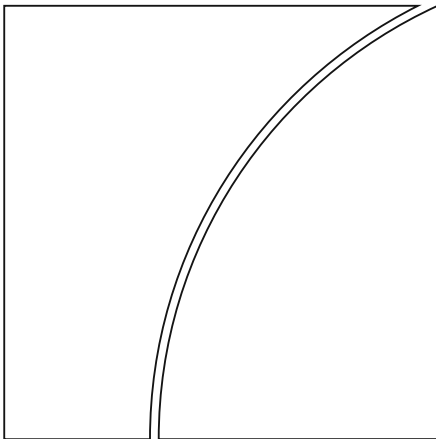




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# Fiscal sustainability and the financial cycle

by Claudio Borio, Marco Lombardi and Fabrizio Zampolli

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# Fiscal sustainability and the financial cycle

Claudio Borio, Marco Lombardi and Fabrizio Zampolli<sup>#</sup>

## Abstract

A frequently neglected aspect of financial booms and busts – financial cycles – is their impact on fiscal positions. And yet, the latest financial crisis and history show that these cycles can wreak havoc with public finances. After reviewing the impact of financial cycles on fiscal positions, we offer a new tool to estimate cyclically adjusted balances, illustrate its performance, explore its strengths and weaknesses, and sketch out a way forward to measuring sustainability in a more holistic way.

Keywords: financial cycle, financial crisis, cyclically adjusted fiscal balance.

JEL classification: H30, H62, E44, E52, E60.

<sup>#</sup> Bank for International Settlements.

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## Introduction

The Great Financial Crisis has reminded us of a few important lessons.

One is that severe financial crises are by no means confined to history or less developed economies (eg Reinhart and Rogoff (2009)). Even in the most advanced economies, a prolonged financial boom, if unchecked, may end up in a bust and a systemic banking crisis. And, when the bust occurs, the countries affected face deep recessions and several years of sluggish growth (Reinhart and Rogoff (2009), BCBS (2010), Jordà et al (2013), Ball (2014)). The huge costs involved have hammered home a simple message: ignoring the build-up of financial imbalances, or failing to contain them, is no longer tenable (Borio (2014), BIS (2014, 2015)).

A second lesson is that financial crises can wreak havoc with public finances. Since the onset of the Great Financial Crisis, public debt in many advanced economies has shot up to unprecedented peacetime levels and, in several cases, it is still rising. Even countries that were believed to be running prudent fiscal policies before the crisis found their fiscal sustainability rapidly called into question after the crisis erupted. Ireland and Spain are vivid examples. Their pre-crisis financial booms had made their fiscal accounts look much stronger than they actually were.

A third lesson is that there is a close two-way link between the health of the financial system and that of public finances. Private sector financial booms may eventually lead to a sharp deterioration of public finances when a financial crisis occurs, impairing the sovereign's ability to carry out countercyclical policies or act as a backstop for the banking system. And weaker public finances may, in turn, cause financial instability, by sapping the strength of financial institutions' balance sheets (Das et al (2010), CGFS (2011), Jordà et al (2016)). This is particularly the case when these institutions hold large amounts of public debt. Thus, fiscal stress may both reflect and cause banking crises (Reinhart and Rogoff (2009, 2013), Laeven and Valencia (2013)).

The close link between financial and fiscal risks calls for great prudence in managing public finances (eg Obstfeld (2014)). This is especially important and difficult in good times. It is then that policymakers may delude themselves that strong growth is here to stay – perhaps as the deserved reward for their policies – rather than seeing the poisoned chalice of an unsustainable domestic financial boom for what it is (Santos (2014)). Just like the private sector, governments may lull themselves into a false sense of security in the belief that debt tolerance has permanently increased. Even if they refrain from expansionary fiscal policy, they may thus fail to recognise the need to build sufficient buffers.

But how can one judge whether fiscal positions are prudent when a financial boom is in full swing and as events unfold – ie in real time and not just with the benefit of hindsight? Typically, in order to measure the underlying fiscal position, policymakers seek to adjust fiscal balances for the business cycle, for one-off changes and for other temporary factors. The adjustment for the business cycle is normally based on standard measures of the output gap, which have traditionally been used to explain inflation – the well-known Phillips curve relationship. But as the pre-crisis experience reminded us once more, output may be above its potential or sustainable level even if inflation remains low and stable, boosted temporarily by a financial boom – unusually strong increases in credit and asset prices on the back of aggressive risk-

taking. The boom masks the weakening of underlying fiscal strength. Policymakers may then be caught unprepared when the boom turns to bust. This is very much what has happened, again, in recent years.

This paper takes one more step in tackling this complex issue. It builds on previous work, which developed an alternative measure of potential output and the output gap to take into account the impact of financial factors – the so-called finance-neutral output gap (Borio et al (2013, 2014)). The method makes a simple modification to the Kalman filter problem associated with the popular Hodrick-Prescott (HP) filter in order to incorporate information about credit and property prices. Applying it, the authors find that it would have provided reliable signals that output was above potential pre-crisis. This is very much in contrast to traditional methods, which range from pure statistical filters to more elaborate approaches that combine a production function with a Phillips curve (eg Giorno et al (1995), Beffy et al (2006)). Such methods have generally indicated that output was above potential only after the fact, as they have revised previous estimates of trends, de facto rewriting history – the notorious end-point problem. Indeed, such revisions have typically been quite large, often as large as the output gap itself (Orphanides and van Norden (2002)).

Here we take forward this previous work in two respects. First, we consider its strengths and weaknesses in the specific context of the cyclical adjustment of fiscal positions. Second, we sketch out ways in which this tool could be improved and become part of a more holistic approach to measuring underlying fiscal strength and to ensuring adequate fiscal space.<sup>1</sup>

The rest of the paper is organised as follows. Section I documents and discusses the potentially large impact that financial crises have on public finances. Section II describes how the finance-neutral output gap is computed and then proceeds to apply it to adjust fiscal positions, illustrating its properties with data for Spain and the United States. Section III discusses the limitations of the finance-neutral gap measure together with possible ways of overcoming them and then sketches out how the tool might be part of a broader toolkit to evaluate financial strength. The conclusion highlights the key takeaways of the analysis.

## I. Fiscal balances over the financial cycle

### The damaging effect of financial busts

Several studies have documented the behaviour of public debt around financial crises. Reinhart and Rogoff (2009, 2013) find that, in the postwar period, (central) government debt almost doubles (86% increase) on average within three years from the onset of a crisis. Using a different data set limited to the period 1970–2011, Laeven and Valencia (2013) find somewhat smaller, but still sizeable, increases in public debt in advanced economies, some 24 percentage points of GDP, and smaller ones in

<sup>1</sup> Adjusting current fiscal balances for the financial cycle is key to assessing fiscal strength, but a full assessment requires that the resulting cyclically adjusted measures be complemented with measures of the fiscal gap or sustainable debt. The latter take into account not only current but also expected future expenditures and revenues as well as unexpected contingencies or risks (see eg Auerbach (2011), Gosh et al (2011)). A discussion of these measures goes beyond the scope of this paper.



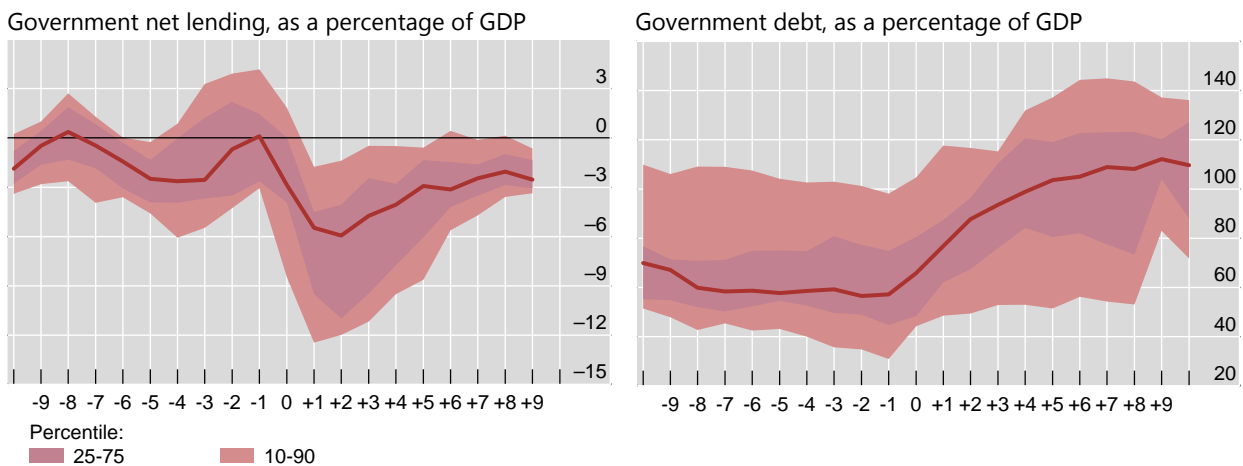
emerging market economies, about 9 percentage points. In a sample spanning 1980–2006, Furceri and Zdzienicka (2012) document that the rise in public debt is quite persistent and depends on the severity of the crisis: in the case of the crises that coincide with the largest output losses, the debt-to-GDP ratio surges by 37 percentage points over eight years.

The Great Financial Crisis is no exception, even though it has mainly affected advanced economies (Graph 1). For one, there is a sizeable and persistent increase in deficits. Around the time the crisis broke out (2007 or 2008, depending on the country) the median fiscal balance fell by over 5 percentage points within three years, to about 6% of GDP, with a quarter of the countries experiencing a much larger deterioration, to over 10% (left-hand panel). Thereafter, the deficits narrowed only very slowly, remaining sizeable in many countries several years after the onset of the crisis.

## Government net lending ratio and debt

Crises between 2007–08 in advanced economies<sup>1</sup>

Graph 1



Median, percentiles including partial data and forecast figures.

<sup>1</sup> Austria (2008), Belgium (2008), Denmark (2008), France (2008), Germany (2008), Greece (2008), Iceland (2008), Ireland (2008), Italy (2008), the Netherlands (2008), Portugal (2008), Spain (2008), Sweden (2008), Switzerland (2008), the United Kingdom (2007), the United States (2007).

Sources: L Laeven and F Valencia, "Systemic Banking Crises Database: An Update", *IMF Working Paper*, no 12/163, June 2012; IMF, *World Economic Outlook*; OECD, *Economic Outlook*; BIS calculations.

In addition, the general government debt to GDP ratio soared (Graph 1, right-hand panel). This ratio increased by more than 50 percentage points at the median, from around 60% at the onset of the crisis to over 90% three years after – not far from the historical evidence uncovered by Reinhart and Rogoff (2013) and, for the most severe crises, by Furceri and Zdzienicka (2012). After nine years the ratio exceeded 110% and was even above 135% for 10% of the countries in the sample.

The steep post-crisis rise in public debt is usually driven by a number of factors.

First, the sovereign uses its fiscal space to support the repair of banks' balance sheets – what is often colloquially referred to as "bailout fiscal costs". The government's role is critical, ranging from supporting the recognition of losses and purchasing bad assets to recapitalising institutions, sometimes through temporary ownership. In some cases, the sovereign's support also extends to non-financial borrowers, including both corporations and households. From an ex ante perspective,

this amounts to contingent liabilities that are generally not recognised in the fiscal accounts, except perhaps when they are explicit and subject to strict measurement and disclosure criteria.<sup>2</sup> Indeed, their recognition ex ante would be inconsistent with efforts to put in place credible non-bail out schemes, regardless of their ultimate effectiveness (eg Diaz-Alejandro (1985)).

These costs can be quite large, but are difficult to estimate precisely, even ex post. Depending on the method and time horizon of the analysis, estimates for the same country and crisis often vary by a large amount.<sup>3</sup> That said, in many historical episodes such costs do not seem to have been the main driver of the rise in public debt (Reinhart and Rogoff (2013), Laeven and Valencia (2013)).

Second, output and employment collapse and recover only slowly, sapping revenues and boosting non-discretionary spending and transfers whenever automatic stabilisers are in place. The evidence suggests that this is frequently the main factor.<sup>4</sup> Initial output losses – measured from peak to trough or from the peak to the point at which the growth rate returns to pre-crisis rates – are substantial, ranging from 6% to 14% on average across countries, against only 2% in an ordinary recession (ie recessions not accompanied by financial crises). In general, crises are followed by weak recoveries: it takes several years on average for activity to return to its pre-crisis peak. Above all, there is evidence that these losses are not entirely recouped in the subsequent recovery. Using a range of techniques, samples and controls, studies find permanent output losses of between 7½ to 10%.<sup>5</sup> Put differently, the evidence indicates that, even when growth returns to its pre-crisis long-term, output generally does not.

Third, for a given behaviour of output and income, compositional effects may weaken public finances further. The collapse in asset prices, in particular, can play a key role. For example, panel regressions by Eschenbach and Schuknecht (2004) indicate that 30–40% of the deterioration of fiscal balances that took place in the United Kingdom and Sweden in the early 1990s was due to asset price effects, especially in the real estate market.

Fourth, much like asset price effects, exchange rates may play a similar role. This would be the case whenever debt is denominated in a foreign currency and, as often happens, the crisis coincides with sharp currency depreciation. Indeed, concerns of this nature have been behind attempts to reduce the sovereign's reliance on foreign currency borrowing in emerging market economies since the crises of the 1980s and 1990s (CGFS (2007), Turner (2012)). Even when this is so, however, the sovereign may remain indirectly exposed to such currency mismatches if the private sector indulges

<sup>2</sup> For a detailed discussion of various types of contingent liabilities and historical episodes, see Bova et al (2016).

<sup>3</sup> Moreover, over time countries may be able to recover some or most of the initial costs, in some cases even making a small net profit, provided they succeed in managing and resolving the crises effectively.

<sup>4</sup> Reinhart and Rogoff (2013) document a strong rise in real government revenue in the three years leading to a banking crisis and a decline in the following three years.

<sup>5</sup> These studies are surveyed in BCBS (2010) and normally follow Cerra and Saxena (2008); for a more recent study, see Ball (2014). See also Box III.B in BIS (2014). Output losses in an ordinary recession are usually temporary, although this has been challenged recently (eg Martin et al (2015) and Blanchard et al (2015)).

in this practice: the sovereign may come under pressure to come to the rescue. For instance, in the recent crisis, households in some central and eastern European countries had borrowed extensively to purchase real estate and subsequently ran into trouble, putting pressure on governments to intervene (BIS (2010), Fischer and Yeşin (2016)).

Fifth, the one-off permanent loss of output may also go hand in hand with a long-lasting decline in trend output growth. Until recently, the literature has generally failed to find permanent effects on growth. But the impact may be persistent, even if sometimes difficult to disentangle from the one on the level of output. For example, recent research has found that, in the wake of financial crises, productivity growth may be badly damaged for many years (Borio et al (2015a)) – a point to which we return below.<sup>6</sup>

Sixth, the policy response may lead to a further deterioration in the fiscal position. For one, especially where the authorities have room for manoeuvre, they may respond to the crisis by increasing discretionary spending or cutting taxes to prop up aggregate demand. This was indeed the case in several countries in the wake of the Great Financial Crisis (eg Carnot and de Castro (2015)). The response may be especially problematic in the longer term if it reflects an overly rosy assessment of the underlying fiscal strength. The stimulus may not be easily reversed in subsequent years, as worries of a faltering recovery and political economy pressures prevail.<sup>7</sup> Moreover, if the increase in the public debt to GDP ratio is not arrested, it may end up undermining trend growth. While no consensus exists, there is considerable evidence supporting this viewpoint (eg Cecchetti et al (2011), Checherita-Westphal and Rother (2012), Baum et al (2013), Chudik et al (2015), Woo and Kumar (2015)). Possible mechanisms include distortionary taxation, which may inhibit investment at least beyond certain thresholds (eg Jaimovich and Rebelo (2012)) and adverse effects on sovereign risk premia<sup>8</sup> (see also below). Finally, misguided attempts not to use fiscal space to repair balance sheets may end up by backfiring, delaying and weakening the economic recovery. A well known case in point is the difference between the rapid post-crisis recovery in the Nordic countries, where balance sheet repair was prompt and thorough, and the protracted weakness in Japan, where

<sup>6</sup> See also the study by Reinhart and Reinhart (2015), which finds that the incidence of financial crises is negatively related to economic growth in a sample of over 60 countries and over 150 years. As pointed out by the authors, it is, however, unclear how far the relationship reflects reverse causation.

<sup>7</sup> Budina et al (2015) find evidence of a debt bias and evidence that this bias is exacerbated by financial booms and busts.

<sup>8</sup> As debt rises, countries may get closer to their fiscal limits as perceived by investors, leading to a sharp (non-linear) increase in risk premia. Fiscal limits (ie the maximum government debt that can be sustained without appreciable risk of default or higher inflation) depend on how far a country is from the peak of the Laffer curve and how far authorities can cut expenditure without triggering a severe political backlash. The idea of fiscal limits has been formalised within a DSGE model by eg Bi and Leeper (2013) and Leeper (2013).

balance sheet repair was delayed for a decade following the reversal of their financial cycles in the late 1980s and early 1990s (Borio et al (2010)).<sup>9 10</sup>

The role of interest rates deserves a separate mention, as it is important but highly dependent on circumstances.

On the one hand, interest rates may rise in the aftermath of a financial crisis. This is more likely to be the case in countries exposed to a tightening of external funding conditions, possibly because of a weak external position, a large stock of debt denominated in foreign currency and/or limited fiscal space. The experience of several less developed economies is a case in point. The same may be true of countries with limited monetary policy room for manoeuvre, as the debt crisis in the euro area has shown. In these cases, interest rates may rise either because of attempts to defend the currency and prevent inflationary pressures or owing to a sharp rise in risk premia, as investors lose confidence in the sovereign's creditworthiness. In their historical study, Reinhart et al (2012) report many examples of this kind.

On the other hand, where these constraints do not operate, central banks may have the leeway to ease very aggressively and, above all, persistently in response to the financial strains and the subsequent weak recovery. This is precisely what has happened in many jurisdictions following the Great Financial Crisis, with central banks pushing interest rates all the way to zero, if not into negative territory, through a combination of adjustments in policy rates, forward guidance and large-scale sovereign bond purchases (eg BIS (2015)).

Clearly, the issues are very different in the two cases.

When interest rates rise, this adds immediately to the deficit and debt burden, to an extent that depends on the size of the debt outstanding and its contractual features (eg maturity and interest rate sensitivity more generally). At the same time, it also constrains the room for countercyclical fiscal policy, possibly quite tightly.<sup>11</sup> This may well be the reason why, despite the often greater severity of the crises, the fiscal position has historically deteriorated less sharply in emerging market economies than in their advanced counterparts.

When interest rates sink persistently to exceptionally low levels, fiscal positions may look much stronger than they really are, with policymakers and investors overestimating sustainability. Consistently with this view, rating agencies appear to give a prominent weight to current debt service ratios in their sovereign ratings

<sup>9</sup> Consistent with this, considerable evidence points to the importance of debt forbearance in Japan (eg Peek and Rosengren (2005), Caballero et al (2008)); the reduction of capital and labour mobility compared with the pre-crisis period (eg Iwaisako (2005)); and the rise in the market share of inefficient firms (eg Ahearne and Shinada (2005)). Recent studies have also indicated that debt forbearance has been significant in some countries in the most recent post-crisis experience (eg Albertazzi and Marchetti (2010), Bank of England (2011), Enria (2012)).

<sup>10</sup> Japan's economic growth was also sluggish in the 2000s, but probably the main reason was demographics; by the early 2000s balance sheets had finally been largely repaired. In fact, output growth in terms of working-age population rose much more strongly than in the previous decade and was well above that of many advanced economies over the same period; eg it was twice that of the United States (eg Borio et al (2015b)).

<sup>11</sup> For instance, Alberola et al (2016a) show that in Latin America worsening financing conditions induce fiscal contractions, leading to a procyclical bias in fiscal policy.

(Amstad and Packer (2015)).<sup>12</sup> This may provide an incentive to boost spending and/or cut taxes to sustain aggregate demand at the cost of weakening fiscal strength over the longer term. Large-scale purchases of sovereign debt by central banks add to this vulnerability: from the perspective of the consolidated public sector balance sheet, they amount to issuing liabilities indexed at the very short-term rate (bank reserves) while retiring longer-maturity debt (eg Borio and Disyatat (2010)). This increases the sensitivity of the debt service burden to the eventual normalisation of policy.

## The flattering effect of financial booms

The flattering effect of financial booms on fiscal positions is, in many respects, the mirror image of the havoc wreaked by financial busts, especially when financial crises erupt. Potential output and potential growth are overestimated. Compositional effects, especially those associated with asset price booms,<sup>13</sup> boost revenues further. Nominal exchange rates may tend to appreciate,<sup>14</sup> temporarily reducing the domestic currency equivalent of foreign exchange-denominated debt and the corresponding interest payments. Unnoticed, contingent liabilities to address balance sheet repair build up. And all this may encourage policymakers to relax fiscal policy further, exacerbating the familiar incentives linked to short horizons and political economy pressures (Santos (2014)).<sup>15</sup> Consistent with the flattering effect of financial booms, empirical evidence finds a positive impact of financial variables on fiscal balances over and above that of output (Eschenbach and Schuknecht (2004), Price and Dang (2011), Bénétrix and Lane (2015)).

More recent BIS research sheds further light on the reasons why potential output and growth may be overestimated during the boom and on the mechanisms involved in the lasting damage caused once the boom ushers in a banking crisis. That research produces three findings, based on a sample of over 20 advanced economies and over some 40 years. First, financial booms sap productivity growth as they occur (Cecchetti and Kharroubi (2015)) – an effect that is masked by their temporary boost to output

<sup>12</sup> Amstad and Packer (2015) find that the focus on current debt service measures explains some of the difference between the ratings assigned to advanced and emerging market economies.

<sup>13</sup> Asset price booms can affect personal and corporate income taxes as well as rental income through the sales or the accrual of capital gains. In addition, taxes are also paid on transactions. Since turnover intensifies during a boom, revenues tend to increase for a given level of asset prices.

<sup>14</sup> Empirical evidence indicates that the conjunction of credit booms with real exchange rate appreciation is a reliable leading indicator of financial crises (Borio and Lowe (2002); Gourinchas and Obstfeld (2012)). In a low inflation environment, this tends to reflect a nominal currency appreciation. Even if nominal exchange rates remain relatively stable during a financial boom, stronger aggregate demand, especially towards non-tradables, may lead to higher price and wage inflation than in other economies and/or poor productivity growth. The resulting loss of competitiveness can sow the seeds of future troubles.

<sup>15</sup> For example, when more resources become available, the common pool problem and the competition for them may intensify (eg Tornell and Lane (1999)). Thus, political economy incentives can explain not only why fiscal policy may be procyclical, especially in less developed economies (eg Lane (2003), Talvi and Vegh (2005)), but also why even more developed economies may fail to insure themselves against the fiscal consequences of financial busts (eg Santos (2014)).

(Drehmann and Juselius (2015)).<sup>16</sup> For a typical credit boom, just over a quarter of a percentage point per year is a lower bound. Second, a good chunk of this, almost 60%, reflects the shift of labour to lower productivity growth sectors (Borio et al (2015a)). Think, in particular, of shifts into a temporarily bloated construction sector. The rest would be the impact on productivity growth that is common across sectors, such as the shared component of aggregate capital accumulation and of total factor productivity growth. Third, the subsequent impact of labour misallocations that occur during a boom is much larger if a crisis follows. The average loss per year in the five years after a crisis is more than twice that during a boom, around half a percentage point per year (Borio et al (2015a)). Possibly, the scarcity and misallocation of credit, alongside the slow repair of balance sheets, inhibit the transfer of resources across sectors needed to rebalance the economy. Put differently, the reallocations cast a long shadow. Taking the 10-year episode as a whole, the cumulative impact would amount to a loss of some 4 percentage points. Regardless of the specific figure, the impact is clearly sizeable.

But why should financial booms raise output above potential or sustainable levels without necessarily generating inflation? At least four reasons come to mind. One is that unusually strong financial booms are likely to coincide with positive supply side shocks (eg Drehmann et al (2012)). These put downward pressure on prices while at the same time providing fertile ground for asset price booms that weaken financing constraints. A second reason is that the economic expansions may themselves temporarily weaken supply constraints. Prolonged and robust expansions can induce increases in the labour supply, either through higher participation rates or, more significantly, immigration. For instance, there was a strong increase in immigration into Spain and Ireland during the pre-crisis financial boom, not least to work in the construction sector that was driving the expansion. By adding new capacity, the unsustainable capital accumulation associated with the economic expansion may also weaken supply constraints. A third reason is that, as noted, financial booms may coincide with a tendency for the currency to appreciate, as domestic assets become more attractive and capital flows surge. The appreciation puts downward pressure on inflation. A fourth, underappreciated, reason is that, as just highlighted, unsustainability may have to do more with the sectoral and intertemporal misallocation of resources than with overall capacity constraints.<sup>17</sup>

<sup>16</sup> There are many channels through which financial booms boost aggregate demand and output, including wealth, collateral, risk-taking and cash flow effects. To be sure, theoretically, housing wealth effects should tend to wash out in the aggregate, as the gains of those planning to scale down their consumption of housing services should be offset by those planning to scale up. But, because the marginal propensity to consume of the former is generally bigger, the net effect on consumption is generally positive and economically significant (eg Waldron and Zampolli (2010)).

<sup>17</sup> This paragraph focuses on the way in which financial booms may lead to temporary and unsustainable increases in domestic supply or coincide with changes in the exchange rate that keep inflation down. Another possible explanation, as noted earlier, is that the link between inflation and domestic slack has become much weaker owing to other forces. One such force could be the globalisation of the real economy, as some evidence suggests (eg Borio and Filardo (2007), Bianchi and Civelli (2013), Ciccarelli and Mojon (2010), Eickmeier and Pijnenburg (2013)).

## II. Adjusting fiscal positions for the financial cycle

As the previous discussion indicates, there are obvious reasons to believe that the financial cycle has a first-order impact on fiscal strength and sustainability. We next illustrate a method for correcting fiscal positions for one of the many factors considered, albeit a key one: the behaviour of potential output, especially during financial booms. Before we adjust the fiscal balance, though, we need to spend a few words explaining the specific statistical method used to estimate potential output, as developed in Borio et al (2013, 2014)).

### The finance-neutral output gap

Borio et al (2013) start from the premise that traditional measures of potential or sustainable output do not adjust for financial developments. The methods most commonly used in policymaking to make cyclical adjustments vary widely and use economic information to various degrees. At one end are univariate statistical filters, such as the popular Hodrick-Prescott filter, which distinguish trend from cycle based purely on the behaviour of output itself and assuming that the two components have certain statistical characteristics (such as that the cycle is of a certain length). At the other end are production function methods, in which potential output is defined as a function of production inputs. Given that production inputs, such as capital and labour, are also subject to cyclical fluctuations, these methods often involve the cyclical adjustment of those inputs, which can be performed with univariate statistical filter or can be combined with additional theoretical restrictions, not least a Phillips curve (eg Giorno et al (1995), Beffy et al (2006)). In between are methods that focus on fewer economic relationships, such as the determinants of inflation (the Phillips curve), the link between unemployment and output (Okun's law) and the like.<sup>18</sup> What is common to all of the procedures is that they either completely ignore financial factors or relegate them to a minor role. Based on the previous analysis, however, such an omission can be dangerous.

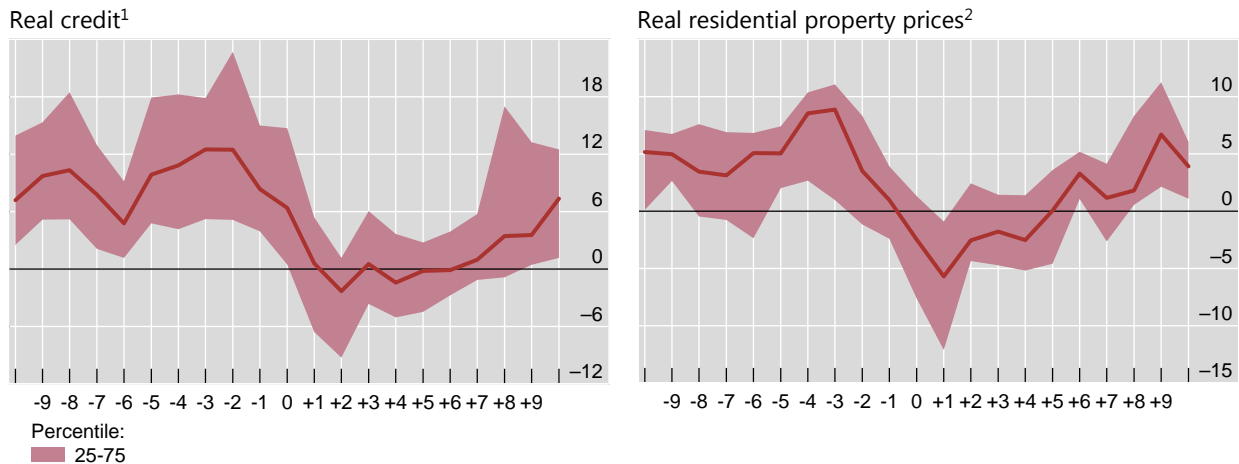
There is no unique way of incorporating the information that financial variables have for output fluctuations. Moreover, as compared with inflation, theory so far provides less formal guidance. Because of this, Borio et al (2013) opt for a more data-driven approach and allow the "data to speak" as much as possible. The strategy is to make simple and transparent modifications to the HP filter, augmenting it with information from variables that are closely linked to the financial cycle. Here they follow Drehmann et al (2012), who find that when the key concern is banking crises, the combined behaviour of credit and property prices is probably the most parsimonious way of describing the financial cycle, in turn confirming previous work about the leading indicator properties of these variables (Borio and Drehmann (2009)). This point is hinted at in Graph 2, which shows that both credit and property (house) prices grow very fast in inflation-adjusted terms in the years prior to the crisis, but slow down considerably before it breaks out, with property prices tending to lead and actually starting to decline before it.

<sup>18</sup> Even more theory-based are measures based on fully specified New Keynesian DSGE models in which potential output is defined as the hypothetical output that would prevail were prices and wages free to adjust instantaneously. Such methods, however, are not commonly explicitly used to derive standalone measures of potential output, not least as these are very volatile.

## Credit and residential property prices growth

Crises between 1970–2011; in per cent

Graph 2



Median, percentiles including partial data and forecast figures.

<sup>1</sup> Argentina (1989, 1995, 2001), Belgium (2008), Brazil (1990, 1994), Chile (1976, 1981), Colombia (1998), Denmark (2008), France (2008), Germany (2008), Greece (2008), Hungary (2008), Iceland (2008), Indonesia (1997), Ireland (2008), Italy (2008), Japan (1997), Korea (1997), Latvia (2008), Malaysia (1997), Mexico (1981, 1994), the Netherlands (2008), Norway (1991), Peru (1983), the Philippines (1997), Portugal (2008), Russia (2008), Slovenia (2008), Spain (1977, 2008), Sweden (1991, 2008), Switzerland (2008), Thailand (1997), Turkey (2000), the United Kingdom (2007), the United States (1988, 2007). <sup>2</sup> Belgium (2008), Colombia (1998), Denmark (2008), France (2008), Germany (2008), Iceland (2008), Italy (2008), Japan (1997), Korea (1997), the Netherlands (2008), Norway (1991), Russia (2008), Spain (1977, 2008), Sweden (1991, 2008), Switzerland (2008), Thailand (1997), the United Kingdom (2007), the United States (1988, 2007).

Sources: L Laeven and F Valencia, "Systemic Banking Crises Database: An Update", *IMF Working Paper*, no 12/163, June 2012; IMF, *World Economic Outlook*; OECD, *Economic Outlook*; BIS calculations.

The authors call the corresponding measure of deviations of actual output from its potential or sustainable level the "finance-neutral" output gap. The term denotes the objective of filtering out the information that financial factors have for potential output.

Specifically, Borio et al (2013) proceed as follows. The starting point is the HP filter, expressed in state-space form (eg Kuttner (1994)). The state equation governing the evolution of the unobservable (log) potential output  $y^*$  is:

$$\Delta y_t^* = \Delta y_{t-1}^* + \varepsilon_{0,t}. \quad (1)$$

The measurement equation relates actual (log) GDP  $y$  to its potential:

$$y_t = y_t^* + \varepsilon_{1,t}. \quad (2)$$

The two noise terms are assumed to be normal iid, with zero mean and variances  $\sigma_0^2$  and  $\sigma_1^2$ . The HP filter (applied to quarterly data) fixes the ratio  $\lambda_1 = \sigma_1^2 / \sigma_0^2$  (the so-called signal-to-noise ratio) to 1600, which corresponds to a business cycle length of roughly up to eight years. So far, this is entirely standard. The next, less standard step, is to augment (2) with a set of additional explanatory variables  $x$ :

$$y_t - y_t^* = \gamma x_t + \varepsilon_{2,t}, \quad (3)$$

and, for simplicity, to calibrate the signal-to-noise ratio  $\lambda_2 = \sigma_2^2 / \sigma_0^2$  to match the same business cycle duration as assumed in the standard (non-modified) HP filter.

In doing this matching, there is a small technical wrinkle. In an infinite sample, this last step would simply be accomplished by fixing  $\lambda_2 = \lambda_1 = 1600$ , as in the



standard HP filter. But in finite samples, the empirical counterpart of the signal-to-noise ratio will be higher due to the strong autocorrelation of the cyclical component of output. So, to match the business cycle duration, Borio et al (2013) propose to match the empirical counterparts of the signal-to-noise ratios linked to the two filters. This is equivalent to choosing  $\lambda_2$  so that the relative volatilities of output around potential are the same:

$$\text{var}(y_t - y_{(2),t}^*) / \text{var}(\Delta^2 y_{(2),t}^*) = \text{var}(y_t - y_{(3),t}^*) / \text{var}(\Delta^2 y_{(3),t}^*), \quad (4)$$

where  $y_{(2),t}^*$  and  $y_{(3),t}^*$  are the potential output estimates from equations (2) and (3), respectively.

Technical details aside, the key point of the specification is that it does not “force” the explanatory variables to shape potential output. That is,  $x$  does not appear directly in the state equation (1). Instead, explanatory variables only influence potential output estimates via their presence in the measurement equation (3), and hence in the likelihood function for observed output. In other words, they only contribute to the extent that they convey relevant information on the status of actual output with respect to its potential at the chosen frequency. In principle, any economic variable could do the job, not least the most popular candidate – inflation. As it turns out, however, the growth rates in (inflation-adjusted) credit and (inflation-adjusted) residential property prices perform quite well according to relevant criteria (see below). By contrast, as examined in detail in Borio et al (2014), inflation performs poorly. This no doubt reflects the very weak link between domestic output gaps and inflation since at least the 1990s (eg Borio and Filardo (2007), Kuttner and Robinson (2008)).

But what does “performing well” mean in this context? Borio et al (2013) use mainly three criteria. First, high statistical precision – ie small confidence bands. Second, good real-time properties – ie small revisions as time unfolds and new data become available. Third, in the absence of a formal model, “reasonable” patterns – ie a path that broadly accords with intuition.

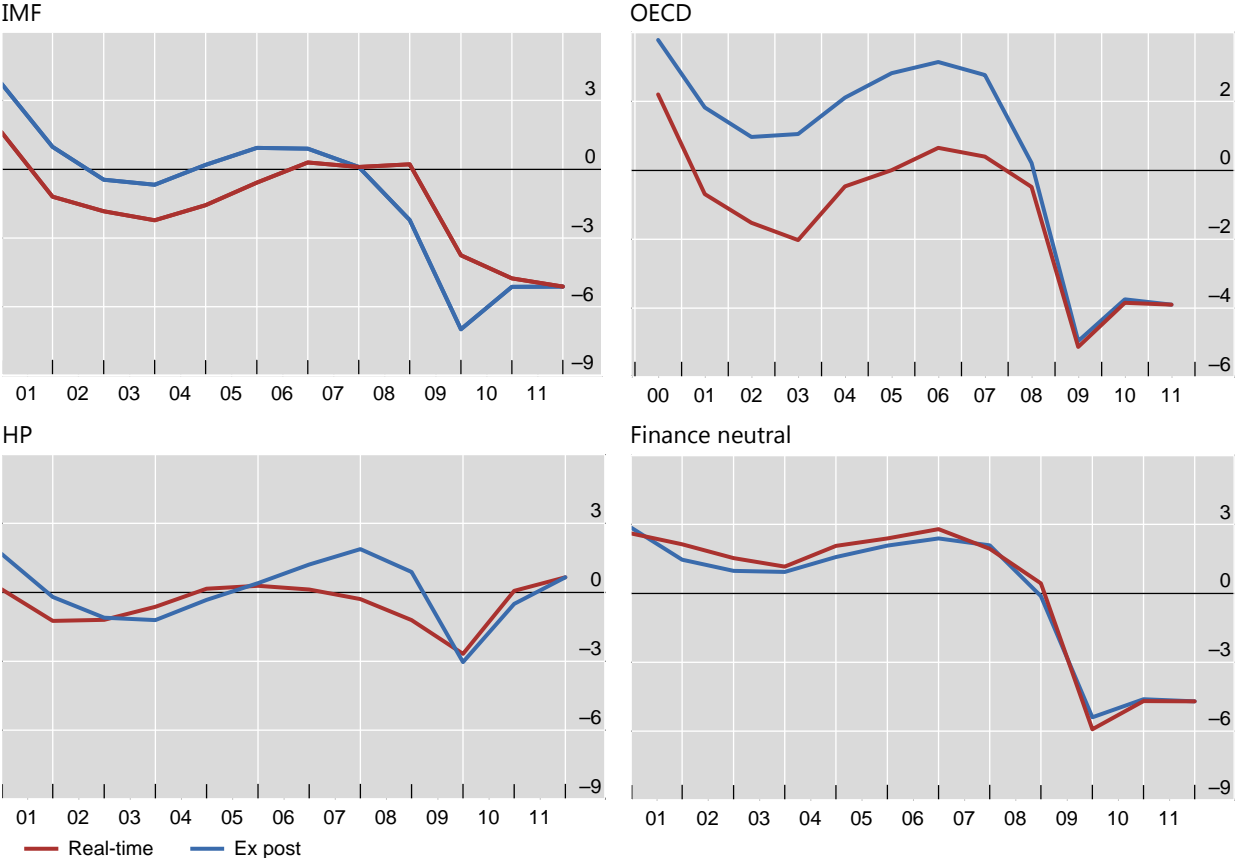
On this basis, the finance-neutral gap appears to outperform traditional measures. Graph 3 illustrates this for the United States with respect to the last two criteria (see Borio et al (2013) for statistical precision). The graph compares the real-time and full-sample performance of the finance-neutral output gap with those derived from the traditional HP filter and the full production function approaches used by the IMF and OECD. Strikingly, ahead of the financial crisis, as the financial boom played itself out, the traditional measures indicated that output was below, or at most close to, potential (red lines). Only after the crisis, once the recession took place, did they recognise that, to varying degrees, output had been above its potential, sustainable level (blue lines). By contrast, the finance-neutral measure is able to spot the unsustainable expansion in real time, pointing to a substantial positive gap between output and potential during the boom (red line). Moreover, the finance-neutral estimates are hardly revised as time unfolds and new data become available (the blue and red lines are very close). Thus, given what happened after the boom, the finance-neutral gap appears to provide much more useful information for policymakers concerning the sustainability of the output expansion.

In the specific example shown, two factors help explain the difference in performance. For one, the traditional methods, as applied here, are especially vulnerable to the end-point problem (Orphanides and Van Norden (2002)). One common reason is the reliance on the mechanical calculation of trends. For instance,

the HP filter is applied directly to the output series, but in production function approaches it is not uncommon to use the HP filter or similar procedures to estimate the “normal” level of the utilisation of factor inputs. In addition, the performance of inflation may well be another factor in traditional production function approaches in which a Phillips curve relationship is a key ingredient. Recall that inflation was generally low and stable ahead of the crisis, providing little signal from the underlying disequilibria.

Comparing output gaps for the United States: ex post and real-time estimates

In per cent Graph 3



Note: For each time *t*, the “real-time” estimates are based only on the sample up to that point in time. The “ex-post” estimates are based on the full sample.

Sources: Borio et al (2013); OECD, *Economic Outlook*; IMF; Authors’ calculations.

That said, there is no guarantee that the finance-neutral gap will have good real-time properties (Borio et al (2014)). This depends on (i) the financial explanatory variables having high explanatory power at the chosen business cycle frequency, and (ii) these variables having stable means. We will return to some of these issues later, when we discuss the possible shortcomings of the approach.

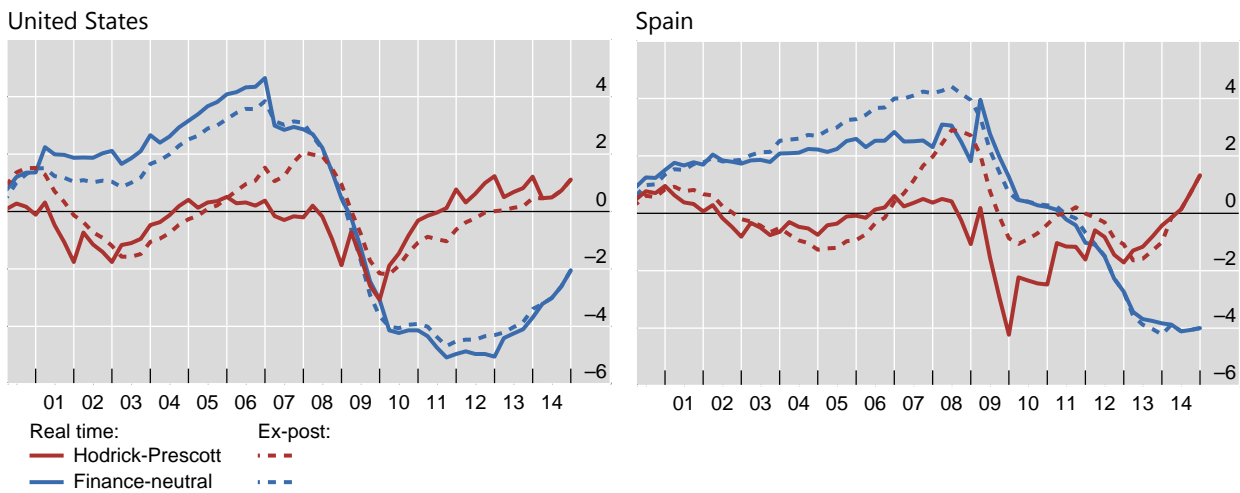
For completeness, Graph 4 shows updated estimates of the finance-neutral output gap and the HP filter for the two reference countries used in the rest of the paper – the United States and Spain. The estimates confirm the previous findings. They indicate similar patterns for the two countries and the superior real-time performance of the finance-neutral measure. They also highlight how the HP filter,

tracing the actual behaviour of output, points to a quicker rebound relative to potential post-crisis. Indeed, implausibly, output is already above potential in 2012 (United States) and 2014 (Spain). The shortfall narrows (United States) or stabilises (Spain) according to the finance-neutral estimates.

## Financial-neutral and HP output gaps

In per cent

Graph 4



Sources: OECD; BIS calculations.

## Cyclical adjustment of fiscal balances

Having obtained a measure of the output gap that filters out the GDP fluctuations explained by financial cycle proxies, one can construct a corresponding measure of cyclically adjusted fiscal balances. Here we follow the methodology employed by the OECD (Girouard and André (2005)).

Define the cyclically-adjusted fiscal balance as:

$$B^* = [\sum_{i=1}^4 T_i^* - G^* + X]/Y^*, \quad (5)$$

where  $Y^*$  is the level of potential output,  $X$  is non-tax revenues,<sup>19</sup>  $G^*$  is the cyclically adjusted current primary government expenditures and  $T_i^*$  represents the cyclically adjusted revenues from the  $i$ -th tax category – personal and corporate income taxes, social security contributions and indirect taxes. To implement the adjustment, we can then use the elasticities of taxes and expenditures with respect to the output gap (denoted  $\eta_{Ti}$  and  $\eta_G$  respectively).<sup>20</sup> Hence,  $T_i^*$  and  $G^*$  are defined as:

$$T_i^*/T_i = (Y^*/Y)^{\eta_{Ti}}, \quad (6)$$

$$G^*/G = (Y^*/Y)^{\eta_G}. \quad (7)$$

<sup>19</sup> If the adjustment was made on the primary balance, then this component would exclude net interest payments.

<sup>20</sup> Girouard and André (2005) actually use the unemployment gap for government expenditures. Here we stick to the output gap for ease of presentation and interpretation of the results.

Substituting into (5) yields:

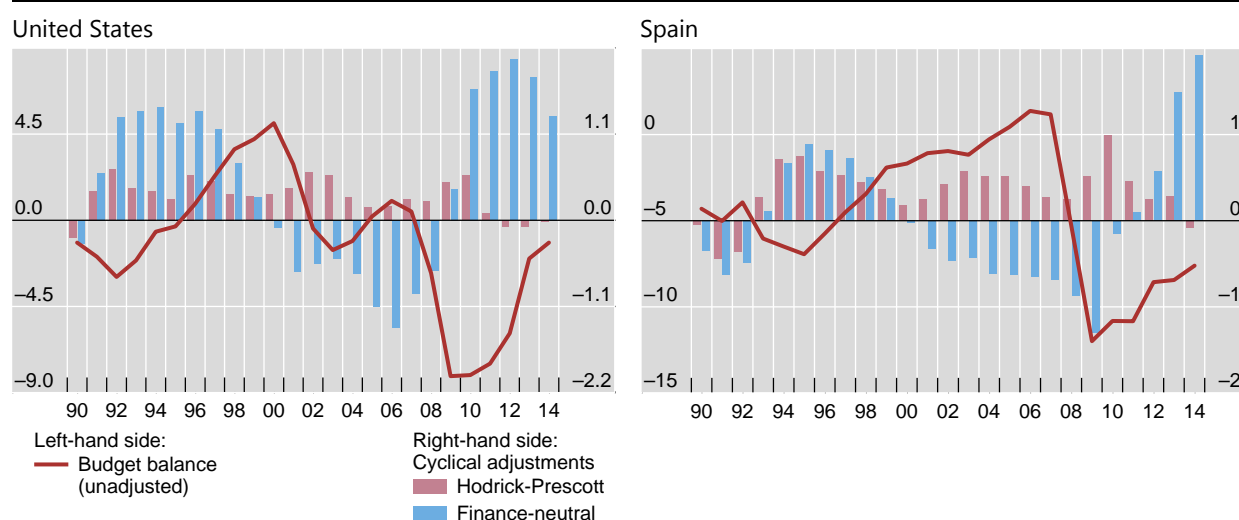
$$B^* = [\sum_{i=1}^4 T_i(Y^*/Y)^{\eta_{Ti}} - G(Y^*/Y)^{\eta_G} + X]/Y^* \quad (8)$$

Naturally, estimates of the output gap play a key role in the adjustment defined in (8). This is shown in Graph 5, which compares cyclical adjustments based on the finance-neutral output gap with those based on the HP filter. In both cases, we rely on the estimates of expenditure and tax elasticities reported in Girouard and André (2005). The continuous line denotes the unadjusted balance, while the bars correspond to the adjusted balance, in real time (red) and ex post or based on the full sample (blue).

### Cyclically-adjusted fiscal balances (real time)

As a percentage of GDP

Graph 5



Sources: OECD; BIS calculations.

The results are striking. While the adjustments to the fiscal position based on the HP filter point to a sound fiscal position in the years preceding the Great Recession, those based on financial cycle information paint a different picture. In the 2000s, the HP-filtered cyclical adjustments consistently improve the apparent fiscal strength for both the United States and Spain; those based on the finance-neutral measure consistently worsen it. Pre-crisis, the adjustment peaks at above 1% for the United States and is a bit lower for Spain. The pattern generally reverses post-crisis.

### III. Current limitations and possible ways forward

In considering the limitations of the approach, it is worth distinguishing between two issues. The first has to do with the specific way of incorporating financial cycle information in the estimates of potential output; the second with the omitted channels through which the financial cycle influences the sustainability of fiscal positions. Consider each in turn.

## Improving estimates of potential output

The specific method illustrated above is simply one among a variety of possible ones. It has the advantage of a certain simplicity, parsimony and transparency. One could add that the proof of the pudding is in the eating: it works well as a means of identifying, in real time, key cases where it turned out *ex post* that problems were brewing.

The approach is based on number of restrictive assumptions. For instance, to facilitate comparison with the traditional macroeconomic literature, the duration of the business cycle is fixed to be up to eight years – ie the value of  $\lambda$  is set a priori. Likewise, it is assumed that the explanatory variables have a deterministic mean – a testable hypothesis that holds well enough in the cases examined and helps to explain the robustness of the estimates to the arrival of additional data as time unfolds. Moreover, the approach recognises only slowly the permanent loss of output that appears to be a stylised feature of financial crises. Typically, after a crisis both credit and property price growth are well below average. This, and the fact that the method constrains potential output to evolve slowly, implies that the size of the output gap is overstated for some time. As a result, so would be the fiscal space.

Some of these drawbacks could be addressed through statistical techniques. For instance, it is possible to estimate the frequency of common cycles through appropriate multivariate methods and to allow for structural breaks in the filter variables (eg Harvey and Trimbur (2008)).<sup>21</sup> It might also be feasible to allow for more discontinuous (non-linear) adjustments in the statistical properties of GDP. None of these approaches, however, is a panacea. Increasing the number of unobservable variables may lead to larger *ex post* revisions as more data become available. And purely statistical methods for detecting breaks would generally require a minimum set of post-break data to recognise the breaks with sufficient statistical confidence, reducing the tool's usefulness to policymakers in real time.

Addressing some of these shortcomings may require the policymaker to impose some form of an a priori restriction. This means bringing to bear information that goes beyond that included in the statistical properties of the variables over the relevant sample. For example, if a crisis occurs, it should be possible to make adjustments based on the fact that, as the historical record indicates, such episodes have tended to result in permanent output losses. There are many ways in which this could be done, from ad hoc revisions based on the typical historical experience to the inclusion of judgmental elements supported more formally by Bayesian methods.

More generally, at the cost of simplicity, it is also possible to incorporate financial information in increasingly rich approaches. They vary in terms of the range and role of the financial variables themselves, the number of additional unobservable variables, the set of a priori theory-based restrictions and estimation methods. It is up to the policymaker to decide which method is more reliable and strikes a better

<sup>21</sup> de Jong and Penzer (1998) provide diagnostic tests that can be used to test for structural breaks in multivariate filters. Strategies for modelling such breaks are discussed in Koopman et al (2008).

balance between the trade-offs involved.<sup>22</sup> Again, the proof of the pudding is in the eating.

## Dealing with the omitted channels

Estimating potential output and the corresponding elasticities of the various expenditure and tax items, even if done without error, is only one of the adjustments necessary to assess fiscal strength in the face of financial cycles. As noted above, other adjustments are called for to account for other factors: the use of public sector money to support balance sheet repair during the bust; tax and expenditure compositional effects for a given level of output; exchange rate-induced effects on the valuation of debt and on debt-servicing costs; and systematic patterns in the behaviour of interest rates. Consider each in turn.

To adjust the strength of underlying public finances for balance sheet repair costs, one could use an approach consistent with that used to derive cyclically-adjusted balances. This would amount to estimating a time-varying expected contingent liability that is given by the probability of a crisis times the potential financial cost of support. In practice, estimating both items is not straightforward. The probability could be estimated based on early warning indicators of crises, while the potential cost could simply be drawn from historical experience.<sup>23</sup> In both cases, relying on cross-country data would be almost inevitable, since crises are rare events. Less ambitiously, the probability of a crisis could be fixed rather than time-varying, and chosen, alongside the costs, to reflect the policymaker's risk tolerance. For instance, a methodology of this kind underlies the top-down approach to the international calibration of bank capital requirements, which is based on their macroeconomic costs and benefits (BCBS (2010)).

Adjustments for the evolution of asset prices could be done in several ways. One method, most consistent with the potential output adjustment, is to estimate asset price elasticities conditional on the output gap (eg Price and Pang (2011)). More ambitiously, one could even bypass potential output altogether, estimating directly the co-movements of the key fiscal balance components with the financial cycle proxies. Either method could be coupled with forms of sensitivity analysis. Similar methodologies could be employed to adjust fiscal positions for the impact of the exchange rate.

Adjustments for the systematic behaviour of interest rates are trickier. The main reason is that, as the previous analysis indicates, their behaviour depends on the strategy (reaction function) followed by the central bank and on the market-driven

<sup>22</sup> The literature is growing rapidly but a systematic analysis is not possible, since existing studies provide insufficient information. For example, the real-time properties of the estimates are often not reported. Here are just a few examples. Alberola et al (2013) adjust the components of the production function by several measures of imbalances, including the current account, and Alberola et al (2016b) for commodity prices. Albert et al (2015) employ a similar method in their assessment of potential output in China: the capital stock input to the production function is adjusted for the credit cycle to account for possible overinvestment. Blagrove et al (2013), Melolinna and Tóth (2016) and Tóth (2015), in addition to relying on a relationship akin to equation (3), also include a Phillips curve and an Okun law.

<sup>23</sup> More ambitiously, one could in principle adjust the cost as a function of the financial system's characteristics, such as leverage, concentration etc; see eg Arslanalp and Liao (2014, 2015) for one possible approach to estimating time-varying contingent liabilities.

influences on the relevant constellation of rates. In turn, both depend on the constraints, internal and external, that the economy faces, including the sovereign's initial creditworthiness. All this suggests that any adjustment would have to be very country-specific.

That said, a couple of points are worth noting, all inspired by the need for prudence. First, sovereigns with a lower initial creditworthiness would need to be especially alert to the possibility of sharp (non-linear) increases in interest rates should financial busts materialise. The same holds for economies where the policy room for manoeuvre is more limited because of, say, balance sheet characteristics (eg a large share of foreign currency debt, public or private), history (eg one of defaults or persistently high inflation) and institutional features (eg a tight exchange rate regime, including being member of a broader currency area).

Second, and at the other end of the spectrum, for countries with a broad room for monetary policy manoeuvre, it would be imprudent to assess the underlying fiscal strength on the basis of the unusually and persistently low interest rates that may prevail during the post-crisis phase. Rather, it would be important to assess the strength based on some "normal" long-term level. True, establishing what that level should be is not easy. Even so, using prevailing interest rates is bound to paint too rosy a picture. Worse, it could even pave the way for a self-fulfilling debt trap ((BIS (2015), Borio and Disyatat (2014), Borio (2015)). Lulled into a false sense of security, the sovereign could loosen its fiscal stance and accumulate further debt. Directly and indirectly, this would make it harder for the central bank to raise rates without causing economic damage. And at some point, regardless of the policymakers' intentions, a sovereign crisis could be triggered by investor fears of a formal default or inflationary finance.

As a final point, it is worth stressing that fiscal balances adjusted for the financial cycle are an important but insufficient statistic for fiscal sustainability. As a result, they need to be complemented with measures of sustainable debt that take full account of future prospects and risks over long horizons. In this regard, a possible but very ambitious avenue for future research would be to build on existing models of debt sustainability (see eg D'Erasmus et al (2015)) to incorporate financial risks and the endogenous behaviour of interest rates and other variables in a realistic way. This would also help to understand how the risk of a fiscal crisis could feed back on the financial sector through higher risk premia and by reflection on the rest of the private sector.

## Conclusion

Financial booms and busts, or financial cycles, can wreak havoc with public finances. It is therefore critical to design fiscal policy in a way consistent with this threat, so as not to endanger the sovereign's creditworthiness and retain valuable fiscal space. In this paper, we have taken a first step in that direction.

Our main focus has been on how to estimate more reliable cyclically adjusted fiscal balances to take into account the nexus between the financial cycle and potential output. Both during financial booms and during financial busts, economists and policymakers tend to overestimate potential or sustainable output, and possibly also its growth rate. This leads to too rosy a picture of the underlying fiscal strength,

which risks undermining it further: governments may be tempted to relax needed consolidation and/or to rely too much on fiscal policy to boost disappointing post-crisis growth. The risk is especially high if the cyclical adjustment relies heavily on the premise that rising inflation provides the key signal of sustainability – the typical Phillips curve relationship. As history indicates, dangerous financial booms have built up even in the context of low and stable inflation. The recent Great Financial Crisis is but the latest reminder.

In addition, we have also sketched out how policymakers might take into account the other channels through which financial cycles flatter fiscal accounts. During booms, these include the build-up of hidden contingent liabilities associated with the need to support balance sheet repair if a financial crisis subsequently erupts, effects on the structure of tax receipts and possibly expenditures linked to asset price increases, and the impact of exchange rate appreciation on the valuation of foreign currency debt and debt-servicing costs. Moreover, during busts and for countries with sufficient monetary policy room for manoeuvre, the channels include the effect of unusually and persistently low interest rates, sometimes compounded by central banks' large-scale government bond purchases.

But the ultimate objective should be more ambitious. It should be to design fiscal policy as part of a broader macro-financial stability framework aimed at taming the financial cycle and ensuring sustainable and balanced growth. Taming the financial cycle is not a task that can be left to macroprudential measures alone (BIS (2014, 2015), Borio (2015)). Monetary and fiscal policies, too, have a role to play. For fiscal policy, this is not just a matter of ensuring that it retains fiscal space to address the financial bust without endangering the sovereign's creditworthiness or having it become a source of macroeconomic instability more generally. Fiscal policy ought to play a more proactive role to restrain financial booms in the first place. This means leaning more deliberately against financial booms, possibly with corresponding targets for deficits and debt, and possibly using the tax code and other fiscal instruments to remove any bias in favour of debt over equity.

In other words, there is a two-way street. We need to protect the sovereign from the financial cycle, but also the financial cycle from the sovereign.



## References

- Ahearne, A and N Shinada (2005): "Zombie firms and economic stagnation in Japan", *International Economics and Economic Policy*, vol 2, pp 363–81.
- Alberola, E, A Estrada and D Santabárbara (2013): "Growth beyond imbalances: Sustainable growth rates and output gap reassessment", *Banco de España Working Paper*, no 1313.
- Alberola, E, I Kataryniuk, Á Melguizo and R Orozco (2016a): "Fiscal policy and the cycle in Latin America: The role of financing conditions and fiscal rules", *BIS Working Papers*, no 543.
- Alberola, E, R Gondo, M Lombardi and D Urbina (2016b): "Output gaps in Latin America. The effect of commodity and capital flows cycles", *BIS Working Papers*, forthcoming.
- Albert, M, C Jude and C Rebillard (2015): "The long landing scenario: Rebalancing from overinvestment and excessive credit growth, and implications for potential growth in China", *Banque de France Document de Travail*, no 572.
- Albertazzi, U and D Marchetti (2010): "Credit supply, flight to quality and evergreening: an analysis of bank-firm relationships after Lehman", *Bank of Italy Temi di Discussione (Working Paper)*, no 756.
- Amstad, M and F Packer (2015): "Sovereign ratings of advanced and emerging economies after the crisis", *BIS Quarterly Review*, December, pp 77–91.
- André, C and Girouard (2005): "Measuring cyclically-adjusted budget balances for OECD countries", *OECD Working Paper*, no 434.
- Arslanalp, S and Y Liao (2014): "Banking sector contingent liabilities and sovereign risk", *Journal of Empirical Finance*, vol 29, pp 316–30.
- (2015): "Contingent liabilities from banks: how to track them?", *IMF Working Paper*, no 15/255.
- Auerbach, A (2011): "Long-term fiscal sustainability in major economies", *BIS Working Papers*, no 361.
- Bank of England (2011): *Financial Stability Report*, no 30, December.
- Bank for International Settlements (2010): "The global crisis and financial intermediation in emerging market economies", *BIS Papers*, no 54.
- (2014): *84th Annual Report*, June.
- (2015): *85th Annual Report*, June.
- Ball, L (2014): "Long-term damage from the Great Recession in OECD countries", *European Journal of Economics and Economic Policies*, vol 11, pp 149–60.
- Basel Committee on Banking Supervision (2010): "An assessment of the long-term economic impact of stronger capital and liquidity requirements", August.
- Baum, A, C Checherita-Westphal and P Rother (2013): "Debt and growth: New evidence for the euro area", *Journal of International Money and Finance*, vol 32, pp 809–21.

Beffy, P, P Ollivaud, P Richardson and F Sédillot (2006): "New OECD methods for supply-side and medium-term assessments: a capital services approach", *OECD Economics Department Working Papers*, no 482.

Bénétrix, A and P Lane (2015): "Financial cycles and fiscal cycles", *Trinity Economics Papers*, no 0815.

Bi, H, and E Leeper (2013): "Analyzing fiscal sustainability", *Bank of Canada Working Paper*, no 2013-27.

Bianchi, F and A Civelli (2013): "Globalization and inflation: structural evidence from a time-varying VAR approach", *Economic Research Initiatives at Duke (ERID) Working Papers*, no 157.

Blagrove, P, R Garcia-Saltos, D Laxton and F Zhang (2015): "A simple multivariate filter for estimating potential output", *IMF Working Paper*, no 15/79.

Blanchard O, E Cerutti and L Summers (2015): "Inflation and activity – Two explorations and their monetary policy implications", *NBER Working Paper*, no 21726.

Borio, C (2014a): "The financial cycle and macroeconomics: what have we learnt?", *Journal of Banking and Finance*, vol 45, pp 182–98.

——— (2014b): "Macroprudential frameworks: (too) great expectations?", *Central Banking Journal*, 25th Anniversary issue, August. Also available in BIS Speeches.

——— (2015): "Revisiting three intellectual pillars of monetary policy received wisdom", BIS Speeches, *The Cato Journal*, forthcoming.

Borio, C and P Disyatat (2010): "Unconventional monetary policies: an appraisal", *The Manchester School*, 78(s1), pp 53–89, September. Also available as *BIS Working Papers*, no 292, November 2009.

——— (2014): "Low interest rates and secular stagnation: is debt a missing link?", *VoxEU*, 25 June.

Borio, C, P Disyatat, and M Juselius (2013): "Rethinking potential output: Embedding information about the financial cycle", *BIS Working Paper*, no 404.

——— (2014): "A parsimonious approach to incorporating economic information in measures of potential output", *BIS Working Paper*, no 442.

Borio, C, M Erdem, A Filardo and B Hofmann (2015a): "The costs of deflations: a historical perspective", *BIS Quarterly Review*, March, pp 31–54.

Borio, C and A Filardo (2007): "Globalisation and inflation: new cross-country evidence on the global determinants of domestic inflation", *BIS Working Papers*, no 227.

Borio, C, E Kharroubi, C Upper and F Zampolli (2015b): "Labour reallocation and productivity dynamics: financial causes, real consequences", *BIS Working Paper*, no 534.

Borio, C and P Lowe (2002): "Assessing the risk of banking crises", *BIS Quarterly Review*, December, pp 43–54.

Borio, C, B Vale and G von Peter (2010): "Resolving the current financial crisis: are we heeding the lessons of the Nordics?", *Moneda y Crédito*, no 230, pp 7–49. Also available in extended form as *BIS Working Papers*, no 311.

Bova, E, M Ruiz-Arranz, F Toscani and H Ture (2016): "The fiscal costs of contingent liabilities: A new dataset", *IMF Working Paper*, no 16/14.

- Budina, N, B Gracia, X Hu and S Saksonovs (2015): "Recognizing the bias: Financial cycles and fiscal policy", *IMF Working Paper*, no 15/246.
- Caballero, R, T Hoshi and A Kashyap (2008): "Zombie lending and depressed restructuring in Japan", *American Economic Review*, vol 98, pp 1943–77.
- Cecchetti, G and E Kharroubi (2015): "Why does financial sector growth crowd out real economic growth?", *BIS Working Paper*, no 490.
- Cecchetti, S, M Mohanty and F Zampolli (2012): "The real effects of debt", in *Achieving Maximum Long-Run Growth*, proceedings from the symposium sponsored by the Federal Reserve Bank of Kansas City, Jackson Hole, August 2011.
- Cerra, V and S Saxena (2008): "Growth dynamics: the myth of economic recovery", *American Economic Review*, vol 98, pp 439–57.
- Ciccarelli, M and B Mojon (2010): "Global inflation", *Review of Economics and Statistics*, vol 92, pp 524–35.
- Committee on the Global Financial System (2007): "Financial stability and local currency bond markets", *CGFS Papers*, no 28.
- (2011): "The impact of sovereign credit risk on bank funding conditions", *CGFS Papers*, no 43.
- Checherita-Westphal, C and P Rother (2012): "The impact of high government debt on economic growth and its channels: An empirical investigation for the euro area", *European Economic Review*, vol 56, pp 1392–405.
- Chudik, A, K Mohaddes, M Pesaran and M Raissi (2015): "Is there a debt-threshold effect on output growth?", *IMF Working Papers*, no 15/197, September.
- Das, U, M Papapioannou, G Pedras, F Ahmed and J Surti (2010): "Managing public debt and its financial stability", *IMF Working Papers*, no 10/280.
- D'Erasmus, P, E G Mendoza and J Zhang (2015): "What is a sustainable public debt?", paper prepared for *The Handbook of Macroeconomics*, vol 2.
- de Jong, P and J Penzer (1998): "Diagnosing shocks in time series", *Journal of the American Statistical Association*, vol 93, pp 796–806.
- Drehmann, M, C Borio, and K Tsatsaronis (2012): "Characterising the financial cycle: don't lose sight of the medium-term!", *BIS Working Papers*, no 380.
- Drehmann, M and M Juselius (2015): "Leverage dynamics and the real burden of debt", *BIS Working Papers*, no 501, May.
- Eickmeier, S and K Pijnenburg (2013): "The global dimension of inflation: evidence from factor-augmented Phillips curves", *Oxford Bulletin of Economics and Statistics*, vol 75, pp 103–22.
- Enria, A (2012): "Supervisory policies and bank deleveraging: a European perspective", speech at the 21st Hyman P Minsky Conference on the State of the US and World Economies, 11–12 April.
- Eschenbach, F and L Schuknecht (2004): "Budgetary risks from real estate and stock markets", *Economic Policy*, vol 19, pp 314–46.
- Fischer, A and P Yeşin (2016): "Undoing CHF mortgage loans in post-crisis Eastern Europe", mimeo, Swiss National Bank.

- Furceri, D and A Zdzienicka (2012): "The consequences of banking crises for public debt", *International Finance*, vol 15, pp 289–307.
- Giorno, C, P Richardson, D Roseveare and P Van den Noord (1995): "Estimating potential output, output gaps and structural budget balances", *OECD Economics Department Working Papers*, no 152.
- Gosh, A, J Kim, E Mendoza, J Ostry and M Qureshi (2011): "Fiscal fatigue, fiscal space and debt sustainability in advanced economies", *NBER Working Paper*, no 16782.
- Gourinchas, P and M Obstfeld (2012): "Stories of the twentieth century for the twenty-first", *American Economic Journal: Macroeconomics*, vol 4(1), pp 226–65.
- Harvey, A and T Trimbur (2003): "Generalised model-based filters for extracting trends and cycles in economic time series", *Review of Economics and Statistics*, vol 85, pp 244–55.
- Koopman, S, N Shephard and J Doornik (2008): *Statistical algorithms for models in state space form: SsfPack 3.0*, Timberlake Consultants Press.
- Iwaisako, T (2005): "Corporate investment and restructuring", in *Reviving Japan's Economy*, MIT Press, pp 275–310.
- Jaimovich, N and S Rebelo (2012): "Non-linear effects of taxation on growth", *NBER Working Paper*, no 18473.
- Jordà, Ò, M Schularick and A Taylor (2013): "When credit bites back", *Journal of Money, Credit and Banking*, vol 45, pp 3–28.
- (2016): "Sovereigns versus banks: credit, crises and consequences", *Journal of the European Economic Association*, no 14, pp 45–79.
- Kuttner, K (1994): "Estimating potential output as a latent variable", *Journal of Business and Economic Statistics*, vol 12, pp 361–7.
- Kuttner, K and T Robinson (2008): "Understanding the flattening Phillips curve", *Reserve Bank of Australia Research Discussion Papers*, no 2008-05.
- Lane, P (2003): "The cyclical behaviour of fiscal policy: evidence from the OECD", *Journal of Public Economics*, vol 87, pp 2661–75.
- Laeven, L and F Valencia (2013): "Systemic banking crises database", *IMF Economic Review*, vol 61, pp 225–70.
- Leeper, E (2013): "Fiscal limits and monetary policy", *NBER Working Paper*, no 18877.
- (2015): "Fiscal analysis is darned hard", *NBER Working Papers*, no 21822.
- Martin, R, T Munyan and B Wilson (2015): "Potential output and recessions: are we fooling ourselves?", *International Finance Discussion Papers*, no 1145, Federal Reserve Board.
- Melolinna, M and M Tóth (2016): "Output gaps, inflation and financial cycles in the UK", *Bank of England Staff Working Paper*, no 585.
- Obstfeld (2013): "On keeping your powder dry: fiscal foundations of financial and price stability", *Monetary and Economic Studies*, vol 31, November, pp 25–38.
- Orphanides, A and S Van Norden (2002): "The unreliability of output-gap estimates in real time", *Review of Economics and Statistics*, vol 84, pp 569–83.

- Peek, J and E Rosengren (2005): "Unnatural selection: perverse incentives and the misallocation of credit in Japan", *American Economic Review*, vol 95, pp 1144–66.
- Price R and T Dang (2011): "Adjusting fiscal balances for asset price cycles", *OECD Working Paper*, no 868.
- Reinhart, C and V Reinhart (2015): "Financial crises, development and growth: a long-term perspective", *The World Bank Economic Review*, vol 29, Supplement pp S53–S76.
- Reinhart, C, V Reinhart and K Rogoff (2012): "Public debt overhangs: advanced-economy episodes since 1800", *Journal of Economic Perspectives*, vol 26, pp 69–86.
- Reinhart, C and K Rogoff (2009): *This time is different: Eight centuries of financial folly*, Princeton University Press.
- (2011): "From financial crash to debt crisis", *American Economic Review*, vol 101, pp 1676–706.
- (2013): "Banking crises: an equal opportunity menace", *Journal of Banking and Finance*, vol 37, pp 4557–73.
- Santos, T (2014): "Credit booms: Implications for the public and the private sector", *BIS Working Papers*, no 481.
- Talvi, E and C Vegh (2005): "Tax base variability and procyclical fiscal policy in developing countries", *Journal of Development Economics*, vol 78, pp 156–90.
- Tornell, A and P Lane (1999): "The voracity effect", *American Economic Review*, vol 89, pp 22–46.
- Tóth, M (2015): "Potential output in crisis times: sustainable or not?", unpublished mimeo, European Central Bank.
- Turner, P (2012): "Weathering financial crises: domestic bond markets in EMEs", *BIS Papers* no 63, pp 15–34.
- Waldron, M and F Zampolli (2010): "The rise in home prices and household debt in the UK: potential causes and implications", in S Smith and B Searle (eds), *The Blackwell Companion to the Economics of Housing: The Housing Wealth of Nations*, Wiley-Blackwell.
- Woo, J and M Kumar (2015): "Public debt and growth", *Economica*, vol 82, pp 705–39.

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