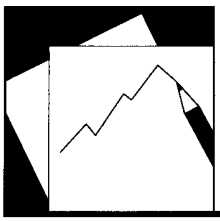
WP/13/182



IMF Working Paper

Assessing the Impact and Phasing of Multi-year Fiscal Adjustment: A General Framework

Ran Bi, Haonan Qu, and James Roaf

INTERNATIONAL MONETARY FUND

 WP/13/182

IMF Working Paper

Strategy, Policy, and Review Department

Assessing the Impact and Phasing of Multi-year Fiscal Adjustment: A General Framework

Prepared by Ran Bi, Haonan Qu, and James Roaf[1]

Authorized for distribution by James Roaf

August 2013

Abstract

This paper provides a general framework to assess the output and debt dynamics of an economy undertaking multi-year fiscal adjustment. The framework allows country-specific assumptions about the magnitude and persistence of fiscal multipliers, hysteresis effects, and endogenous financing costs. In addition to informing macro projections, the framework can also shed light on the appropriate phasing of fiscal consolidation—in particular, on whether it should be front- or back-loaded. The framework is applied to stylized advanced and emerging economy examples. It suggests that for a highly-indebted economy undertaking large multi-year fiscal consolidation, high multipliers do not always argue against front-loaded adjustment. The case for more gradual or back-loaded adjustment is strongest when hysteresis effects are in play, but it needs to be balanced against implications for debt sustainability. Application to actual country examples tends to cast doubt on claims that very large multipliers have been operating post-crisis. It seems that the GDP forecast errors for Greece may have been due more to over-optimism on potential growth estimates than to underestimating fiscal multipliers.

JEL Classification Numbers: E32, E62, H3, H68
Keywords: Fiscal Multiplier, Hysteresis Effect, Phasing of Fiscal Consolidation
Author's E-Mail Address: rbi@imf.org, hqu@imf.org, and jroaf@imf.org

[1] This paper builds on a background note by the authors and Ferhan Salman prepared for the 2012 IMF Crisis Programs Review. We are grateful to Abebe Selassie, Ali Abbas, Anke Weber, Daniel Leigh, Donal McGettigan, Paolo Mauro, Helge Berger, Rakesh Mohan, seminar participants of the Fund Fiscal Macro Working Group and the Fiscal Policy Group in the Strategy, Policy and Review department, and colleagues in the Fiscal Affairs Department for useful comments and discussions. We thank Malika Pant and Trung Thanh Bui for outstanding research assistance.

Contents Page

I. INTRODUCTION

1. With many economies in recession and also in need of sizeable fiscal consolidations, a key policy challenge is to properly design multi-year fiscal adjustment plans to achieve the best growth and debt outcomes. This task is made difficult by the trade-off between output and debt dynamics: a large or front-loaded fiscal adjustment would lead to larger output loss in the short term (and possibly a resulting temporary increase in the headline debt ratio) but could result in quicker improvement in underlying debt dynamics; a smaller or more gradual adjustment, on the other hand, would have smaller immediate impact on output but could result in a longer (if shallower) recession and persistently higher debt levels. With markets focusing on both output developments and fiscal/debt dynamics, the appropriate pace of adjustment to maintain or restore investor confidence can be difficult to gauge. To inform the policy decisions, it is critical to understand how a sizeable multi-year fiscal adjustment might affect output and public debt in a dynamic setting.

2. The current debate has tended to focus on the size of short-term (or peak) fiscal multipliers, with little attention paid to the dynamic impact of fiscal consolidation, especially in the context of a multi-year adjustment. Moreover, few papers put both output and debt dynamics into the picture and balance the tradeoffs between them under alternative fiscal adjustment plans.[2] Thus this paper aims to providing an integrated and tractable approach to assess the dynamic output and debt outcomes under various fiscal adjustment scenarios. It does not seek to contribute to the large literature on the size of multipliers,[3] but rather to focus on a less studied area by working through the implications of fiscal multipliers over time, under different assumptions about magnitude and persistence. The framework proposed integrates the dynamic effect of cumulative fiscal multipliers from multi-year adjustments, taking into account potential varying multipliers (as a function of output gap), and hysteresis effects and endogenous financing costs of public debt as markets respond to debt and growth developments. The framework (which is built into a user-friendly template) is flexible enough to be calibrated to specific country conditions, and we also compare results under baseline parameters with those under alternative assumptions. While the literature provides guidance on some elements of the framework (notably factors affecting the size of the short-term fiscal multiplier), we have to rely on judgment and sensitivity analysis to parameterize other elements.

3. The framework can be applied in two main areas:

- **Informing/assessing macro projections**. For given assumptions about long-run potential growth in the absence of fiscal adjustments, the framework can generate a "first-step" growth projection based on the planned fiscal consolidation. On top of this first step, other non-fiscally driven factors affecting growth need to be considered, such as arising from asset or commodity price cycles or other private sector business cycle

[2] Recent exceptions include Batini, Callegari, and Melina (2012), Cherif and Hasanov (2012), and Eyraud and Weber (2013).

[3] Although the framework may indirectly provide evidence on size of multipliers, by pointing to inconsistencies arising from particular multiplier assumptions, as discussed in Section IV.

effects. Similarly, the framework can be used to assess the internal consistency of growth projections and the fiscal consolidation paths across various modeling assumptions.

- **Designing an appropriate fiscal adjustment path**. The framework can be used to run simulations on growth and debt dynamics under various multi-year fiscal adjustment scenarios, which would shed light on the appropriate fiscal phasing (i.e., front-loaded vs. gradual fiscal adjustment). Depending on the constraints a country faces (e.g., the urgency to restore fiscal sustainability, the availability of financing at reasonable costs, or the need to support growth in the near term), a fiscal adjustment path that can achieve the optimal output-debt dynamics combination can be chosen.

4. We use both stylized and the actual country examples to explore these applications, with a particular focus on countries with both high initial deficits and high public debt. The framework suggests that for such an economy, even when fiscal multipliers are estimated to be high, front-loaded adjustment tends to allow an earlier turnaround in the debt-to-GDP path and persistently lower debt levels in the medium term, at the cost of a larger short-term output loss and possibly a temporary rise in the debt-to-GDP ratio in the near term. Therefore, for countries facing an urgent need to restore fiscal sustainability and tight financing constraints, front-loaded adjustment may be appropriate or unavoidable. Gradual fiscal consolidation, on the other hand, is likely to be more desirable if hysteresis effects are at play, and more feasible for countries with lower debt levels and/or availability of large-scale official financing at lower costs. But when faced with a choice between extremely large (or extremely front-loaded) fiscal adjustment – which would lead to a major output collapse – and unsustainable debt, the other option would be debt restructuring, which could help restore sustainability relatively quickly with less output loss than under an extreme fiscal consolidation.

5. Finally, given that fiscal multipliers provide only highly simplified "rule of thumb" descriptions of complex and uncertain underlying processes, policy conclusions should be drawn with caution. Although the framework aims to integrate the relevant elements affecting output and debt dynamics, and allows for country-specific assumptions and various sensitivity analyses, it remains a mechanical exercise. Notably, unlike the Dynamic Stochastic General Equilibrium (DSGE) models, our framework does not explicitly model the monetary policy response, which could have an important impact on output. This is reflected implicitly in the fiscal multiplier assumptions in our framework (which can be allowed to vary with the output gap), but future work would be needed to explicitly integrate the monetary policy response into the picture.

6. The paper is structured as follows. Section II provides a focused literature review, which helps to inform the construction of our framework. The methodology and the assumptions of our framework are presented in Section III, followed by two applications of the framework, using both country examples and stylized examples, in Section IV, including the policy implications on fiscal cyclicality. Section V offers some conclusion remarks.

II. LITERATURE REVIEW

7. There is a vast literature on the growth impact of fiscal adjustment. In this section, we focus on three strands of literature that are most relevant to our approach: the size of short-

term fiscal multiplier, persistence and long-term impact of fiscal adjustment, and the effect of fiscal adjustment on public debt and financing costs.

8. There is a wide range of estimates on the size of short-term fiscal multiplier. It is found that the short-term multiplier could be significantly higher than unity if, for example: the economy is under recession (Auerbach and Gorodnichenko (2012a, 2012b), and IMF (2012)); there is lack of offsetting monetary policy support due to the zero lower bound on nominal interest rates (Hall (2009), Alumnia et al. (2010), Woodford (2011), Christiano, Eichenbaum and Rebelo (2011), and Eichengreen and O'Rourke (2012)); or external demand is weak and the economy's trading partners undergo fiscal consolidation at the same time (IMF (2010)). In the recent work Coenen et al. (2012), the authors use a number of leading DSGE models to show that the size of fiscal multiplier could vary significantly with different exogenously specified monetary response functions. These estimates help us choose the size of underlying fiscal multiplier in our framework for an economy based on its monetary policy stance. These DSGE models, however, do not allow for state dependent multiplier in general. Batini et al. (2012) use a regime-switching VAR approach to estimate state-dependent fiscal multiplier while allowing fiscal impact to be able to shift underlying economy from one regime to the other. Following the same spirit, we will be discussing how we incorporate time-varying fiscal multiplier into our framework in the following section. The size of short-term fiscal multiplier also depends on the composition of fiscal measures, although there is not necessarily agreement on which measures have the higher multipliers (see e.g. Alesina and Ardagna (2010), IMF (2010, 2012),). In addition, Ilzetzki et al. (2011) show that other characteristics such as development stage, exchange rate regime, and openness also matters.

9. There are few studies focusing on the persistence of fiscal multipliers, but some look into the long-term effect of fiscal adjustment. The fiscal impact on growth in the long run, which is important in assessing debt sustainability, is an ongoing debate. Some studies argue for the neutrality of government spending on economic growth in the long run, e.g. Solow (1956), Cass (1965), Koopmans (1965), and Romer (1986). Others believe that fiscal austerity measures could have implications on economic growth in the long run. For instance, the hysteresis effect discussed in DeLong and Summers (2012) could induce a prolonged effect of fiscal adjustment on output. Some studies use endogenous growth model to establish the link between public spending and long-term growth (Barro (1990), Yakita (2008), and Agénor and Yilmaz (2011)), arguing productive public capital investment (e.g. infrastructure, property rights) could raise marginal return of private capital.

10. How the market may react to the fiscal consolidation adds another layer of uncertainty on public debt dynamics. Countries undergoing fiscal consolidation may still face high borrowing costs if the market has reservations on the effectiveness of measures due to the negative growth impact in short-run (Cottarelli and Jaramillo (2012)). Under high multiplier assumptions, it is possible for output effects to dominate fiscal adjustment such that the consolidation causes the headline debt/GDP ratio to increase in the short run, potentially denting market confidence (Padoan et al. (2012), Corsetti (2012), Eyraud and Weber (2013) – but see discussion in paragraph 18).On the other hand, a slow and protracted adjustment could fail to allay fears about debt sustainability or about long term commitment to fiscal rectitude (Alesina and Perotti (1996)). And if the pace of consolidation is slow and the public debt remains high for a protracted period of time, this could defer private sector investment due to debt overhang,

which imposes a drag on economic growth (e.g., Cecchetti, Mohanty, and Zampolli (2011)) and weakens the effort of bringing down the public debt to a sustainable level.

III. Methodology and Stylized Examples

11. This section describes our approach to assessing the impact of fiscal consolidation on output and debt for an economy undertaking multi-year fiscal adjustment. The framework takes into account short- and long-term fiscal multiplier effects, potential variation in the size of the multiplier under different output gaps, potential hysteresis effects under large negative output gaps, and endogenous interest rates.[4] Each of these elements can be calibrated to country-specific circumstances. Such flexibility allows easy application of our methodology in a wide group of countries, and enables various sensitivity analyses to ensure the robustness of results, especially in light of the uncertainty surrounding some key parameters.

Magnitude and persistence of fiscal multipliers[5]

12. The fiscal multiplier is the ratio of a change in output to a change in the fiscal stance—but its magnitude depends on how the latter change is measured. The change in fiscal stance can be measured in two ways—by identified structural fiscal adjustment measures, or by the change in structural primary balance. The former is generally preferred, but if data on measures are not available, the latter may be used as a proxy. However, the two measures can be quite different: especially in a recession, fiscal adjustment measures may add up to much more than the structural adjustment calculated under standard aggregate methodologies (for example if revenues collapse by more than GDP, if potential output is assumed to fall, or if public wage and pension cuts are counted as measures even when matched by a falling GDP deflator).[6] Thus fiscal multipliers estimated against the change in the structural balance will often be markedly higher than those estimated against identified fiscal measures. By way of example, over 2009-11, IMF staff estimate that Ireland took fiscal measures totaling almost 10 percent of GDP, while the structural primary balance improved by only 6 percent of GDP. A multiplier estimated against the structural balance would therefore be more than 1½ times the size of one estimated against measures over this period. This difference may help explain the discrepancies between fiscal multiplier estimates in the literature, since different papers use different definitions.

---

[4] We also tried to include the growth impact of debt overhang in the framework, using the findings from Cecchetti, Mohanty, and Zampolli (2011): once public debt reaches 85 percent of GDP, an additional 10 percentage point increase in the ratio of public debt to GDP is associated with a 17–18 basis point reduction in subsequent average annual growth. However, this has only a marginal impact on our results, and hence is not reported.

[5] See also IMF Staff Position Note, SPN/09/11.

[6] Standard aggregate cyclical adjustment methodology effectively assumes that, absent structural changes, nominal revenues would move in line with nominal actual GDP, while nominal expenditures would move in line with nominal potential GDP. Thus if revenues fall faster than GDP and measures are taken to compensate, they will show as fiscal tightening from the measures perspective but as no change in the structural balance. Similarly, if nominal potential GDP falls, either from the real component or the deflator, then measures would be needed to reduce nominal expenditures correspondingly, to remain at zero structural change. It is also possible for these factors to reverse (especially in an expansion) so the change in structural balance would exceed identified measures.

13. Multiplier effects depend not only on their magnitude (the "peak" multiplier) but also on their assumed persistence and evolution over time. The peak multiplier is defined as the maximum output effect from a permanent fiscal adjustment undertaken in a particular year. Under our initial assumption of long-run fiscal neutrality, the effect of a permanent change in fiscal stance on the level of output would eventually fade away to zero (or equivalently, the change in the fiscal stance has no effect on the level of potential GDP to which the economy will eventually revert). Note that this implies that a fiscal tightening would have an initial contractionary effect, but would actually be making a gradual positive contribution to growth in the outer years. The assumption of long-run fiscal neutrality may be unrealistic, especially in the current environment when sizeable fiscal consolidation has to be implemented during economic downturns, exacerbating the recession and potentially leading to a permanently lower potential output (the so-called "hysteresis effect", see, e.g., DeLong and Summers (2012)). We introduce potential hysteresis effect in the extension of the baseline model (see ¶25).

14. The literature provides little guidance on how quickly or slowly fiscal multiplier effects are likely to dissipate, or how the effect evolves over time. Based on charts presented in the Fiscal Monitor (2011), we assume the multiplier effects to last for seven years, with 80 percent of the peak fiscal multiplier effect realized in the first year of adjustment, rising to 100 percent (peak effect) in the second year, and then gradually declining to zero over the remaining years.[7] We have tried shorter (five-year) and longer (ten-year) persistence and the results are very similar. Also, for simplicity, linear paths of convergence are assumed, but results are not very sensitive to this assumption (e.g., slower convergence in outer years). The template allows full flexibility to change the evolution path if needed. Figure 1 illustrates the implied real output path under the fiscal multiplier effect following a permanent improvement in the structural primary balance.

Data

15. Data and projections on real GDP, potential GDP (in the absence of fiscal adjustment), and change in fiscal stance (in percent of potential GDP) are used for the analysis. Potential GDP can be estimated using the filtering approach or production side approach.[8] Since our framework takes into account the impact of fiscal consolidation on potential GDP, the data input should be the potential GDP estimates without the effect of fiscal adjustment to avoid double counting. For the change in fiscal stance, our template allows the use of either planned structural measures or the change in structural primary balance (in percent of potential GDP), which can be computed using the standard elasticity approach and adjusted for one-off items.

Methodology

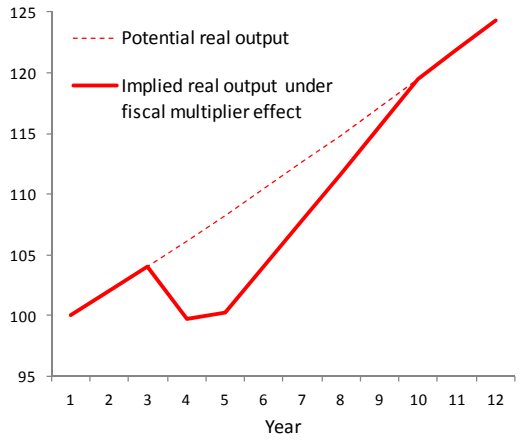
[7] Thus, assuming a multiplier of 1, a 1 percent permanent structural tightening would reduce the level of output by 0.8 percent in the current year, reaching 1.0 percent in the second year, and then 0.8 percent, 0.6 percent, 0.4 percent, 0.2 percent, and finally reverting to zero level effect in subsequent years.

[8] CBO (2004) presents a summary of methodologies for estimating potential GDP.

(i) ***Multiplier effects under long-run fiscal neutrality***

16. Figure 1 illustrates the fiscal multiplier effect of a permanent fiscal tightening under the assumption of long-run fiscal neutrality. The multiplier effect is applied to the path of potential GDP to provide an estimate of "fiscally adjusted potential GDP". Of course actual GDP would not necessarily be expected to follow this measure closely, because GDP is also influenced by a host of other factors (for example, credit or asset booms or busts, and/or commodity price cycles). The relationship should be closest in cases where the fiscal adjustment is the dominating factor on growth.

Figure *1*. *Effect of a One*-time Permanent Fiscal Tightening

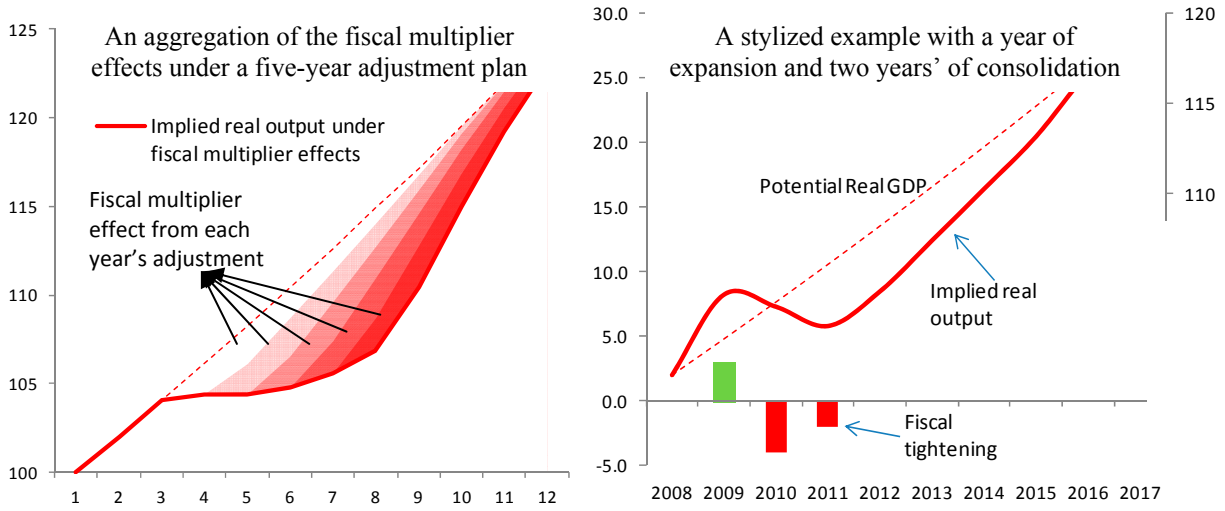


17. To track the dynamic effects of multi-year fiscal adjustment, individual single year multiplier effects from the past and present are aggregated to give estimates of the total fiscal multiplier effect at each point in time. In algebraic terms, fiscally adjusted potential GDP, $\tilde{Y}$, is determined as follows:

$$\tilde{Y}_t = \overline{Y}_t + \sum_{s=t-6}^{t} \Delta F_s f m_s \qquad (1)$$

Where $\overline{Y}_t$ is potential output, the ΔF_s's are the past and present changes in structural primary balance that are still influencing output (going back to t-6 under our assumption of seven year persistence), and the fm_s's denote the fiscal multipliers that apply to each of these changes in fiscal stance. Each fm_s depends on both the size of the multiplier and the position on the persistence path. The left chart in Figure 2 below illustrates, under a five-year fiscal adjustment plan, how the fiscal multiplier effects from each year's additional fiscal tightening are aggregated to determine the final implied output path (again on the assumption that fiscal policy is the only factor causing a deviation of output from potential). The right chart in Figure 2 shows a stylized example for a country that starts at potential and implements a year of fiscal expansion followed by two years of consolidation.

Figure 2. An Illustration: Implied Real Output Under Multi-year Fiscal Adjustments



(ii) Taking debt dynamics into account

18. Apart from the impact on output, fiscal adjustment also affects debt dynamics and financing costs, which are built into our framework as well. To examine the debt dynamics under fiscal consolidation, we add the calculation of the debt-to-GDP ratio to our template. On the financing cost, we assume constant interest rate in the baseline, but allow endogenous interest rate in the extension of the baseline model (see ¶29)[9]

19. To evaluate debt dynamics, we look at not only the headline debt-to-GDP ratio, but also the structural debt condition. A powerful argument for slowing down a fiscal adjustment in a high debt country is that under high multipliers, the fiscal tightening could cause the debt-to-GDP ratio to rise, if the effect on GDP outweighs the effect on debt. While this would be a temporary effect (since the effect of fiscal consolidation on debt is permanent, while the effect on GDP is all, or mostly all, temporary), it could raise market concerns. However, just as the headline fiscal balance may tell a misleading story about the underlying structural fiscal stance, so can the headline debt-to-GDP ratio present a biased picture of a country's structural debt condition, as GDP includes a cyclical component. Therefore, a more appropriate measure of structural debt position, in our view, would be the ratio of debt to potential GDP.[10] At the same

[9] To calculate debt levels, one needs not only the structural primary balance and interest payment, but also the automatic stabilizer. For this purpose, we assume, as a common practice in the literature, that revenues change in proportion to real output and hence the revenue-to-output ratio remains constant. This implies that all fiscal consolidation is from spending cuts. This is not a critical assumption—it can be adjusted depending on the country-specific composition of fiscal adjustment measures.

[10] Eyraud and Weber (2013) provide an extensive discussion on alternative measures of cyclically-adjusted debt ratios (CADRs), and express reservation about using debt-to-potential GDP as an appropriate CADR because this measure still has a cyclical component in the numerator (from past cyclical components of fiscal deficits).

(continued…)

time, measuring debt as a ratio to potential GDP carries the serious risk of understating the scale of a debt problem, if potential GDP is overestimated. But this is the same risk as for measures of structural fiscal balances: indeed, the latter are even more susceptible, because overestimating potential output affects both the numerator (decreasing it) and the denominator (increasing it) in the structural deficit/potential GDP ratio. Because of this risk, which historically has been pervasive, we would suggest that for both debt and deficits, structural ratios should be presented under a wide range of estimates of potential output.

A stylized example of an advanced economy with high multipliers

20. Here we present the output and debt dynamics of a highly-indebted country under different multi-year fiscal adjustments, using a stylized example calibrated for an advanced country. The exercise illustrates the tradeoffs between short-term pains and long-term gains under different assumptions, shedding light on the policy debate of front-loaded vs. back-loaded fiscal adjustment when the economy is in recession and possibly has large multipliers.

21. We start with a simple setup with a fixed fiscal multiplier, and then extend the framework, step by step, to include other key factors affecting the output and debt dynamics, such as the potential hysteresis effects and endogenous interest rate. This approach highlights the role of each additional factor and clarifies the circumstances under which each assumption would apply. The main assumptions for the basic setup are summarized in Box 1.

(i) Basic setup: with fiscal multiplier effects only

22. With a large fiscal multiplier, the front-loaded fiscal adjustment results in a deeper initial recession, but a quicker restoration of growth, with total output loss the same under both adjustment scenarios.[11] There could be political and social preferences between a more V-shaped or a more U-shaped recession: from a social welfare perspective and assuming a quadratic welfare function, the U-shaped output path could result in higher welfare; from a political point of view, however, concerns over the credibility of sustained implementation and reform fatigue could favor the more V-shaped path (noting that in the even phasing example in Figure 3, growth is resumed only in 2015, compared to 2012 under frontloading). Other considerations could include the relative resilience of the financial sector under the different scenarios, and the availability of financing on reasonable terms to run temporarily higher deficits under back-loading.

Therefore, they argue against using it to design short-term fiscal policy. This concern, though valid, is not very relevant for our purposes, as we do not propose to use debt-to-potential GDP as a fiscal anchor, but instead as a simple improvement over the headline debt-to-GDP ratio to monitor a country's debt sustainability risks.

[11] Technically, the output loss is slightly larger under the gradual adjustment scenario, because potential GDP is assumed to start growing from 2013—as a result, a cumulative adjustment of 10 percent (of potential GDP) over 2010-14 is slightly larger in level terms than a 10 percent adjustment over 2010-12, but the difference is negligible.

Box 1. A Stylized Example: Basic Assumptions for an Advanced Economy

This Box summarizes the main assumptions under the basic setup (i.e., with fiscal multiplier effects only) of the stylized example:

(i) ***Fiscal adjustment scenarios.*** The initial (2009) debt-to-GDP ratio is assumed to be 100 percent. The 2009 structural primary deficit is 5 percent of potential GDP. A cumulative fiscal adjustment of 10 percent of potential GDP is implemented under two alternative scenarios (with a "no adjustment" scenario also shown for comparison):

- *Front-loaded adjustment* improves the structural primary balance by 6 percent, 3 percent and 1 percent in 2010, 2011 and 2012, respectively.
- *Even adjustment* has the same adjustment spread over five years, 2 percent a year from 2010 to 2014.

(ii) ***Potential GDP*** is assumed to be flat at 100 over 2009-12 and then to grow 2 percent a year from 2013.

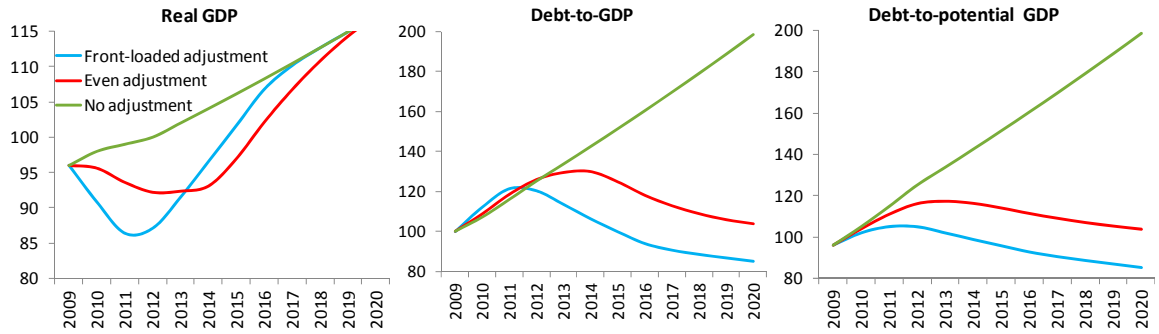
(iii) A ***non-fiscal driven output gap*** is assumed to be -4 percent in 2009, and to close autonomously over the next three years. This illustrates how the output gap would evolve *in the absence of* fiscal consolidation (hence the name "non-fiscal driven"). This assumption, though not critical in driving the results, serves two purposes: first, it shows how *pure* private sector activities (e.g., asset and credit busts) could exacerbate the contractionary effect of fiscal consolidation; second, it allows experiments of starting fiscal consolidation at different point of time to test the idea that it is better to start fiscal consolidation after the economy is out of recession.

(iv) A ***fiscal multiplier*** of 1.5 is assumed with persistence of 7 years, with the GDP impact of fiscal tightening in year t taking the full effect in year t+1 and gradually reversing in subsequent years. As explained in ¶2, this paper does not argue for a specific size of the multiplier—we use a very large one to illustrate the difficult circumstances a country could be in.

(v) For illustration and simplicity, ***nominal interest rate*** is assumed to be a constant at 5 percent, and ***revenue-to-GDP, GDP deflator and nominal exchange rate*** are assumed to remain constant.

23. The medium-term debt path is markedly better under front-loaded adjustment, especially when measured against potential GDP. The blue line in the center chart below shows the initial "counterproductive" effect of front-loaded fiscal consolidation on debt, with the debt-to-GDP ratio first rising above the (explosive) no-adjustment scenario. This is the same finding as in Eyraud and Weber (2013) for high-multiplier and highly-indebted countries. However, this "counterproductive" effect is temporary, and the combination of upfront fiscal consolidation and early turnaround in growth subsequently pushes the debt ratio down quickly. By contrast in the even adjustment scenario, although the debt ratio rises more slowly in the short term, it peaks much later and remains persistently higher. If the debt position is measured against potential GDP (right-hand chart) to eliminate cyclical component in the denominator, the initial "counterproductive" effect under the frontloading scenario disappears—debt dynamics are unanimously better under frontloading.

Figure 3. Basic Setup: Fiscal Multiplier and Debt Dynamics
(Multiplier=1.5)



(ii) Basic setup with multipliers varying with the size of the output gap

24. We explore an alternative structure of the fiscal multiplier, as a function of the output gap. Recent literature suggests that fiscal multipliers can be larger when the economy is in recession.[12] To take this into account, we consider a varying multiplier that depends on the size of the output gap. We assume that the multiplier is 0.5 with positive output gaps and small negative output gaps.[13] The multiplier then increases linearly up to a maximum of 2 for an output gap of -5 percent of potential GDP or wider—this would imply, for example, a multiplier of 1.25 when the output gap is -2.5 percent of potential GDP.[14] In this alternative, the assumed upper bound of the multiplier is necessarily arbitrary but we included extreme multipliers (e.g., 2 with large output gap) to test the maximum growth impact when fiscal consolidation takes place while the economy is in deep recession, which has been the case in some European countries. All the parameters here are illustrative and can be changed to suit country-specific circumstances.

25. Application of a varying multiplier does not appear to have major effects on the policy implications. Front-loaded adjustment results in larger short-term output loss but a quicker turn around in both the output and the debt paths (Figure 4). With the parameters used in this case, the total output loss is somewhat larger under the even-adjustment scenario, as an extended period of fiscal consolidation keeps the output gap and hence the fiscal multiplier relatively large for a longer period. Front-loaded adjustment, on the other hand, results in a very large output gap (and fiscal multiplier) initially, but which narrows more quickly.[15] The debt

[12] Auerbach and Gorodnichenko (2012a, 2012b), and IMF (2012), Delong and Summers (2012), Baum, Poplawski-Ribeiro, and Weber (2012), Batini, Callegari, and Melina (2012).

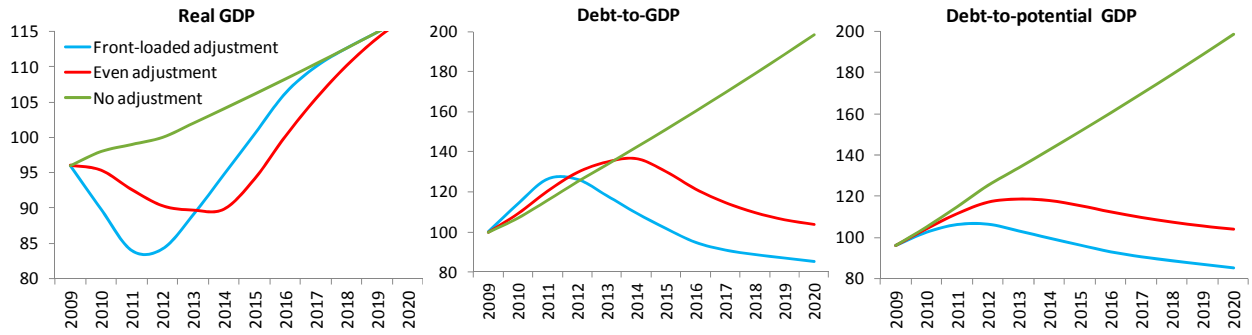
[13] IMF (2010, 2012), Auerbach and Gorodnichenko (2012b), Blanchard and Leigh (2013).

[14] We also considered a different variant where the multiplier is 2 when the negative output gap is wider than 4 percent, and 0.5 otherwise. Results from this alternative assumption are qualitatively the same, and hence are not reported here.

[15] The result on total output loss is sensitive to the effective size of the multipliers used. With smaller effective multipliers (e.g., with a multiplier varying linearly from 0.5 to 2 under an output gap from 0 to -10 percent), the total output loss would be smaller under the even adjustment scenario.

dynamics are better under the front-loaded adjustment, aside from the headline debt-GDP effect in first two years.

Figure 4. Varying Fiscal Multiplier



26. Sensitivity analyses assuming larger multipliers yield the same policy implications. With larger multipliers (under both the fixed and the varying assumptions), the output and debt dynamics worsen under both adjustment scenarios, but the difference between the front-loaded and the back-loaded scenarios remains qualitatively the same.

(iii) Incorporating hysteresis effects

27. Given that many countries currently undertaking fiscal consolidation are in deep recessions, potential hysteresis effects are relevant and hence added to the framework. Unlike the standard fiscal multiplier effect, which eventually tails off to zero, the hysteresis effect is permanent once it kicks in. We assume that permanent hysteresis would be in effect if the output gap is larger than a threshold, and we use a hysteresis coefficient of 0.15 in the stylized example. This parameterization is based on DeLong and Summers (2012), which suggest that the hysteresis coefficient could range between 0 to 0.2, with a value of 0.1 suggested for the US given its flexible labor markets. Our assumption means that if output is well below potential in any year (whether due to fiscal policy or other factors), then 15 percent of the output gap is lost permanently, i.e., potential output going forward is reduced by this amount. Again, both the output gap threshold and the hysteresis coefficient can be calibrated to specific country circumstances. The real output with both the fiscal multiplier and the hysteresis effect in year t is calculated as:

$$Y_t = \overline{Y}_t^H + \sum_{s=t-6}^{t} fm_s \Delta F_s$$

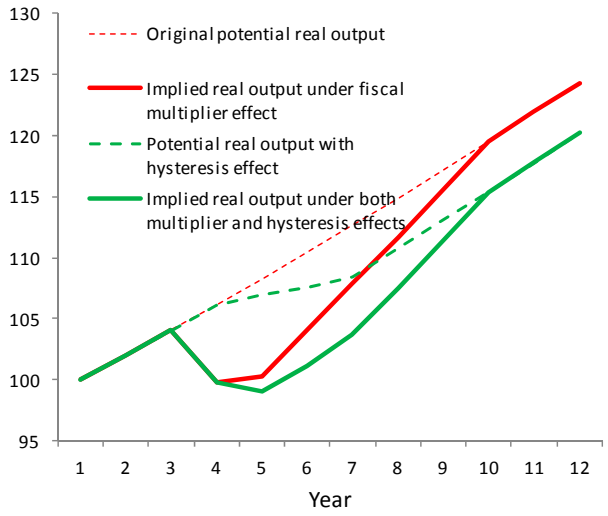
$$where\ \overline{Y}_t^H = \overline{Y}_{t-1}^H + \delta\left(Y_{t-1} - \overline{Y}_{t-1}^H\right)$$

$$s.t.\ Y_{t-1} - \overline{Y}_{t-1}^H < y^{og}$$

$$\overline{Y}_0^H = \overline{Y}_0 \qquad (2)$$

Where δ is the hysteresis coefficient, $\overline{Y}_t^H$ is the potential output with the hysteresis effect and y^{og} is the output gap threshold that defines whether the economy is in the "hysteresis zone". Figure 5 illustrates how the potential and the implied real output paths look like following a one-time permanent fiscal tightening with and without the hysteresis effects.

Figure 5. Output Under Fiscal Multiplier and Hysteresis Effects



28. We then introduce the hysteresis effect to see how this affects the preferences for phasing of fiscal adjustment. The following assumptions are added to the basic setup:

- **A permanent hysteresis effect** takes effect if previous year's negative output gap is wider than 4 percent.[16] Intuitively, one would expect large hysteresis effect under front-loaded adjustment and no (or little) hysteresis effect under the gradual adjustment scenario.

29. With large total fiscal adjustment needs, hysteresis effects could be sizeable even under gradual fiscal adjustment, though smaller than under the front-loaded scenario. Under front-loaded adjustment, the economy is quickly pushed into the "hysteresis zone". Under the gradual adjustment, the economy does not get into the "hysteresis zone" immediately, but as fiscal adjustment has to continue for a longer period under this scenario, the economy is eventually pushed into the "hysteresis zone" and the hysteresis effect stays permanently.

30. To completely eliminate the hysteresis effect, a very long and gradual adjustment path is needed. The adjustment has to start only when the private gap closes and it would take

[16] The choice of the threshold does not affect the hysteresis effects under the front-loaded scenario much as the economy is driven immediately into deep recessions, or the "hysteresis zone", anyway. However, the hysteresis effects under the gradual adjustment is more sensitive to the assumed threshold—a more negative threshold would reduce the likelihood that the economy is driven into the "hysteresis zone" and hence result in smaller hysteresis effects.

more than a decade to complete the 10 percentage points of total adjustment. In reality, however, it may be difficult to maintain the credibility of such a long and gradual fiscal adjustment, a factor not modeled in our framework but essential to the success of fiscal consolidation.

31. Lower output losses under gradual adjustment need to be balanced against worse debt dynamics. With hysteresis effects, both the short-term and longer-term output losses are larger under the front-loaded scenario. Furthermore, the larger the hysteresis coefficient assumed, the worse the output losses are under the front-loaded scenario relative to the gradual adjustment one. Therefore, countries that do not face financing constraints and debt sustainability problems should find gradual adjustment more desirable (unless political economy considerations argued for a shorter adjustment period even at the cost of greater permanent output loss). For countries that do have financing and debt sustainability concerns, however, the priority may need to be debt reduction, tilting the balance towards the front-loaded scenario. That said, if front-loaded adjustment leads to too onerous an output path, and the back-loaded path leads to too-high debt, then the remaining option would be debt restructuring.

Figure 6. Fixed Fiscal Multiplier with Hysteresis Effects

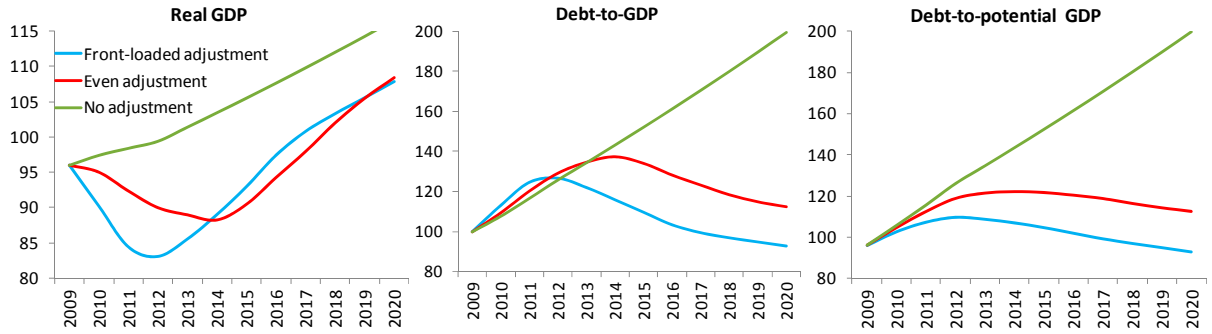
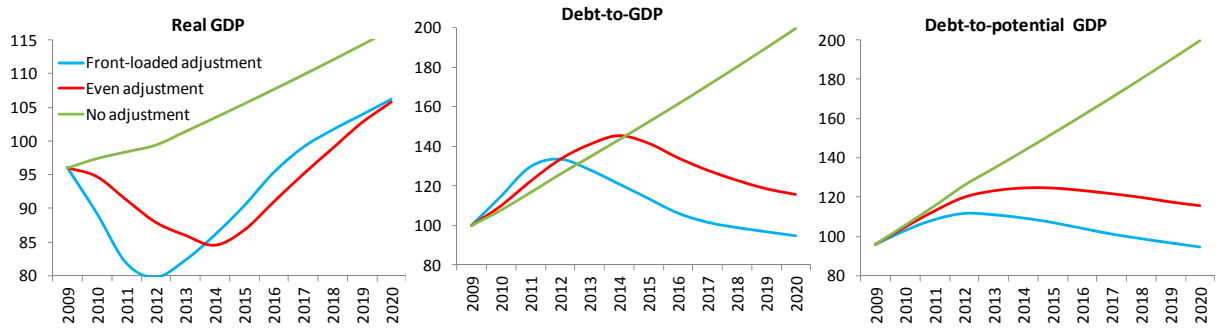


Figure 7. Varying Fiscal Multipliers with Hysteresis Effects



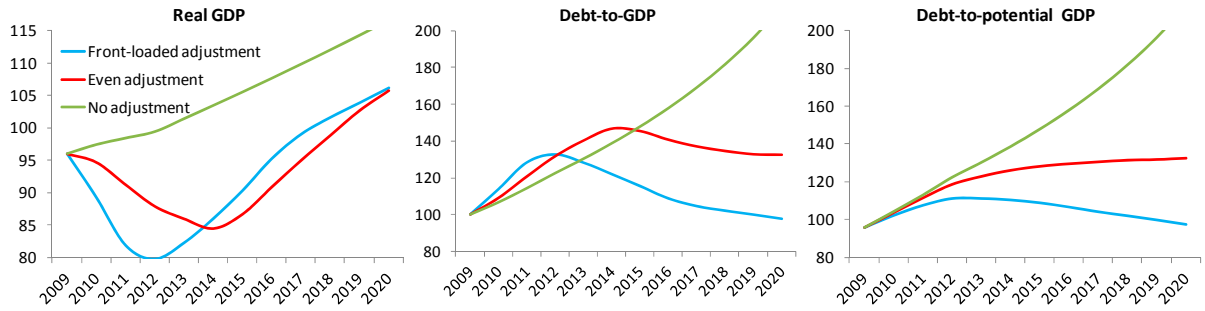
(iv) Incorporating endogenous interest rates

32. Finally, we introduce endogenous interest rates into the model with fiscal multiplier and hysteresis effects to have a complete story. Sovereign spreads may be expected to rise with a larger debt stock and with lower growth, but calibrating these effects is a challenge. This is an area in need of further research but in our template, as a first step, and roughly reflecting the experiences of some European countries, we assume illustratively that the interest rate is

3 percent up to a debt-to-GDP ratio of 90 percent. It then increases linearly with debt up to a maximum of 12 percent for a debt-to-GDP ratio of 200 percent and above.[17] In addition, there is a further risk premium when real GDP growth turns negative, rising linearly from zero at zero growth to 200 basis points for growth of -2 percent or worse. Needless to say, the interest rate schedule assumed here is illustrative—in practice, it depends on a number of characteristics: emerging markets, for example, may face a steeper increase in financing cost even with a lower level of debt; existing debt composition, such as the maturity structure and exposure to foreign exchange risks, also matter. In applying these interest rates to the debt stock we also assume that the government debt turns over with an average maturity of 5 years. These assumptions may all be varied for sensitivity analysis.

33. As a large debt overhang feeds into higher financing cost, front-loaded adjustment is needed to restore debt sustainability in highly-indebted economies. A larger debt overhang from gradual adjustment leads to higher financing cost, which results in an even larger debt stock, a vicious cycle that outweighs the fiscal adjustment efforts. Consequently, despite the fiscal adjustment efforts, the debt-to-GDP ratio is not on a declining trend in the longer term under the even-adjustment scenario (Figure 8).[18] The policy message is clear: if the debt overhang-financing cost feedback loop is in play, then front-loaded adjustment would be needed to restore debt sustainability. Also, contrary to the argument that fiscal adjustment should be delayed until the economy recovers, which would then help lower debt levels, our simulations of a delayed adjustment (for three years until the private sector output gap closes) suggest that debt would be explosive in this scenario. Importantly, if very large-scale low-cost official financing is available, or if the country enjoys a reserve currency status that allows it to retain access to favorable financing rates at high debt levels, this would short-circuit the debt-financing cost feedback loop. However, the large debt overhang may still inhibit growth down the road.

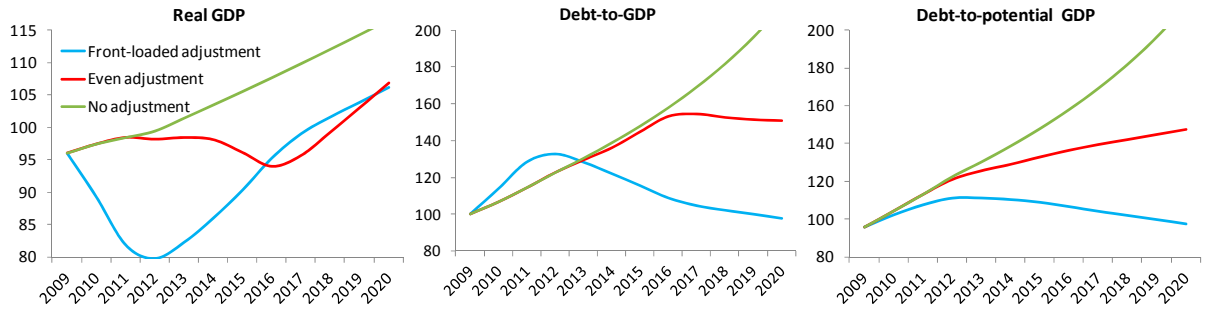
Figure 8. Varying Multiplier, Hysteresis Effects and Endogenous Interest Rate



[17] In practice, some countries may have already lost market access before interest rate reaches 12 percent. In this framework, for simplicity, we do not model the loss of market access explicitly—instead a potential debt crisis is illustrated by showing how the debt path could be explosive when the debt-interest rate feedback loop is in play.

[18] Assuming fixed fiscal multipliers generates similar results, and hence not reported here.

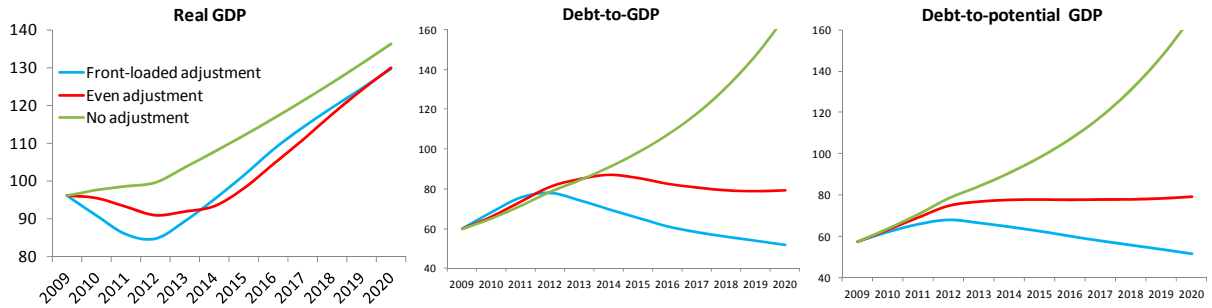
Figure 9. Delayed Fiscal Adjustment



A stylized example of an emerging market

34. The output and debt dynamics, as well as the policy implications, are very similar, if the stylized example is parameterized in a way that captures the characteristics of an emerging market. As established in the literature, emerging markets tend to have smaller fiscal multipliers, more flexible labor markets (especially in the informal sector), lower debt tolerance, and steeper interest rate schedules. The assumptions for an emerging market stylized example are summarized in Box 2, and the output and debt outcomes are presented in Figure 10. The short-term/long-term tradeoffs and the policy implications are largely the same as discussed above.

Figure 10. A Stylized Example of an Emerging Market



Box 2. A Stylized Example of an Emerging Market

This Box summarizes the key assumptions under the stylized example of an emerging market:

(vi) ***Fiscal adjustment scenarios.*** The initial (2009) debt-to-GDP ratio is 60 percent, and the 2009 structural primary deficit is assumed to be 4 percent of potential GDP. A cumulative fiscal adjustment of 8 percent of potential GDP is implemented under two alternative scenarios (with a "no adjustment" scenario also shown for comparison):

- *Front-loaded adjustment* improves the structural primary balance by 5 percent, 2 percent and 1 percent in 2010, 2011 and 2012, respectively.
- *Even adjustment* has the same adjustment spread over five years, 1.6 percent a year from 2010 to 2014.

(vii) ***Potential GDP*** is assumed to be flat at 100 over 2009-12 and then to grow 4percent a year from 2013.

(viii) A ***non-fiscal driven output gap*** is assumed to be -4 percent in 2009, and to close autonomously over the next three years.

(ix) A ***varying fiscal multiplier*** of 0.5 to 1 is assumed for an output gap of 0 to -5 percent with persistence of 7 years.

(x) The ***hysteresis coefficient*** is assumed to be 0.1.

(xi) The ***nominal interest rate*** is assumed to be 5 percent for debt up to 60 percent of GDP. For debt between 60 and 120 percent of GDP, nominal interest rates increase linearly to 20 percent and remains at 20 percent for debt levels higher than 120 percent of GDP. There is an additional risk premium rising to 4 percent for growth between 0 to -2 percent.

(xii) The ***average debt maturity*** is assumed to be five years.

(xiii) ***Revenue-to-GDP, GDP deflator and nominal exchange rate*** are assumed to remain constant.

35. Overall, the framework suggests that with high fiscal multipliers, front-loaded adjustment tends to allow an earlier turnaround in the debt-to-GDP path and persistently lower debt levels in the medium term, at the cost of a larger short-term output loss and a temporary rise in the debt-to-GDP ratio in the near term. Therefore, for countries facing an urgent need to restore fiscal sustainability and tight financing constraints, front-loaded adjustment may be appropriate or unavoidable. Gradual fiscal consolidation, on the other hand, is likely to be more desirable if hysteresis effects are at play, and more feasible for countries with lower debt levels and/or availability of large-scale official financing at lower costs.

36. So far, we have assumed the same size and functional form of multipliers under different adjustment scenarios, but in practice, this may not be the case. By assuming the same multipliers under various consolidation scenarios, we implicitly assume that the

composition (i.e., revenue vs. expenditure measures) of the adjustment is the same under all scenarios. In case one wants to compare scenarios with both different phasing and different composition, one can assign different multipliers to different measures. However, there is no consensus in the literature as to whether the revenue measures or the expenditure measures would have larger multipliers. For example, IMF (2010) finds that revenue measures are associated with larger multipliers, while Batini et. al. (2012) finds the opposite. Again, it is beyond of the scope of this paper to argue for or against these findings, but the framework is flexible enough to be able to replicate qualitatively their results assuming the multipliers used in their work.

37. Another aspect the framework does not capture is the nature of the measures, which may also have a bearing on the phasing. For example, if long-run fiscal improvements can be legislated in advance (for example via entitlement reform), this would give space for a more gradual fiscal adjustment without impacting credibility.

IV. Application to Country Examples

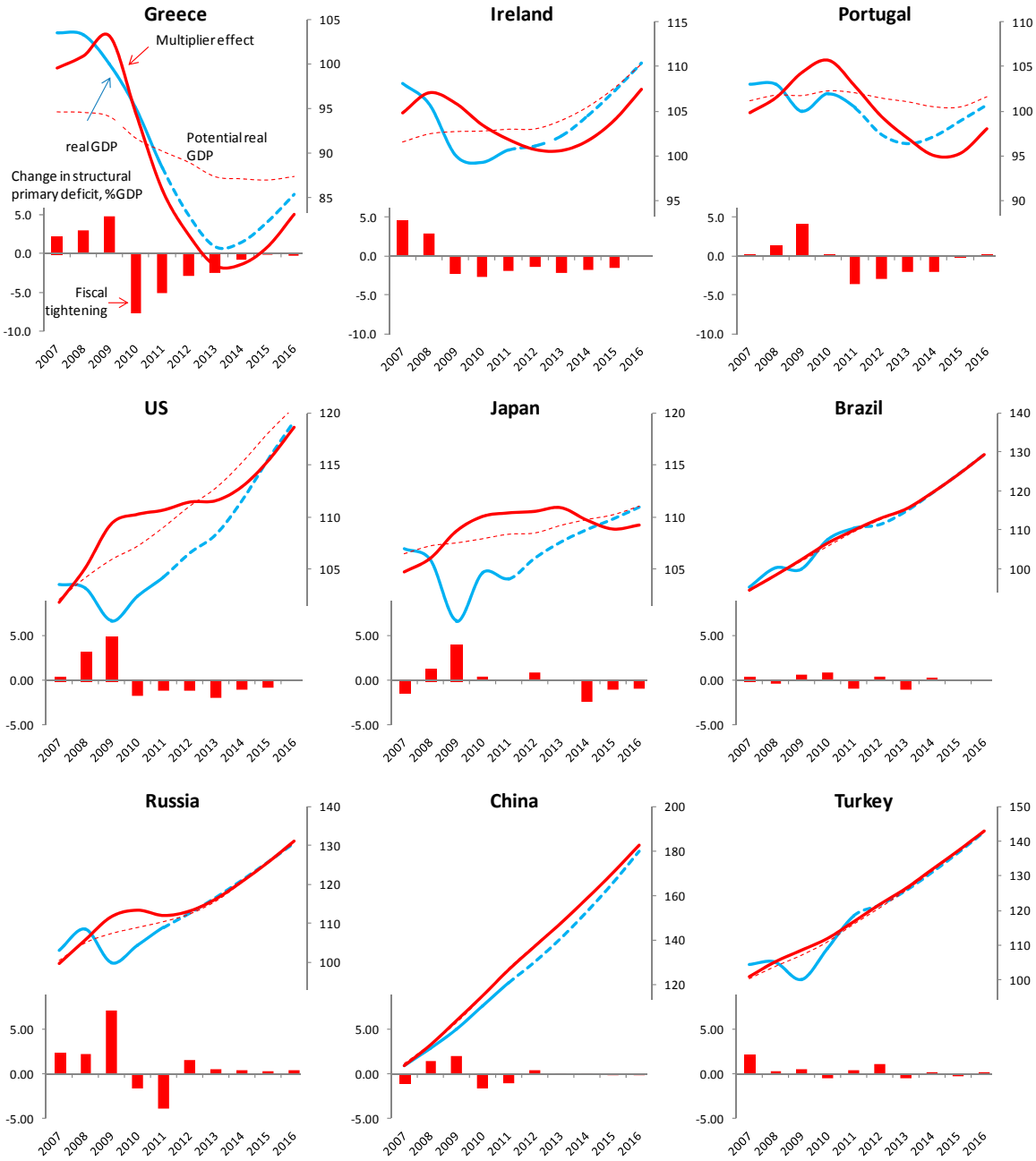
38. We apply the framework to a group of advanced and emerging market economies. In the main text, we report results for nine countries, including five advanced ones (the U.S., Japan, Greece, Ireland, and Portugal) and four emerging markets (Brazil, China, Russia, and Turkey). Additional countries examples (the Euro Area, France, and Italy; India, Mexico, and South Africa) are presented in the Appendix. In choosing the advanced economy cases, we focus on those with high debt and/or facing the need to implement large multi-year fiscal consolidation. On the other hand, debt sustainability is less of a concern in emerging markets and the scale of planned fiscal consolidation there is smaller. We hence present the G-20 emerging markets as examples.

39. A range of illustrative multipliers are applied. As argued in the WEO (2010), fiscal contraction leads to larger multiplier effects when interest rates are close to the zero lower bound and the rest of the world is consolidating. In addition, the Fiscal Monitor (2012) suggests a fiscal multiplier of 1.0 for recent cases in advanced countries, and 0.5 for emerging markets.[19] We set illustrative baseline multipliers in line with these findings, allowing variations given country-specific features. In the following sections, sensitivity analyses are conducted using lower and higher multipliers. The baseline multiplier is set to be unity for Greece (closed economy and large output gaps), 0.75 for Portugal (a more open economy with smaller output gaps), and 0.5 for Ireland, Japan, and the U.S. (much more open economy with high automatic stabilizers and moderate output gaps). The multipliers are also set to be 0.5 in emerging market examples. A persistence of seven years is used for all three cases. The results are shown in the charts below. The path of actual and potential GDP, and structural fiscal balances, are taken from the latest WEO projections.

[19] Fiscal Monitor, April 2012, Chapter 3 "*Easy Does It: The Appropriate Pace of Fiscal Consolidation*".

Figure 11. Country Examples: Fiscal Multiplier Effects

(2009 real GDP=100)



1/ For China, the change in structural primary balance does not include the large quasi-fiscal stimulus employed on and off since the 2008 global financial crisis.

40. In each chart, the bars at the bottom show structural fiscal changes in percent of potential GDP (red bars, downwards, represent fiscal tightening). The dotted red line is potential real GDP, and the solid red line shows the implied potential real GDP incorporating cumulative fiscal multiplier effects. The blue line is actual (solid) and projected (dashed) real

GDP, all normalized to 2009 real GDP = 100. To the extent that the framework and chosen parameters accurately reflect the fiscal multiplier effects, the divergence between the red and blue line reflects "non-fiscal" effects, that is, the private sector-driven business cycle (via confidence effects, asset and commodity price cycles, etc).

41. As expected, fiscal multipliers are the dominant influence on growth declines in Greece and Portugal, with much more significant private sector-driven contractionary effects in other advanced and emerging market examples. In Greece, Ireland, Russia and Turkey, structural fiscal expansion contributed to the pre-crisis booms, but still explained only part of the booms, which were mostly private sector driven.

Alternative multipliers

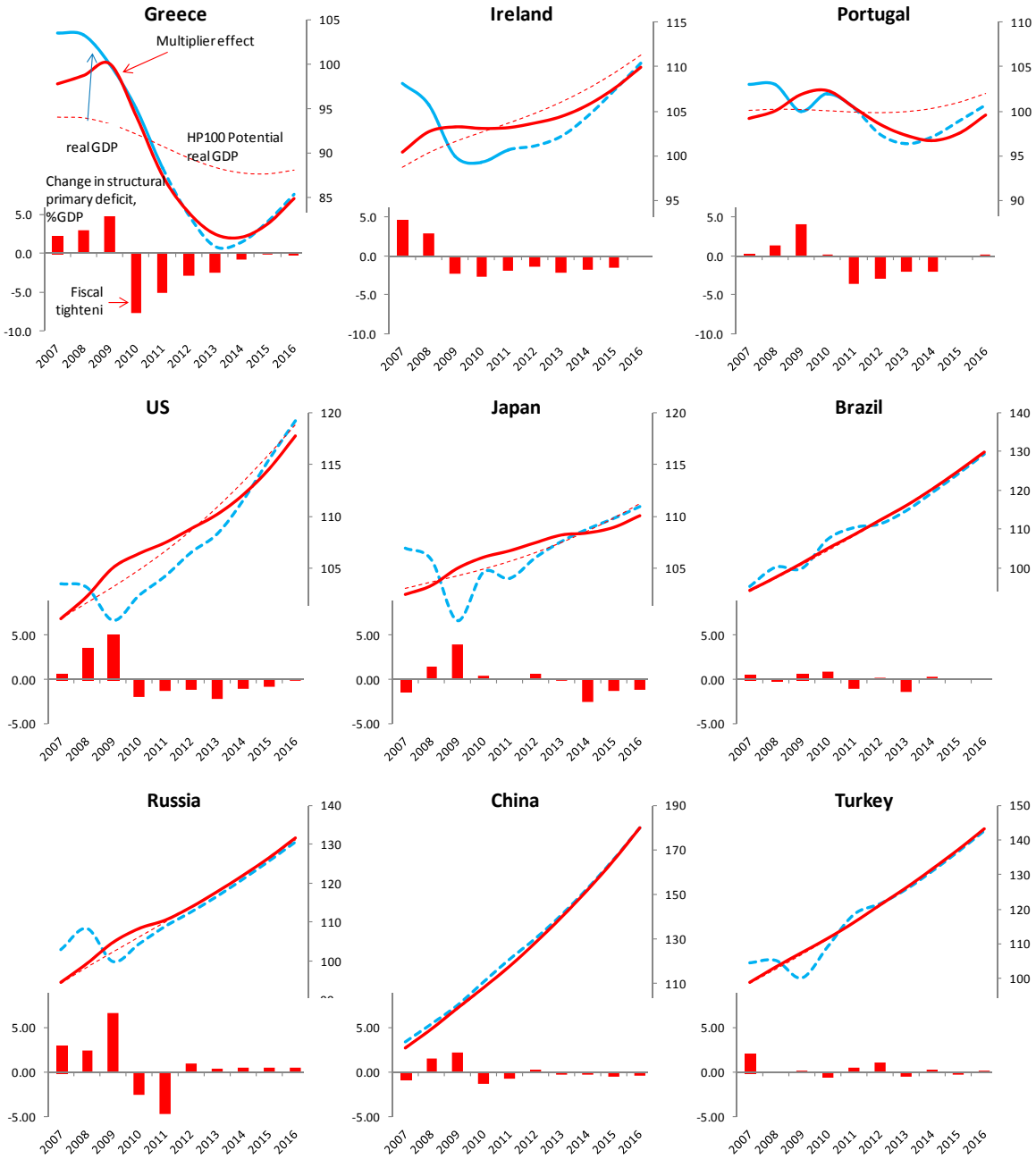
42. Our framework can easily accommodate different parameter values to test different assumptions and provide sensitivity analysis.

(i) Smoother output trends and lower multipliers

- A possible drawback of the results above is that if the assumed potential GDP path already reflects fiscal multiplier effects, adding the multiplier effects to potential GDP would be double-counting and result in an overstated fiscal cycle. This could well apply in cases like Greece where the fiscal cycle is very pronounced. One way round this is to use a smoother trend for potential GDP. Therefore, HP100 is used to estimate potential output.[20] Moreover, smaller fiscal multipliers in all cases (GRC=0.75, PRT=0.5, and others=0.25) are assumed. The results are not very different from the above, but the smoother trends of potential output seem reasonable and are used in the subsequent charts in this section.

[20] Please note that the potential output estimated using the HP100 filter is only as good as the team's real GDP projections (on which the HP filter is applied). If, for instance, the real GDP projections are overly optimistic, the HP100 filter would not be able to correct the problem—all it does is to avoid double counting of the fiscal effect and provides a smoother trend.

Figure 12. Country Examples: Smaller Multipliers and HP-filtered Potential Output



1/ For China, the change in structural primary balance does not include the large quasi-fiscal stimulus employed on and off since the 2008 global financial crisis.

(ii) Higher or varying multipliers

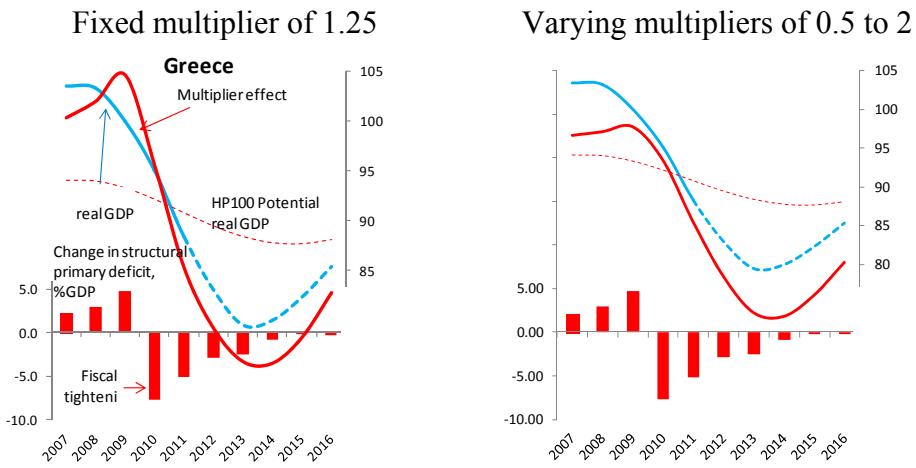
- There is a view that short-term fiscal multiplier could exceed unity in the current environment (e.g., according to the WEO (2012), the multiplier could be as large as

1.7 since the crisis).[21] To test this view, a multiplier of 1.25 for Greece is tested. The resulting chart (Figure 13 LHS) shows calculated fiscal multiplier effect that are much larger than the actual fall in real GDP over 2009−12, suggesting that the private sector provided a large positive boost to output in this period. This seems highly counter-intuitive.

- As a robustness check, we apply the assumption of varying multipliers to Greece using the range of 0.5-2 for output gaps varying from zero to -5 percent and wider. This would imply a multiplier exceeding unity in the post crisis episode. The resulting output path (Figure 13 RHS) has the same problem as under the assumption of large and fixed multiplier—the implied real output (with fiscal effect only) is much lower than the actual data, implying large positive boost to output from pure private sector activities, which is counter-intuitive.

- Similar results are obtained for other country cases. These scenarios seem to cast doubt on claims that multipliers were much larger than unity in countries undertaking large consolidations since the global crisis.

Figure 13. Country Examples: Greece with High Multiplier

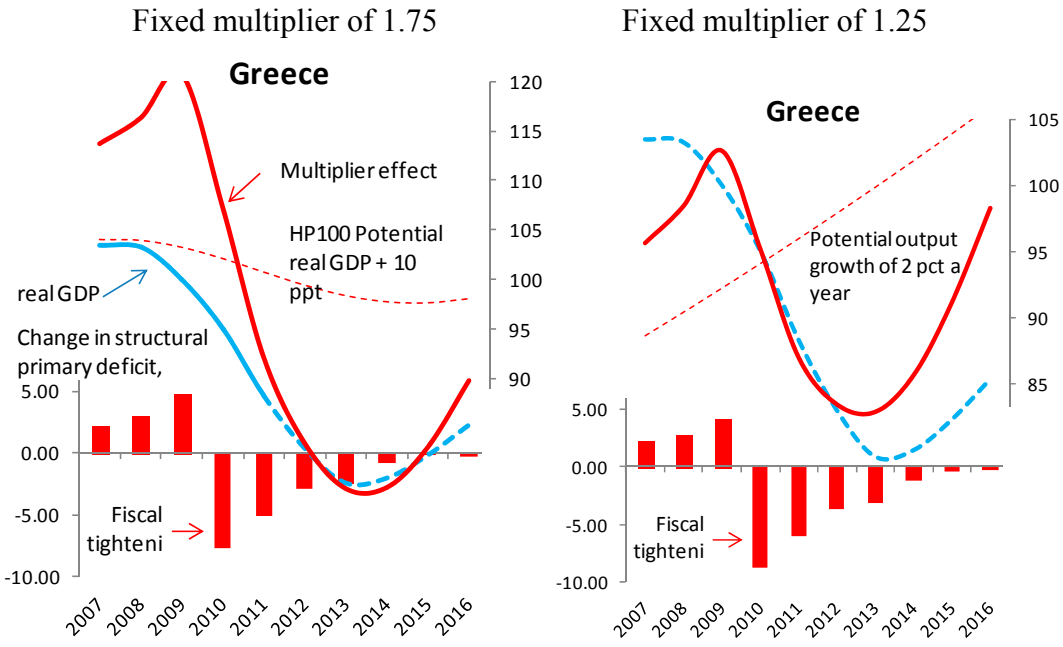


43. It is critical to note that our assessment of the size of the multiplier depends on the estimated potential output—presumably, with a much higher potential output path, one would need a much larger multiplier to "fit" the low post crisis output levels. To test this argument, a potential output path 10 percentage points higher than in Figure 13 is used for illustration

[21] In theory, there are various reasons why the multipliers could significantly exceed unity. For example, as the global economy remains weak and trading partners undertake fiscal consolidation simultaneously, external demand could not help offset the negative impact of fiscal austerity. In addition, the macro-financial feedback loop could play an important role: fiscal consolidation reduces growth with adverse effect on the financial sector, which, in turn, would reduce credit extension, hurting economic growth. Finally, some of the economies in need of large multi-year fiscal adjustment are in the euro zone and hence cannot rely on the exchange rate to partially absorb the negative growth impact of fiscal consolidation.

purposes (Figure 14, left chart). Such a high potential output path requires a multiplier of around 1.75 for the implied real output (the red line) to "fit" the 2011 actual real output and the projected output trough in 2013. However, the red line in this case generates a significantly larger peak-to-trough output collapse than actually experienced, again pointing to the overestimation of the fiscal multiplier.[22] This result holds for a flat or somewhat declining potential output path in the medium term (no matter how high or low the levels are), and the only case where a multiplier considerably larger than unity could be plausible is to have potential output in Greece trends up significantly in the next few years. For example, if one believes that potential output growth in Greece is not disrupted by the crisis and remains robust at 2 percent annually in the medium term, then a multiplier of around 1.25 seems possible (Figure 14, right chart). However, such a potential output path appears optimistic to us.

Figure 14. Illustration: Greece with Alternative Potential Output

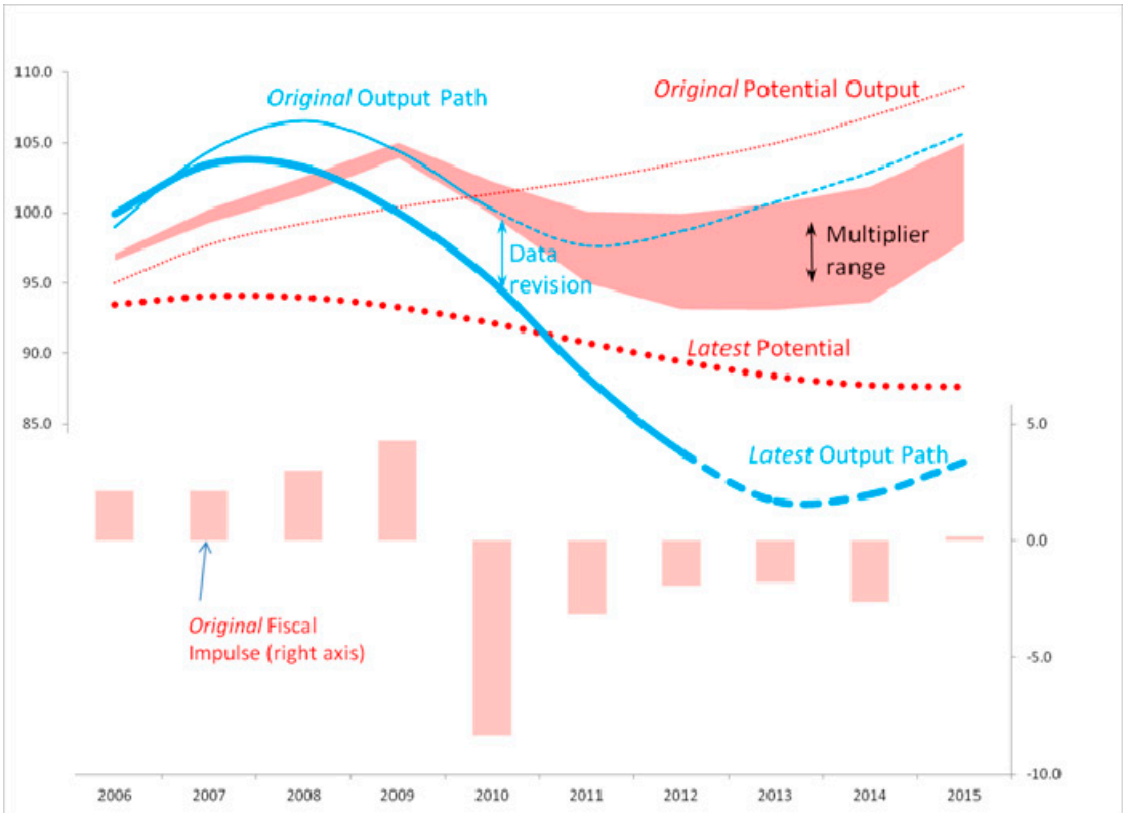


44. If it is not that the fiscal multiplier significantly exceeds unity, what explains the larger-than-expected collapse of Greek output? To address this, we look at the growth projections, potential output, and fiscal impulse at the time of Greece's May 2010 program request. From the upper lines in Figure 15, we see that potential output was projected at the time to continue trending upwards quite strongly. Given that projection, the shaded area gives a sense of the possible multiplier effects under a range of low (0.5) to high (varying to up to 1.5, with a hysteresis factor of 0.15) multipliers. The actual GDP projection shown by the thin blue line was clearly at the optimistic end of this spectrum (implicitly assuming a significant private sector

[22] The peak-to-trough output change is the product of the change in fiscal stance and the fiscal multipliers. As the fiscal actions are the same under both the actual GDP (the blue line) and the implied output level (the red line), the huge discrepancy in the output collapse under the two paths can only be attributed to the wrong calibration of the fiscal multiplier.

boost in outer years even with a low multiplier assumption). However, moving to a higher multiplier assumption would have done little to improve the accuracy of the GDP projections. Instead, by far the more significant factor was the dramatic revision to potential growth, both to its original level and its projected growth. This reflected a number of developments, including large data revisions following the start of the program, weaker than anticipated program implementation and payoffs from reform, political and social dislocation, and other factors contributing to a far weaker underlying economic performance than hoped for in the original program.

Figure 15. Country Examples: Original vs. Current Projections Under the Greece Program



V. CONCLUSIONS

45. What is the appropriate fiscal adjustment path, especially for highly-indebted economies in recession? This is a policy question under intense debate, with sentiment shifting towards a more back-loaded path as some of the economies under fiscal consolidation fall into deeper recessions and as recent papers find that fiscal multipliers tend to be larger in recessions, and in some cases can significantly exceed unity. The current debate, however, is often based on partial analysis of the impact of fiscal adjustment. For example, many focus on the size of the peak (short-term) fiscal multiplier, but few looks at the dynamic effects of multi-year adjustments, or internalize the tradeoffs between the output and debt dynamics.

46. This paper provides a general framework to assess the dynamic impact of multi-year fiscal consolidation on output and debt, shedding light on the appropriate phasing of

fiscal adjustments. Our approach takes into account the magnitude (which may vary as a function of the output gap) and persistence of fiscal multipliers, potential hysteresis effects, and endogenous financing costs, allowing for country-specific parameters. The framework can be used to inform macro projections, and more importantly, to compare output and debt outcomes under different fiscal adjustment scenarios, facilitating the choice of an appropriate fiscal consolidation path.

47. The application of the framework to stylized advanced and emerging market examples yields interesting policy implications. We find that for a highly-indebted economy undertaking large multi-year fiscal consolidation, large multipliers do not always argue against front-loaded adjustment – instead implications for output and debt need to be considered carefully and balanced against each other. The existence of hysteresis effects and endogenous interest rates may be important factors in drawing this balance, the former tending to point to more gradual adjustment, and the latter to more front-loaded consolidation in high debt situations. Beyond the short term, we do not find support for the argument that a more gradual adjustment would support growth to such an extent that the debt ratio declines more than under a front-loaded path, especially when it is measured in structural terms (e.g., by using debt-to-potential GDP). These general conclusions depend on the examples and parameters chosen: although they seem reasonably robust to sensitivity analysis, drawing lessons for individual countries requires careful calibration of the framework to their particular circumstances. This flexibility is provided for in the template.

41. **While our analysis focuses on restoring debt sustainability via fiscal consolidation, alternative approaches can be taken to achieve the objective**. If the analysis implies a choice between unbearable output outcomes from extremely large (or extremely front-loaded) fiscal adjustment on the one hand, and unsustainable debt on the other, then the country may need to consider debt restructuring. In addition, large-scale access to less costly official financing (or the privilege of a reserve-currency issuer) could short-circuit the debt-financing cost feedback loop, providing breathing space for fiscal adjustment.

48. Finally, the application to actual country examples casts doubt on claims that very large multipliers have been operating. In particular, based on plausible potential output assumptions, multipliers significantly exceeding unity would imply a large positive contribution to growth from purely private-sector factors in Greece in 2010-11, which seems counter-intuitive. As this assessment could be sensitive to the potential output assumptions, alternative potential output paths are tested, all pointing to the same conclusion. A closer look using this framework suggests that GDP forecast errors for Greece were due more to over-optimism on potential growth than to underestimating fiscal multipliers.

Appendix

Figure A.1. Selected Country Examples: Fixed Multipliers (I)
(WEO potential GDP; Italy=1, Euro Area=0.75, and others=0.5)

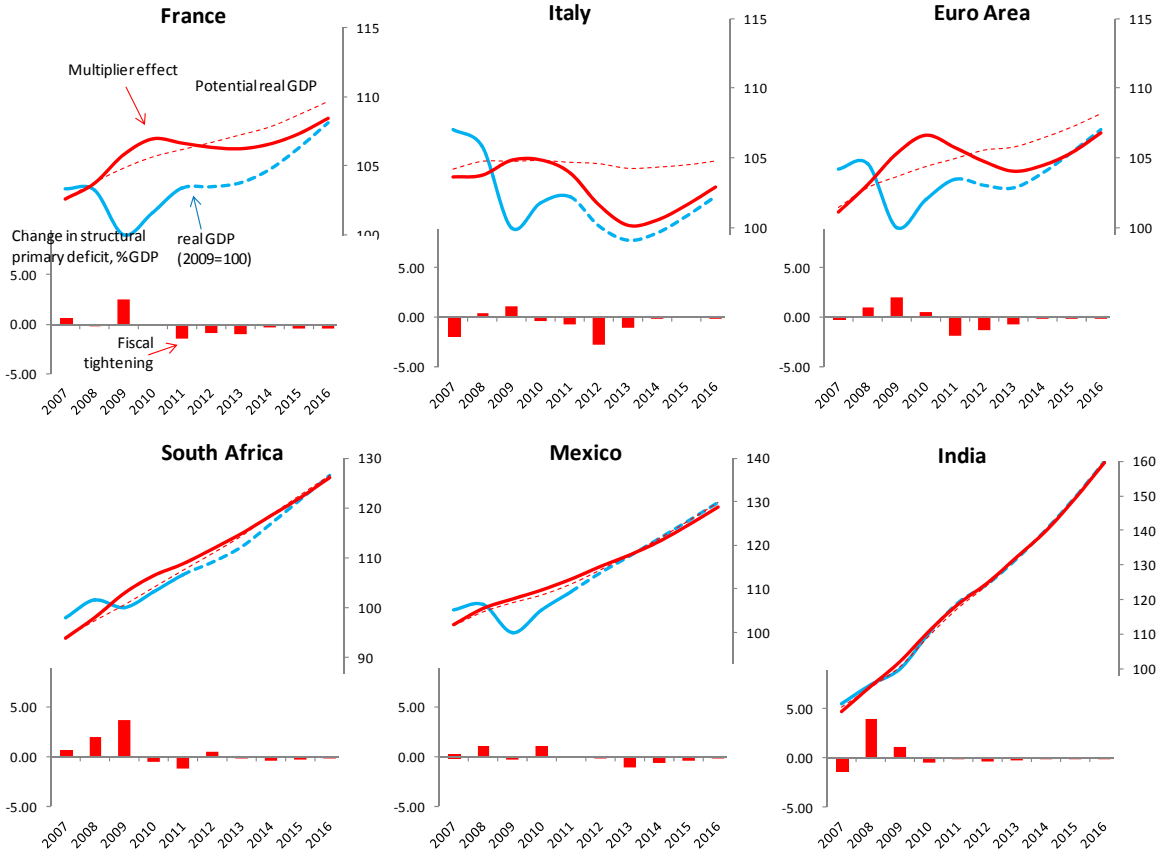
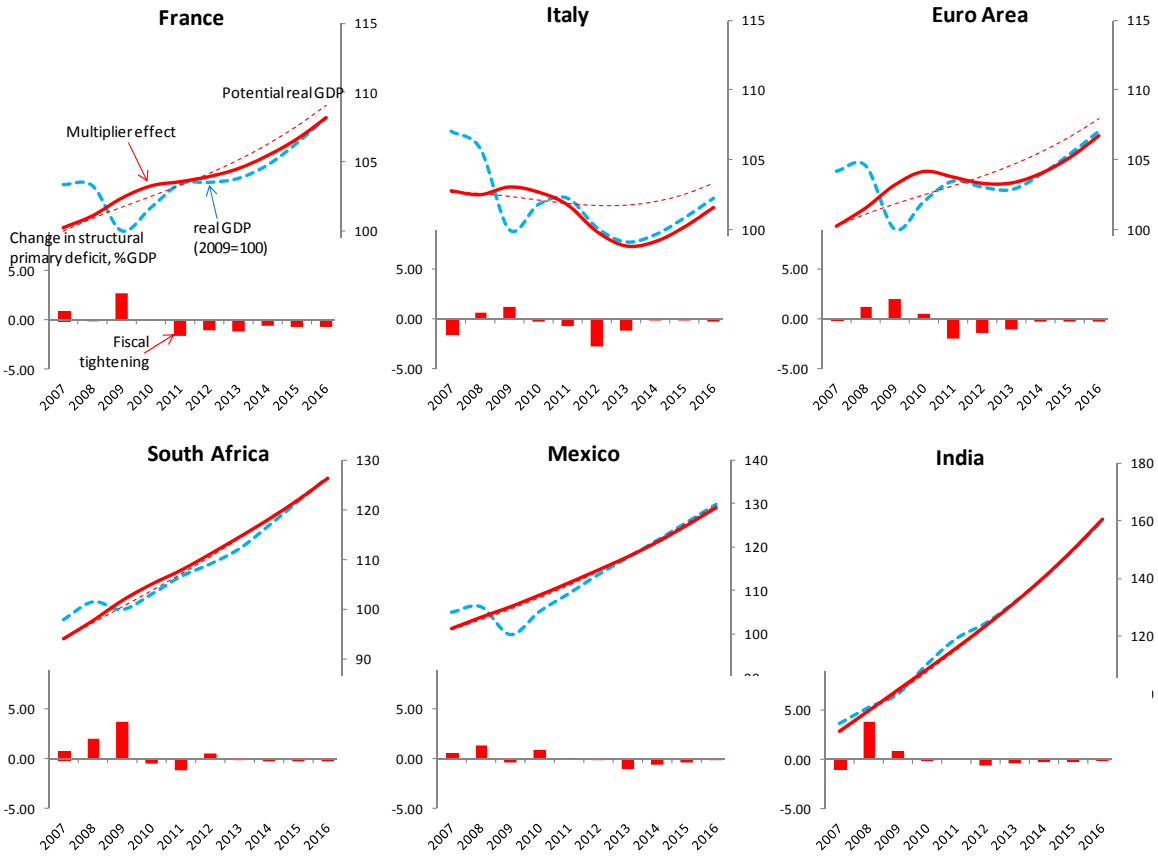


Figure A.2. Selected Country Examples: Fixed Multipliers (II)
(HP100 potential GDP; Italy=0.75, Euro Area=0.5, and others=0.25)



References

Agénor, Pierre-Richard, and Devrim Yilmaz. 2011. "The Simple Dynamics of Public Debt with Productive Public Goods." Working Paper.

Alesina, Alberto, and Roberto Perotti, 1996, "Fiscal Adjustments in OECD Countries: Composition and Macroeconomic Effects", NBER working paper series.

Alesina, A. and S. Ardagna. 2010. "Large Changes in Fiscal Policy: Taxes vs Spending." Tax Policy and the Economy.

Almunia, Miguel, Agustin Benetrix, Barry Eichengreen, Kevin O'Rourke and Gisela Rua (2010), "From Great Depression to Great Credit Crisis: Similarities, Differences and Lessons," Economic Policy 25.

Auerbach, Alan, and Yuriy Gorodnichenko, 2012a, "Measuring the Output Responses to Fiscal Policy," American Economic Journal – Economic Policy 4(2012): pp. 1–27.

Auerbach, Alan, and Yuriy Gorodnichenko, 2012b, "Fiscal Multipliers in Recession and Expansion," in Fiscal Policy after the Financial Crisis, Alberto Alesina and Francesco Giavazzi, eds., University of Chicago Press, 2012.

Barro, R. (1990), "Government Spending in a Simple Model of Economic Growth", Journal of Political Economy, 98, S103-S125.

Batini, Nicoletta, Giovanni Callegari, and Giovanni Melina, 2012, "Successful Asuterity in the United States, Europe and Japan," IMF Working Paper, No. 12/190.

Baum, Anja, Marcos Poplawski-Ribeiro, and Anke Weber, 2012, "Fiscal Multipliers and the State of the Economy," IMF Working Paper, No. 12/286.

Blanchard, Olivier, and Daniel Leigh, 2013, "Growth Forecast Errors and Fiscal Multipliers", IMF Working Paper, No. 13/1.

Cass, D. (1965), "Optimum Growth in an Aggregative Model of Capital Accumulation", Review of Economic Studies, 32: 233-240.

Congressional Budget Office, 2004, "A Summary of Alternative Methods for Estimating Potential GDP", Background Paper.

Corsetti, Giancarlo, 2012, "Has austerity gone too far?", VoxEU.org, April 2012.

Cotteralli, Carlo, and Laura Jaramillo, 2012, "Walking Hand in hand: Fiscal Policy and Growth in Advanced Economies", IMF Working Paper No. WP/12/137.

Delong, Bradford, and Lawrence Summers, 2012 , “Fiscal Policy in a Depressed Economy”, Brookings, 20 March.

Eichengreen, Barry, Kevin H O’Rourke, 2012, “Gauging the Multiplier: Lessons from History,” Vox EU (23 October 2012).

Hall, Robert E., 2009, “By How Much Does GDP Rise If the Government Buys More Output?” Brookings Papers on Economic Activity, Fall 2009, pp. 183-249.

Ilzetzki, Ethan, Enrique G. Mendoza and Carlos A. Végh, 2011, “How Big (Small?) are Fiscal Multipliers?”, IMF Working Paper, No. WP/11/52.

International Monetary Fund, 2010, “Will It Hurt? Macroeconomic Effects of Fiscal Consolidation”, World Economic Outlook 2010 (Washington, DC: IMF).

International Monetary Fund, 2012, “Balancing Fiscal Policy Risks”, Finscal Monitor 2012 April (Washington DC: IMF).

Koopmans, T. (1965), "On the Concept of Optimal Economic Growth", Potificiae Academiae Scientiarum Scripta Varia, 28: 225-300.

Michael Woodford, 2011. "Simple Analytics of the Government Expenditure Multiplier," American Economic Journal: Macroeconomics, American Economic Association, vol. 3(1), pages 1-35, January.

Padoan, Pier Carlo, Urban Sila, and Paul van den Noord, 2012, “Avoiding Debt Traps: Fiscal consolidation, financial backstops and structural reforms”, OECD Journal: Economic Studies.

Reinhart, Carmen, Vincent Reinhart, and Kenneth Rogoff, 2012, “Debt Overhangs: Past and Present”, Working Paper.

Romer, P. (1986), "Increasing Returns and Long-Run Growth", Journal of Political Economy, 94: 1002-1037.

Solow, R. (1956), "A Contribution to the Theory of Economic Growth", Quarterly Journal of Economics, 70: 65-94.

Yakita, Akira. 2008. “Sustainability of Public Debt, Public Capital Formation, and Endogenous Growth in an Overlapping Generations Setting.” Journal of Public Economics 92:897914.