05) value of τ in symmetric or asymmetric rules would lead to a higher volatility of the debt-to-GDP ratio in the opportunistic approach.

Third, Figure 4a illustrates that for any opportunistic rule, there is a symmetric rule that has approximately the same mean and variance for the debt-to-GDP ratio. In this example, the performance of the opportunistic rule with $\tau = 0.3$ is approximated by a symmetric rule with a lower rate of reversion ($\tau = 0.1$) which is centred on the same mean as the one obtained from the asymmetric rule with τ set at 0.3. The distribution of outcomes from this third rule is shown as the green dashed line in the figure.

The larger variance (relative to the symmetric rule with $\tau = 0.3$) confirms the discussion in Section 2 that a lower rate τ in the symmetric fiscal rule decreases debt control. Figure 5 shows the impact on the adjustment paths of choosing a smaller rate of reversion in the symmetric rule. By moving from $\tau = 0.3$ to $\tau = 0.1$ in the symmetric rule, the green arrows replace the red arrows as relevant adjustment paths to the target. The green arrows are also closer to the adjustment paths and interim target of the opportunistic approach, somewhat mimicking them.

Small values for τ (< 0.05) in both symmetric and asymmetric fiscal rules would reverse our conclusions as is shown in Figure 4b. We would obtain a probability distribution for the debt-to-GDP ratio skewed to the right under the opportunistic approach, but a "more" symmetric distribution with a slightly larger variance under the symmetric rule. Approximating the debt-to-GDP distribution of an opportunistic approach with a symmetric rule would therefore require *increasing* slightly the value of τ in the symmetric rule. Finally Figure 4c shows that setting $\tau = 0.05$ in both fiscal rules generates two symmetric distributions with similar variance.

Thus the first and second moments of the distribution for the debt-to-GDP ratio (mean and variance) under an opportunistic approach can be approximated with a symmetric rule when the fiscal authority has the option to choose the appropriate rate of reversion to the target path. Although higher moments of the distribution (skewness) cannot be approximated, the asymmetric rule does not generate enough skewness for this to be a serious concern. In the next subsection we pursue this discussion further by comparing the fiscal policy trade-off under both approaches and by showing that we can match the performance of both approaches in all years.

4.3 Approximating the fiscal policy trade-off of an opportunistic approach with a symmetric fiscal rule

We now present the stochastic simulation results with reference to symmetric and asymmetric fiscal policy rules when the two approaches are centred to deliver the same mean path for the debt-to-GDP ratio. As discussed previously, the degree of responsiveness of the fiscal policy rule to deviation from a target is captured by a parameter τ. In this subsection, the parameter τ has been set at 0.1 and 0.3 in the symmetric and asymmetric rules, respectively. In other words, we allow for a larger responsiveness of the fiscal policy in the opportunistic ($\tau = 0.3$) versus the symmetric ($\tau = 0.1$) approach. The reason for comparing the two approaches at two different degrees of responsiveness is already implicit in the discussion above -- we can approximate the trade-off delivered by an opportunistic approach with a symmetric rule that is less responsive to shocks.

Debt control

We measure the degree of debt control using 95% confidence "ceilings", which are illustrated in Figure 6a for both the symmetric and asymmetric fiscal rules. Figure 6a reports 95% ceilings for the simulated debt-to-GDP ratios at each year over the first 10 years of the simulation period (excluding "year 0"). Ceilings are quite similar for the two rules (about 4.2 percentage points above mean at five-year horizon), which indicates that the level of debt control is comparable in both approaches. [In terms of figure 5, controlling for the same ceiling essentially means finding the smaller value of τ in the symmetric fiscal rule such that the adjustment path (upper green arrow) closely match the adjustment path of the asymmetric rule (upper blue dashed arrow).]

Recall that we compare the two approaches at two distinct values for the parameter τ. Had we compared both approaches at the same value for τ (say $\tau = 0.3$), the symmetric approach would have generated a lower ceiling for the simulated debt-to-GDP ratios and therefore a tighter debt control relative to the mean path.

Commitment to fiscal measures

A tight degree of debt control requires large and frequent changes to discretionary spending. Figure 6b compares 95% confidence floors for real discretionary spending ($million in constant 1992 dollars). At the five year horizon, the fiscal authority can commit to avoid backtracking below 220 billion and 221 billion (in the opportunistic and symmetric approach respectively) with 95% confidence.

Had we compared both approaches at the same value for τ (say $\tau = 0.3$) the symmetric rule would have generated a lower 95% confidence floor for the simulated fiscal measures. This would have been a worse performance in terms of maintaining a reasonably high level of fiscal measures in periods of recession.

Economic stabilisation

Finally, we examine the stabilisation role of fiscal policy by observing how the primary balance moves over the business cycle. This is measured by calculating the correlation between simulated values of the primary balance and the cyclical component of output. A high positive correlation implies a strongly counter-cyclical fiscal policy stance, consistent with the stabilisation objective; a negative correlation implies a pro-cyclical policy stance.

As shown in Figure 6c, the contemporaneous correlation in the fifth year of the debt reduction program is similar under symmetric ($\tau = 0.1$) and asymmetric ($\tau = 0.3$) rules (correlation of about 0.15). Had we compared both approaches at the same value for τ (say $\tau = 0.3$), the symmetric approach would have generated a lower degree of economic stabilisation. This reflects our intuition in Section 3 that the opportunistic approach seems *a priori* conducive to economic stabilisation.

In this subsection we have seen that a symmetric rule with a rate of reversion $\tau = 0.1$ approximates reasonably well the degree of debt control, commitment to fiscal measures and economic stabilisation of an asymmetric rule with $\tau = 0.3$ for all years of the simulated horizon. Hence, the fiscal authority can approximate the fiscal policy trade-off of an opportunistic approach with a "well-chosen" symmetric rule.

In Section 2 we mentioned that another intuitively appealing feature of the opportunistic approach is that it avoids *deliberate* (*i.e*, policy-motivated) increases in the debt-to-GDP ratio. This is a potential concern with a symmetric rule when the target path is declining over time. If a favourable shock brought the debt-to-GDP ratio below its target value, the symmetric rule could cause the fiscal authority to temporarily increase the debt-to-GDP ratio and then resume reducing it. However, our simulations show that this is not an important issue. The probability of observing a *deliberate* increase in the debt-to-GDP ratio from one year to another is usually close to zero and at most about 1% between the last two years of the simulation. (By definition, it is equal to zero under the opportunistic approach.)[9]

The approximation results of this subsection have been generated here for one specific value of the rate of reversion, that is for $\tau = 0.3$ in the asymmetric rule versus $\tau = 0.1$ in the symmetric rule. In the next subsection we show that these results hold for a realistic range of values for τ.

4.4 Generalising the approximation result

This subsection generalises the results of previous subsection. Figure 7a shows the fiscal trade off between debt control (expressed as the percentage point difference between the

[9] This probability is based on the number of times that the debt-to-GDP ratio increases from one year to the next. For each of the 1250 runs, the comparison is from one year's simulated (after shock) debt ratio to the next year's debt ratio *before* shock. This counts only *deliberate* increases in the debt-to-GDP ratio, not increases in the debt-to-GDP ratio due to (unfavourable) shocks.

mean value of the debt-to-GDP ratio and the ceiling, averaged over the ten-year horizon) and economic stabilisation (averaged over the ten-year horizon). The blue line represents the "possibility frontier" for the opportunistic approach. The line is downward-sloping reflecting that more debt control entails less economic stabilisation. The various points on the frontier correspond to different values of the rate of reversion to the interim target (from $\tau = 0.01$ to $\tau = 0.5$). Moving leftwards on this frontier corresponds to the setting of higher values for τ in the asymmetric fiscal rule. This also entails more front-loaded mean paths for the debt-to-GDP ratio.

The red line corresponds to the "possibility frontier" under the symmetric approach. Again, moving to the left corresponds to the setting of higher values for the parameter τ in the symmetric rule as well as more front-loaded mean paths. Symmetric and opportunistic approaches are centred on the same mean path for the same parameters. Comparing symmetric and asymmetric approaches at the same high value of τ (say $\tau = 0.5$), we observe that the opportunistic approach (blue diamond) provides more economic stabilisation than the symmetric approach (red square) at the cost of less debt control.

The fact that the policy frontiers generated by the two approaches are very similar may convince some readers that the two approaches are roughly equivalent for all reasonable choices of tau. However, there is a subtle complication that arises from the fact that the mean path for the debt-to-GDP ratio is different at all points on the frontiers. Thus to establish the equivalence of the two approaches, we perform the following thought experiment.

Suppose that the fiscal authorities are satisfied with debt control of 4 percentage points above mean. The blue diamond at $\tau = 0.3$ indicates the cost in terms of economic stabilisation under an opportunistic approach. The approximation of this trade off with a symmetric rule is (artificially) done in two steps. In the first step the fiscal authority would choose the point (red square) on the possibility frontier that generates 4 percentage points of debt control. This leads the authority to choose the rate of reversion $\tau = 0.1$ in the symmetric rule.

In the second step, the fiscal authority has to control for the same mean path (recall that two different values for τ will imply two different front-loaded debt reduction paths). The combination of debt control and economic stabilisation provided by a symmetric rule with $\tau = 0.1$ centred on the mean path generated by the opportunistic rule with $\tau = 0.3$ is shown by the green triangle at $\tau = 0.1$. This point lies very close to the policy frontier for the opportunistic approach (blue line), such that we conclude that the fiscal authority is able to approximate the trade-off (between debt control and economic stabilisation) of the opportunistic rule with a symmetric rule. (The fact that the green triangle is on the red square indicates that a symmetric rule delivers a fiscal trade off between debt control and economic stabilisation that is independent of the front-loaded nature of the debt reduction path.)

The other green triangle on Figure 7a shows the results of the same experiment with τ = 0.015. Once again, the symmetric rule delivers a result that is very close to the frontier for the opportunistic rule.[10]

Figure 7b shows that similar results are obtained when we consider the trade off between debt control and commitment to fiscal measures.

5. Conclusion

The objective of the paper is to describe and compare the medium-term performance of "symmetric" and "asymmetric" fiscal policy rules as alternative strategies for reducing public debt by keeping actual debt-to-GDP ratios on a clear downward track under a ceiling. Rather than aiming to bring the debt-to-GDP ratio back on track at the same rate whether it is above or below a target path, the fiscal authority would, in the opportunistic approach, wait for the most opportune moments (when economic growth is strong) to reduce the debt burden. In this approach, fiscal policy is geared to a sequence of "interim" debt-to-GDP target paths. The sequence of interim target paths, and therefore the pace of debt reduction, would depend on economic developments.

Using a stochastic simulation model, both types of rules are evaluated relative to three fiscal policy objectives: debt control, commitment to fiscal measures, and economic stabilisation. We control for the potential "under" or "over" achievement of the debt reduction plan under an opportunistic approach by centering both symmetric and asymmetric approaches on the same "mean" or "expected value" path for the debt-to-GDP ratio.

The intuition underlying the opportunistic approach is sound and seems compelling. According to our simulation experiments, however, there appears to be little in the way of an advantage (or disadvantage) relative to a symmetric rule. Both approaches trade-off the conflicting fiscal policy objectives much in the same way – a better performance on the commitment and stabilisation objectives at the expense of a reduced debt control. In particular, there appears to be a way to approximate the performance of an opportunistic approach using a carefully chosen symmetric fiscal policy rule. It is the fiscal authority's ability to choose the degree of flexibility of the fiscal rule that permits it to approximate the fiscal policy trade-off delivered by an opportunistic approach with a symmetric rule.

[10] Here, the fiscal trade-off generated by the asymmetric rule with τ = 0.01 can be approximated with a symmetric rule with τ = 0.015. This reflects our discussion in Subsection 4.2 that for "small" values of τ (τ < 0.05) approximating the trade-off of an opportunistic approach would require *increasing* the value of τ in the symmetric versus the asymmetric policy rule.

Appendix

Symmetric fiscal policy rules

The methodology used by Hostland and Matier (1999) implies announcing a specific target path for the debt-to-GDP ratio as well as a *rule* that makes fiscal policy reacting to the differences between the actual (past, present, and/or projected) and targeted debt-to-GDP ratios.

With respect to the debt-to-GDP target path Hostland and Matier consider a "front-loaded" debt reduction scenario determined by the following equation and with a long term debt-to-GDP target ratio of 30 percent:

(1) $(nd\_yn\_tar)_j = (nd\_yn\_tar)_{j-1} - \alpha^* [(nd\_yn\_tar)_{j-1} - 0.3]$ for $j = t, t+1, t+2\ldots$

where $\alpha = 0.022$ is a parameter that reflects the speed of adjustment of the debt-to-GDP target to its long term value, 0.3;[11] the subscript t refers to the current period (current quarter), and the index j encompasses all present and future periods.

According to this equation, if the target for the debt-to-GDP ratio (*nd_yn_tar*) was set at 69.6% in period t-1 = 1997Q4 (as it is set in Hostland and Matier), then the targets for periods t = 1998Q1 and t+1 =1998Q2 would be 68.7% and 67.9%. Under this scenario, the targeted debt-to-GDP ratio declines by about 24 percentage points over the initial ten years, followed by an additional 15 percentage point decline over the subsequent 30 years, eventually approaching asymptotically a target of 30%.

Because the budget balance is the "flow" dimension of the debt – a stock, an implicit target path for budget-balance-to-GDP ratio must correspond to the target path for the debt-to-GDP ratio. The front-loaded debt reduction scenario envisaged above involves a sequence of decreasing surpluses in the first few years followed by a sequence of budget deficits.[12]

Once a specific debt-to-GDP target path is specified we need a *rule* that makes fiscal policy to react to the deviations between the actual (past, present, and/or forecasted) and targeted debt-to-GDP ratios. In Hostland and Matier, the fiscal authority is able to contain the amplitude and duration of these deviations using the policy rule:

(2) $$(bal\_yn)_t - (bal\_yn\_tar)_t = \tau \sum_{i=0}^{7} E_t[(nd\_yn)_{t+i} - (nd\_yn\_tar)_{t+i}]$$

where:

$$[(bal\_yn)_t - (bal\_yn\_tar)_t]$$

[11] A higher value for the parameter α implies, *ceteris paribus*, a debt reduction scenario more front-loaded.

[12] The analytical expression for the coherent path for the budget-balance-to-GDP ratios (*bal_yn_tar*) is: $(bal\_yn\_tar)_j = (nd\_yn\_tar)_{j-1} * (ygdp)_{j-1} / (ygdp^f)_j - (nd\_yn\_tar)_j$ for $j = t, t+1, t+2\ldots$ where "*ygdp*" stands for nominal GDP and the superscript *f* refers to a forecasted variable.

is the deviation of the current (time-*t*) budget balance/GDP ratio from its time-*t* unconditional expected value[13] and:

$$E_t[(nd\_yn)_{t+i} - (nd\_yn\_tar)_{t+i}]$$

is the time-*t* expected deviation of the debt-to-GDP ratio from the target in quarter "*t*+*i*".

The authors specify the reaction function (2) using a two-year average of expected future deviations in the debt-to-GDP ratio from the desired level. The forward-looking nature of the fiscal policy rule is consistent with budget plans based on expected economic outcomes. The fiscal authority in the stochastic simulation setting plans a budget each fiscal year. After the budget is set, economic developments in the form of stochastic shocks impact on program spending, tax revenue and debt service, causing the debt-to-GDP ratio to diverge from the level projected in the budget. In the subsequent (time-*t*) fiscal year, the fiscal authority reformulates its budget plans taking into account shocks that occurred *prior* to the current fiscal year and taking into account the underlying economic structure to forecast a model-consistent path for the actual debt-to-GDP ratio [$E_t(nd\_yn)_{t+i}$ for i = 0, 1, 2,…7].

Although the fiscal policy rule in equation (2) is specified in terms of the budget balance, the instrument of fiscal policy is discretionary spending. This conveys the idea that a discretionary change to program spending and/or taxes is required to exercise debt control. For instance, when the debt-to-GDP ratio rises unexpectedly, the fiscal authority responds by making a discretionary change (reducing spending and /or increasing taxes) to move the budget balance toward a surplus position (that is, pushing *bal_yn* above its unconditional expected value *bal_yn_tar*) such that the debt-to-GDP ratio declines back to the target over time.

The parameter τ determines the responsiveness or flexibility of the fiscal policy to unanticipated fluctuations in the debt-to-GDP ratio. A high value of τ implies that the fiscal authority brings the debt-to-GDP ratio back to its target rapidly. This would provide a tight degree of debt control, at the expense of large changes to discretionary spending and a pro-cyclical overall fiscal policy stance. Setting $\tau = 0$ provides a surplus/deficit rule whereby the fiscal authority aims to attain a given surplus/deficit over the forthcoming year, with no regard for the debt-to-GDP ratio. Hostland and Matier focus on characterising the fiscal policy trade-off by varying the parameter τ.[14]

A key feature in Hostland and Matier (1999) is the symmetric nature of the adjustment to shocks. Any favourable or positive (unfavourable or negative) shock that pushes the debt-to-GDP ratio below (above) its target induces the fiscal authority to move the discretionary component of the budget balance toward a deficit (surplus) position – a pro-

[13] The unconditional expected value for the budget-balance-to-GDP is derived from the equation given in footnote 3.

[14] The authors also specify a strict debt rule: $(nd\_yn)_t = (nd\_yn\_tar)_t$. This rule targets the desired debt-to-GDP ratio in each fiscal year. Note that this rule is *not* the limit of equation (2) when $\tau \to \infty$.

cyclical fiscal policy stance, which pushes the debt-to-GDP ratio back to its target over time. In other words, the fiscal authority follows rule (2) whether the last period debt-to-GDP ratio is above or below its target, responding to favourable versus unfavourable shocks with equal intensity but opposite direction.

In the particular case of a positive shock, the symmetric fiscal policy rule implies either an increase in program spending, a reduction in taxes, or a combination of both. For the debt-to-GDP ratio, this implies an "unwinding" of a positive development as the ratio is pushed back over time to its "higher" target.[15] This "unwinding" that follows favourable shocks seems to be *a priori* an unpalatable feature of the symmetric nature of the adjustment. There seems to be a compelling case for the fiscal authority to opt out of its pro-cyclical fiscal stance by reducing the debt further, "making the hay when the sun shines". This is the opportunistic approach to debt reduction.

Asymmetric fiscal rule: An opportunistic approach

Under an opportunistic approach the fiscal authority would allow for more debt reduction during economic expansions. The fiscal authority would take advantage of positive shocks to make more progress on the debt reduction front instead of "unwinding" these favourable developments. To model this approach, we introduce an asymmetric behaviour of the fiscal authority in its implementation of rule (2). This approach can be described analytically as follows.

Conditional Statement 1:

If $(nd\_yn)_{t-1} \geq (nd\_yn\_tar)_{t-1}$,

then: $(nd\_yn\_tar)_j = (nd\_yn\_tar)_{j-1} - 0.022^* [(nd\_yn\_tar)_{j-1} - 0.3)]$ for $j \geq t$,

and (2) $(bal\_yn)_t - (bal\_yn\_tar)_t = \tau \sum_{i=0}^{7} E_t[(nd\_yn)_{t+i} - (nd\_yn\_tar)_{t+i}]$.

Conditional Statement 2:

If $(nd\_yn)_{t-1} < (nd\_yn\_tar)_{t-1}$,

then: $(nd\_yn\_tar)_t = (nd\_yn)_{t-1} - 0.022^* [(nd\_yn)_{t-1} - 0.3)]$,

$(nd\_yn\_tar)_j = (nd\_yn\_tar)_{j-1} - 0.022^* [(nd\_yn\_tar)_{j-1} - 0.3]$ for $j \geq t+1$,

and (2) $(bal\_yn)_t - (bal\_yn\_tar)_t = \tau \sum_{i=0}^{7} E_t[(nd\_yn)_{t+i} - (nd\_yn\_tar)_{t+i}]$.

[15] This does not necessarily imply that the debt-to-GDP ratio *increases* during the adjustment to the target. Actually, only large positive shocks would require an increase in the ratio in the first periods of adjustment to the target.

According to Conditional Statement (1), the fiscal authority reacts to a "negative" shock that pushes the debt-to-GDP ratio above its interim target by reducing program spending or increasing taxes as it would do under a symmetric fiscal policy rule. This pushes the debt-to-GDP ratio back to its interim target over time.

According to Conditional Statement (2), positive shocks are followed by the announcement of a new "lower" debt-to-GDP interim target path with unchanged end-point (debt-to-GDP ratio of 0.3). The new target path has a "starting" or "anchored" ratio $(nd\_yn\_tar)_t$ based on the *observed* debt-to-GDP ratio of the previous period $(nd\_yn)_{t-1}$.

When redefining a new interim target path anchored to the actual debt-to-GDP ratio, the fiscal authority automatically resets its expectations such that:

$$E_t[(nd\_yn)_{t+i} - (nd\_yn\_tar)_{t+i}] = 0,$$

that is, such that the expected future deviations from the new target vanish. Substituting this result in (2), we conclude that the fiscal authority selects a discretionary program spending consistent with a budget balance in equilibrium that is, consistent with *bal_yn = bal_yn_tar*.[16] Hence, contrary to the symmetric-behaviour case, the fiscal authority does not respond to positive shocks with larger discretionary spending than "equilibrium" (that is pushing *bal_yn* below *bal_yn_tar*) and therefore does not unwind the positive developments on the actual debt-to-GDP ratio. As a result, the opportunistic approach is also conducive to the objective of stabilisation.

In conclusion, under the asymmetric approach, fiscal policy is geared to a sequence of "interim" debt-to-GDP target paths. The sequence of interim target paths, and therefore the pace of debt reduction, depends on economic development. A favourable shock that pushes the actual debt-to-GDP ratio below target automatically triggers the redefinition of a "lower" interim debt-to-GDP target path with same-end-point. This may be characterised as an opportune approach to debt reduction in the sense that advantage is taken of positive shocks to make further advances on the debt reduction front. Basically, the fiscal authority opts out of its pro-cyclical fiscal stance needed for debt control by reducing the debt further when the economy grows.

[16] To each interim debt-to-GDP target path corresponds a coherent interim path for the ratio budget-balance/GDP. Hence, a positive shock to the ratio debt-to-GDP implies the redefinition of a new debt-to-GDP target path and a new path for the ratio budget balance/GDP. Because the slope of the new debt-to-GDP target path is less steep, the path for the ratio budget balance-to-GDP becomes a sequence of lower surpluses or larger deficits than the ones associated with the previous path.

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Figure 1 Symmetric approach to debt reduction

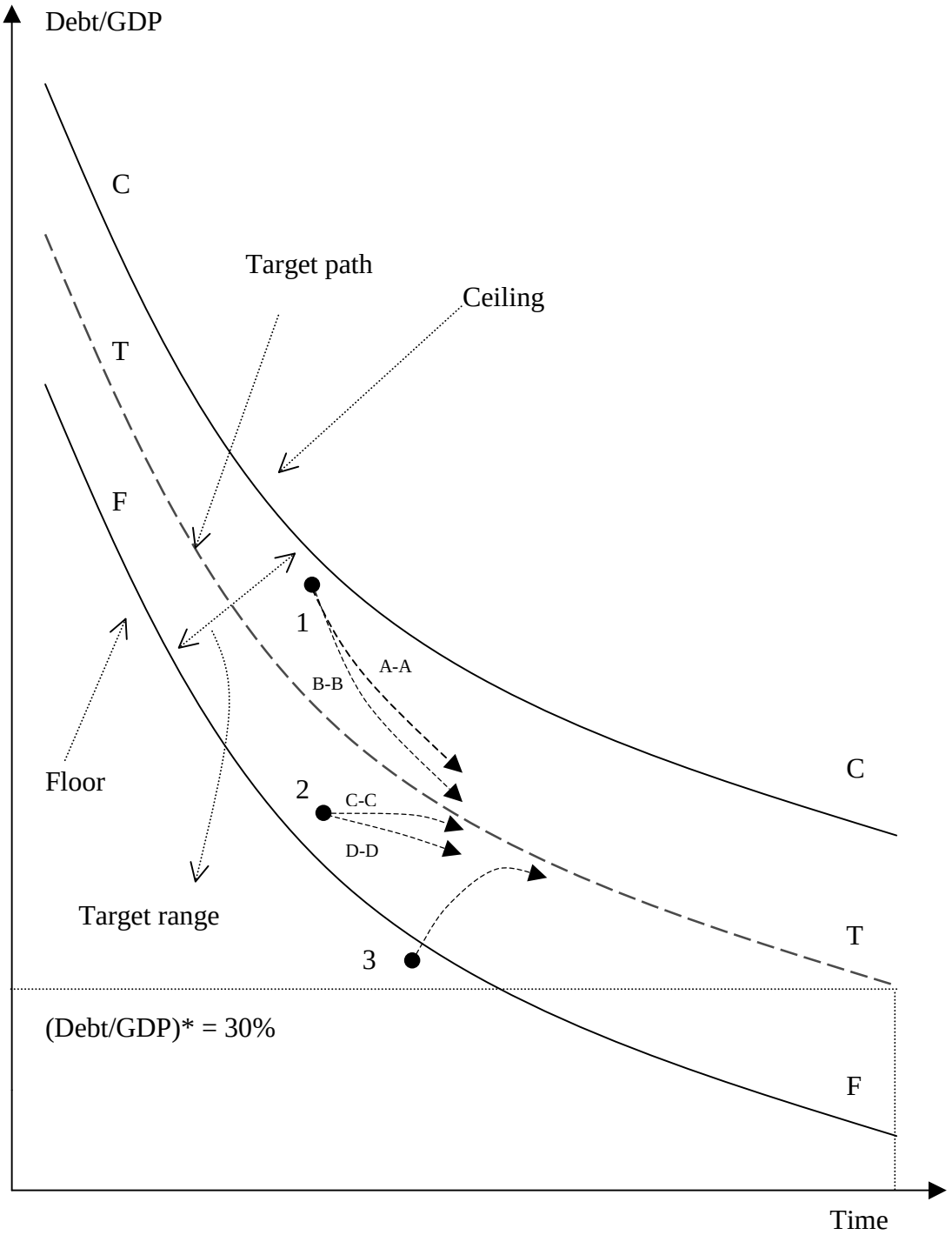


Figure 2 The opportunistic approach to debt reduction

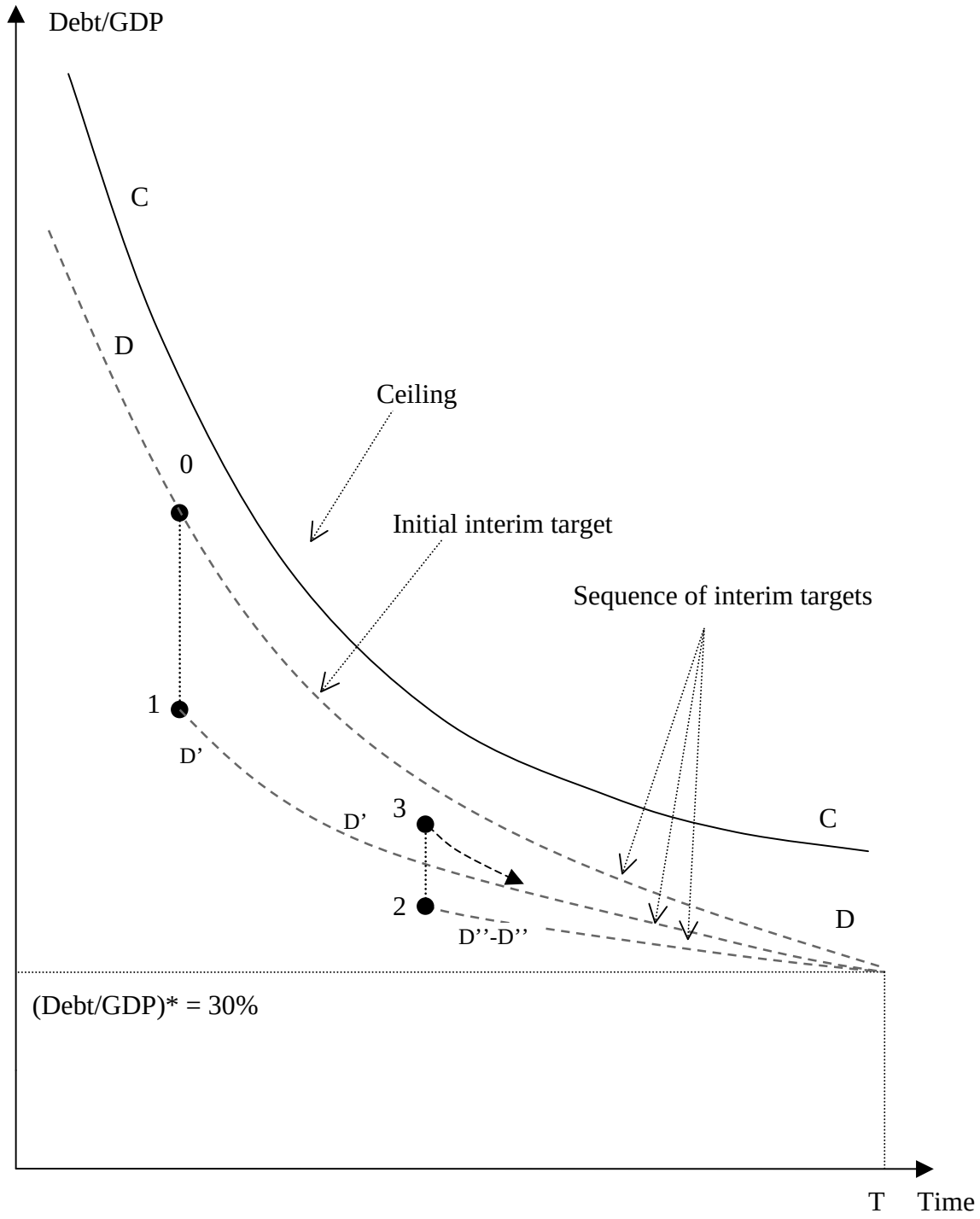


Figure 3 The mean path of an opportunistic approach

Figure 3a *Mean path below initial interim target path (high value for tau)*

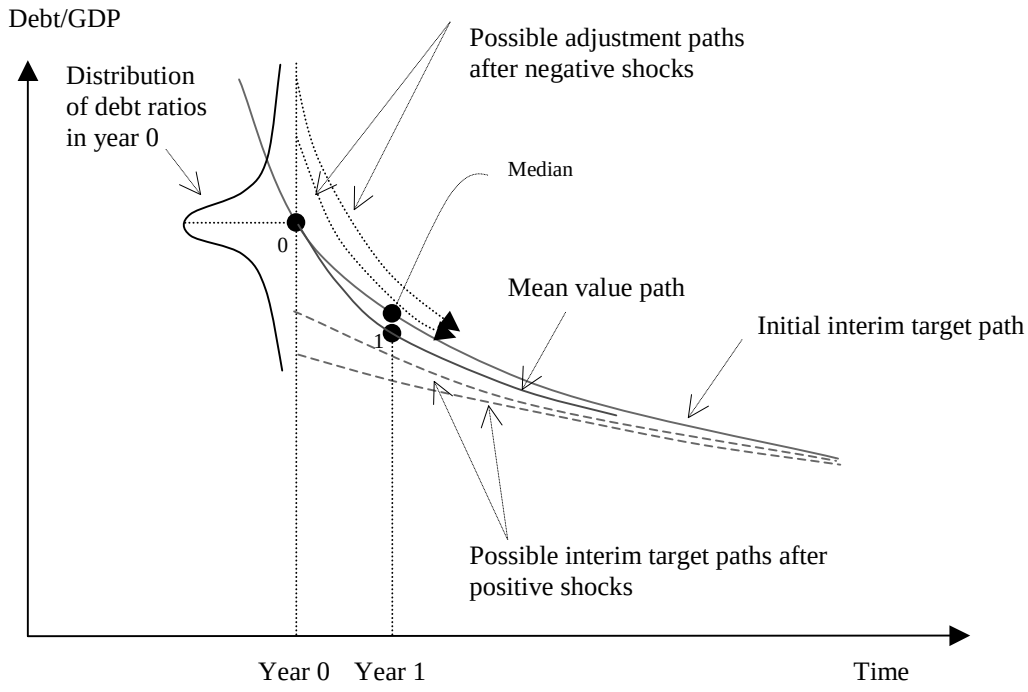


Figure 3b *Mean path above initial interim target path (low value for tau)*

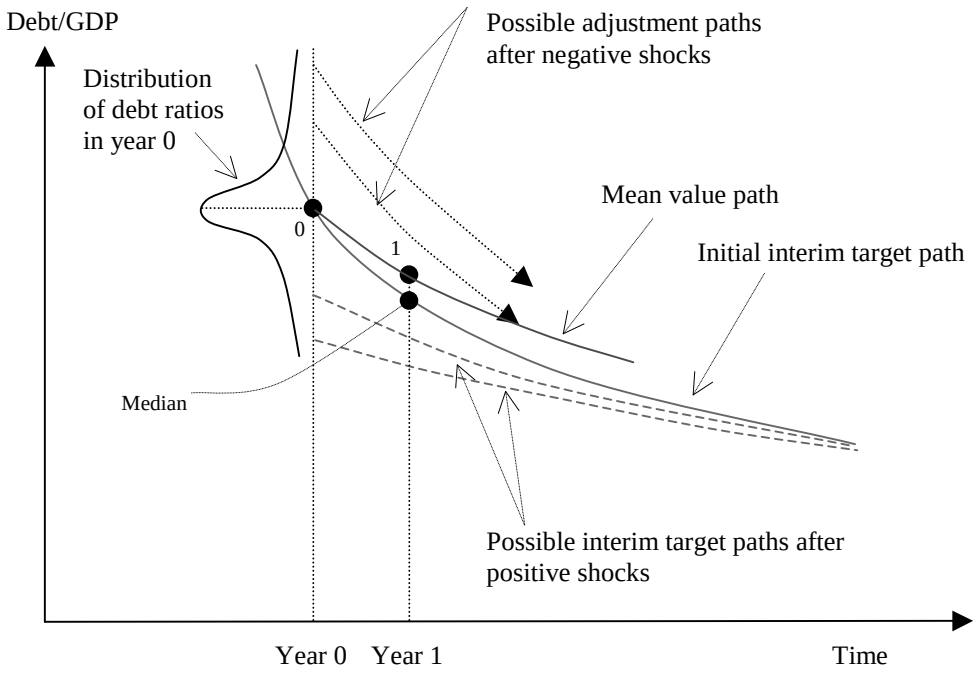


Figure 4a
Distribution of debt/GDP (year 5)
tau = 0.3 versus 0.1

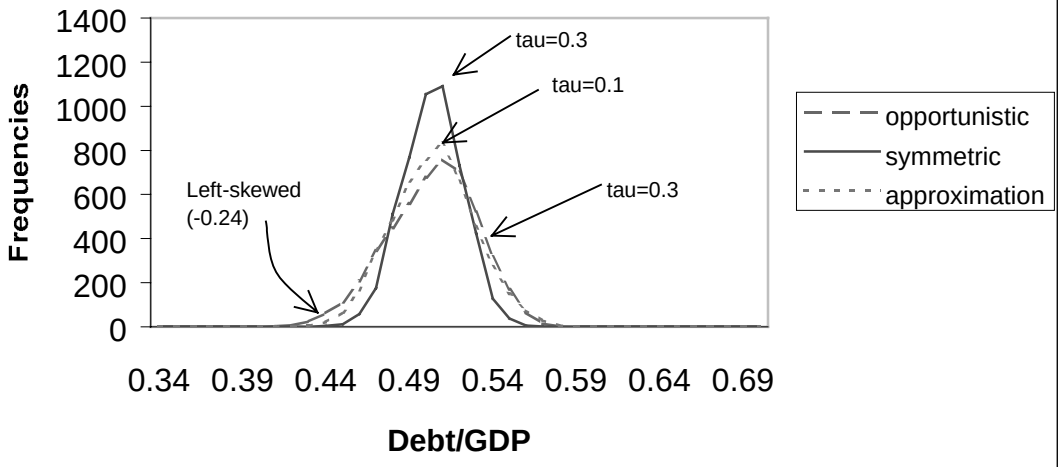
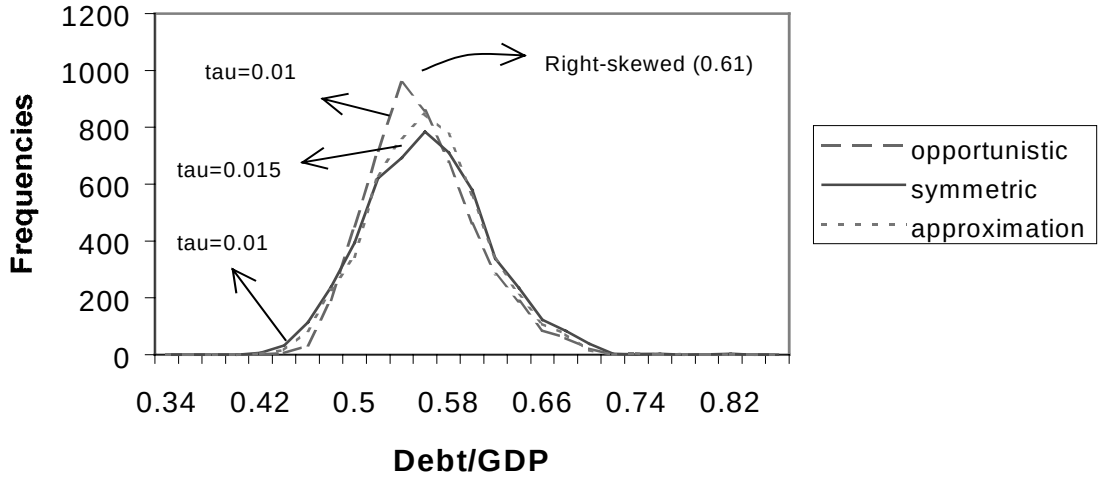


Figure 4b
Distribution of debt/GDP (year 5)
tau = 0.01 versus 0.015



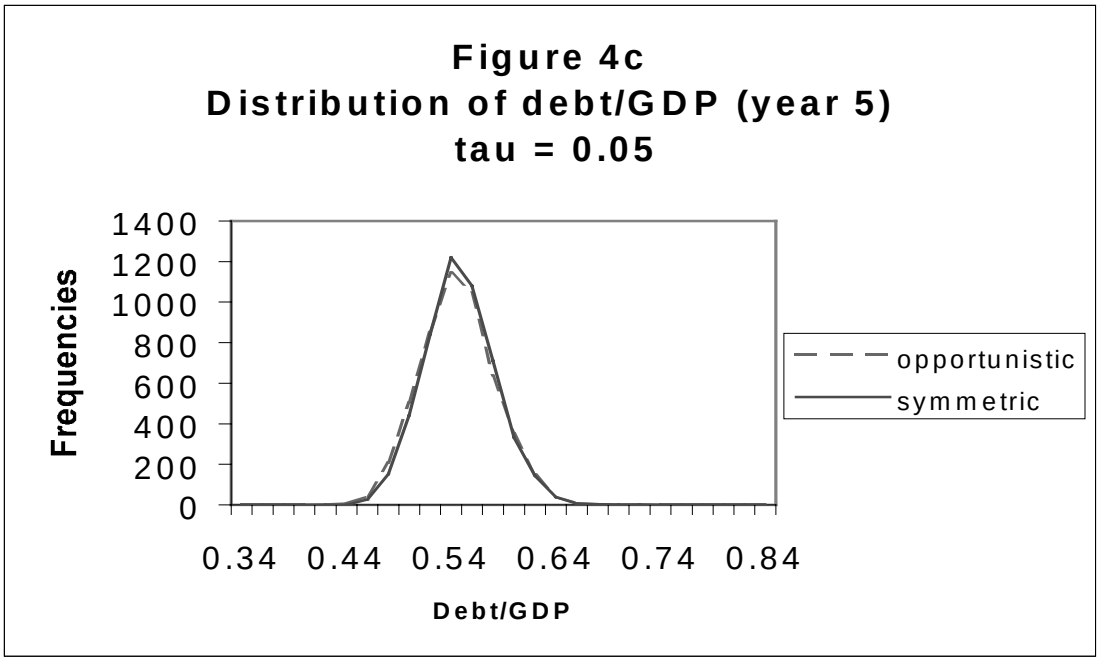


Figure 4c
Distribution of debt/GDP (year 5)
tau = 0.05
Frequencies
1400
1200
1000
800
600
400
200
0
0.34
0.44
0.54
0.64
0.74
0.84
Debt/GDP
opportunistic
symmetric

Figure 5 Symmetric and opportunistic approaches (large tau)

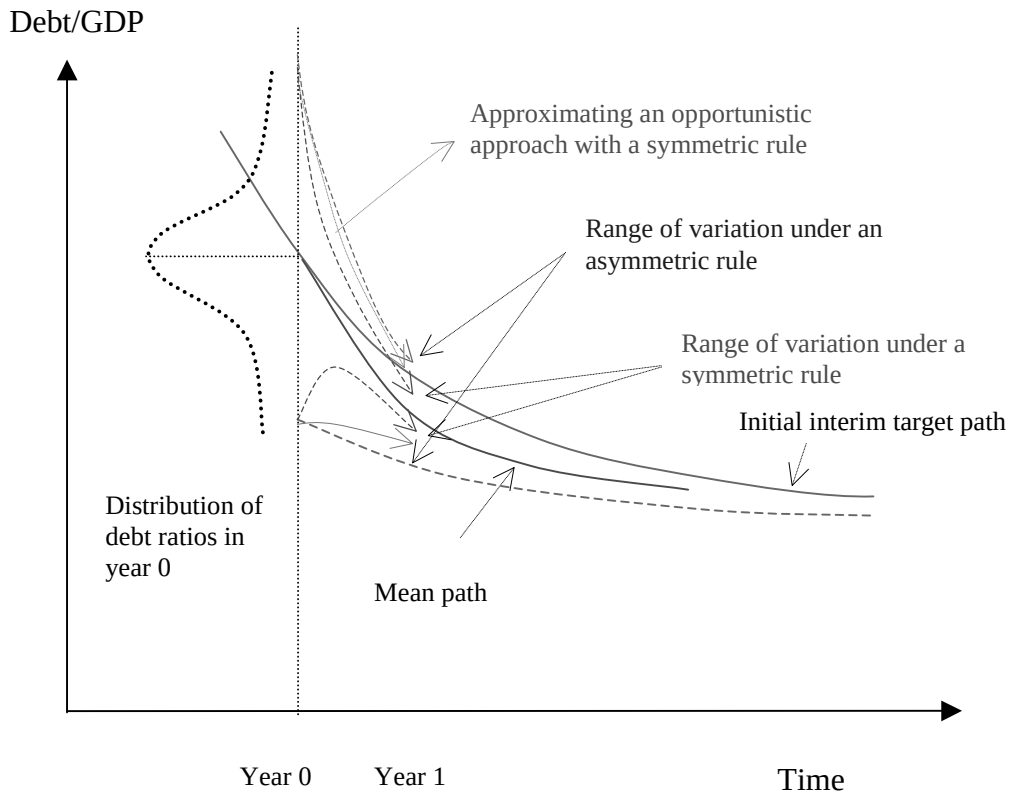


Figure 6a
Stochastic Variation in Net Debt as a Percentage of GDP

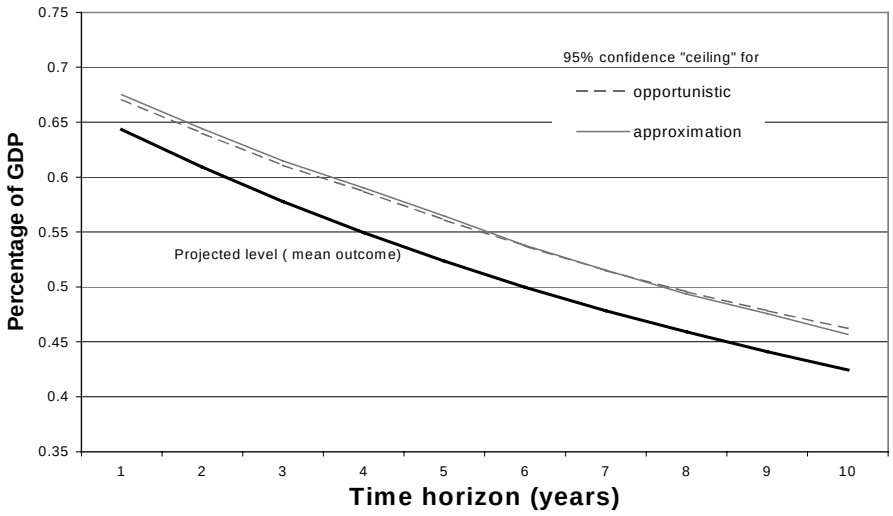


Figure 6b
Stochastic variation in Real Program Spending

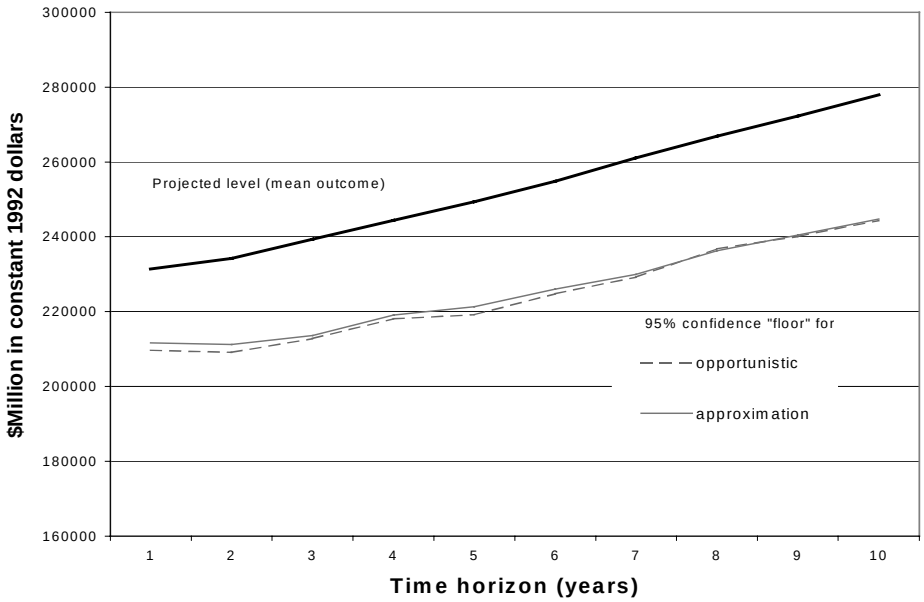


Figure 6c
Correlation between Primary Balance and Output Gap

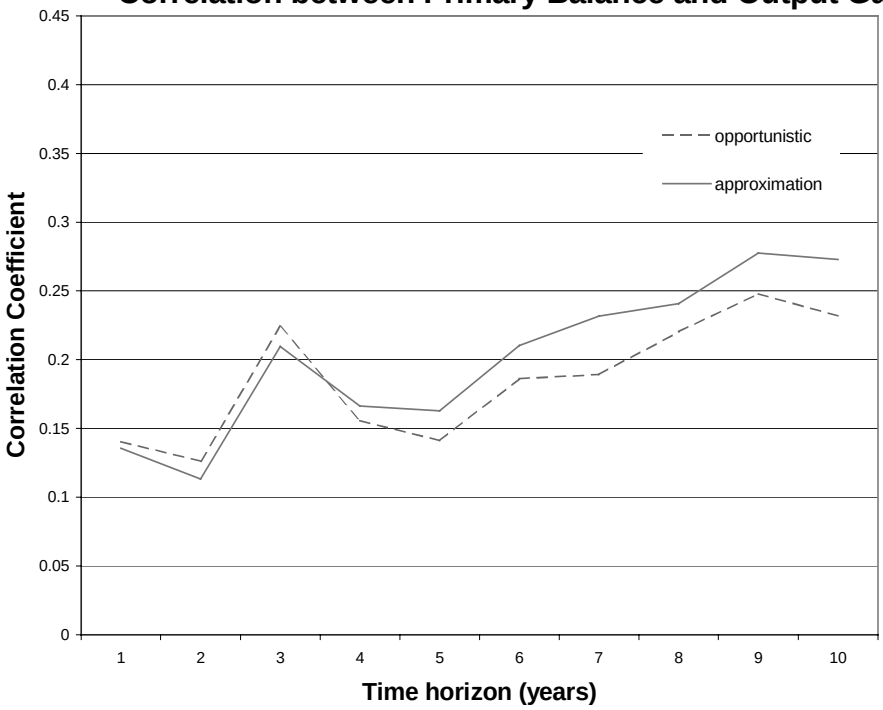


Figure 7a
Fiscal Policy Trade-off

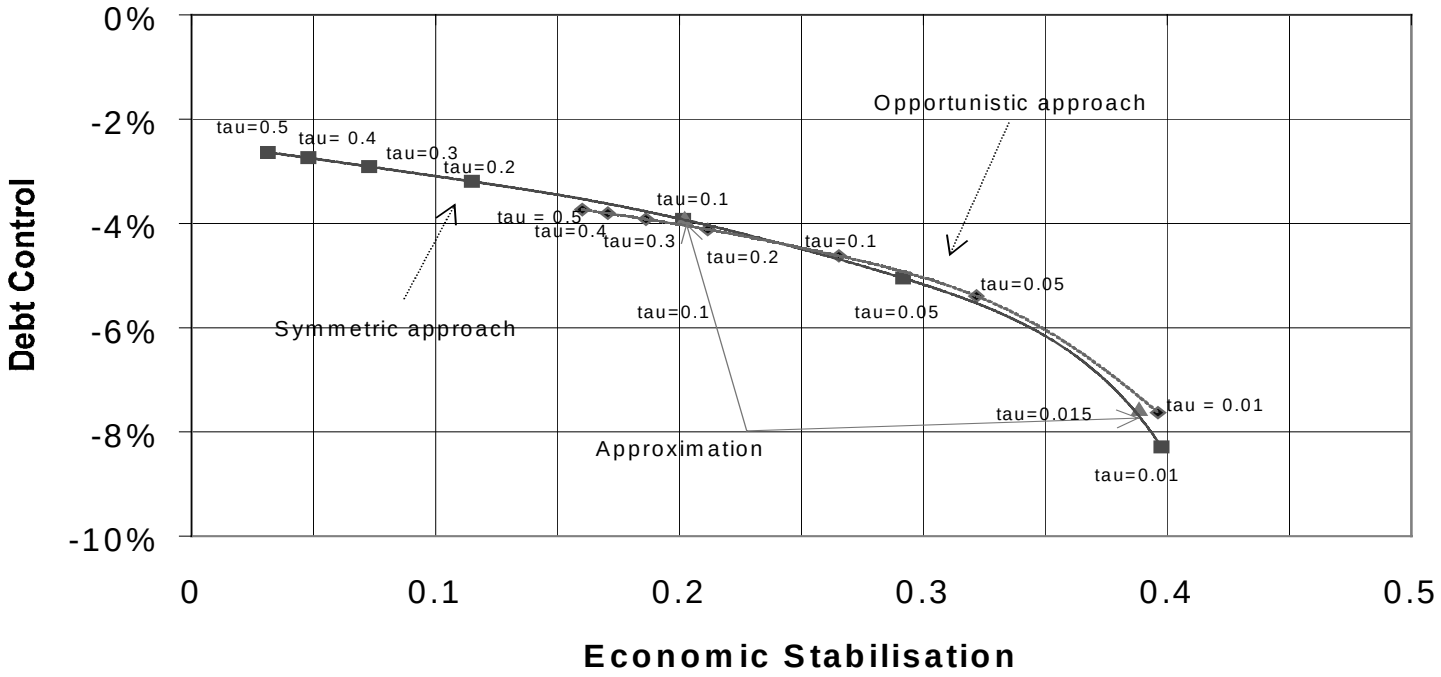
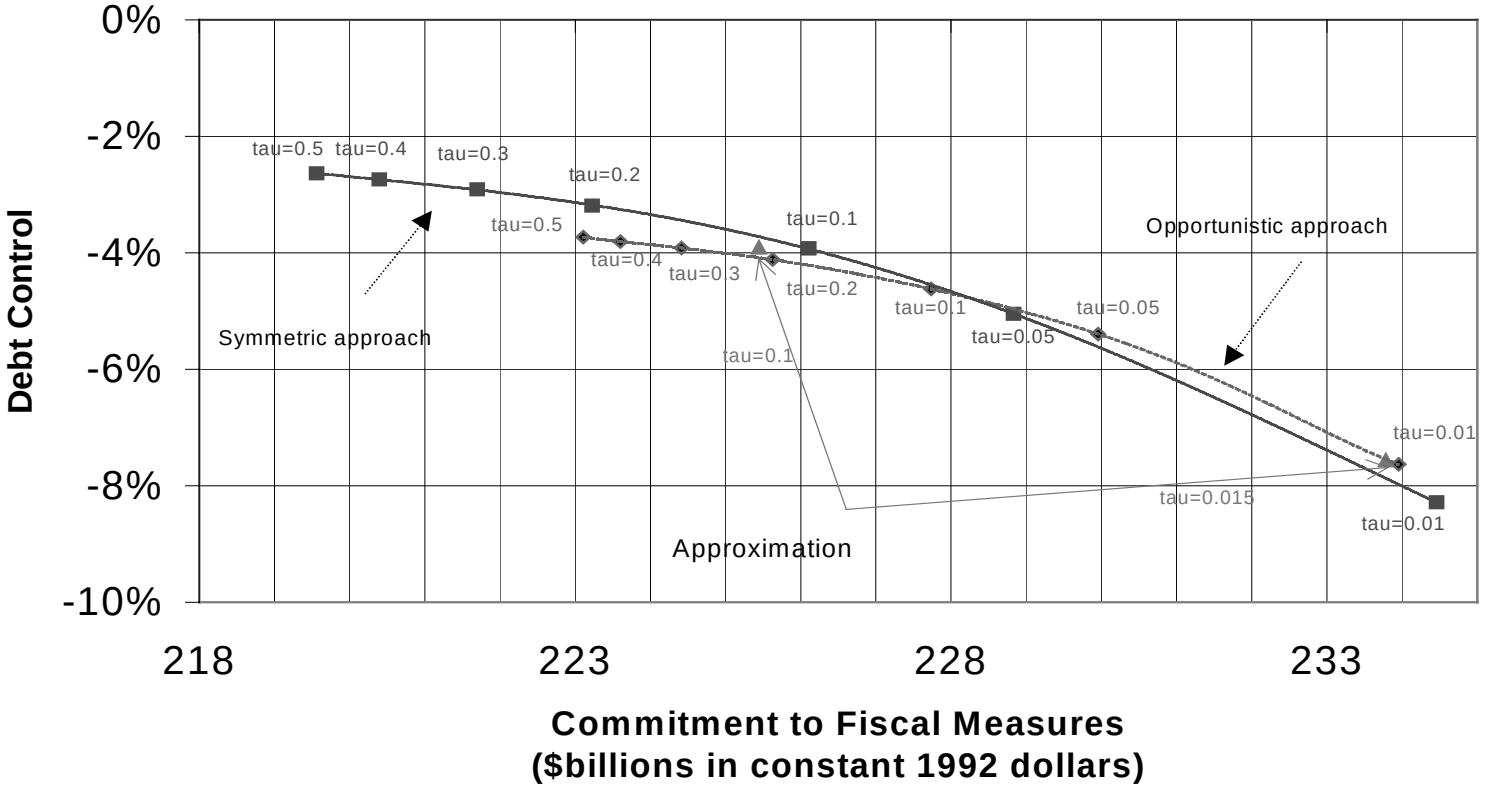


Figure 7b
Fiscal policy trade-off



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