Prices and Policies[1]

A Primer on the Fiscal Theory of the Price Level

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Abstract

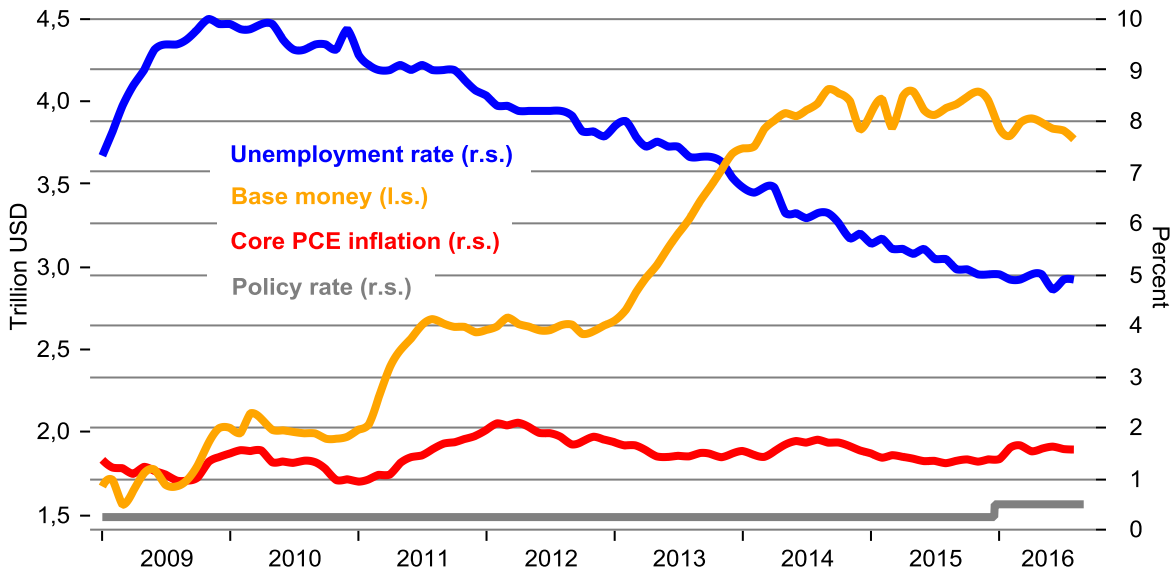
Mainstream monetary theory appears to clash with recent observations. The fiscal theory of the price level seems to offer fresh insights. This fiscal theory links the price level to the amount of government debt and the present value of expected real primary government surpluses. A change in expected real primary surpluses relative to the amount of government debt shifts in the price level. An altered discount factor on government debt also affects the price level. I clarify how the central bank determines its policy rate, and I elucidate the fiscal implications of interest rate policy. For a given real interest rate, the central bank controls expected inflation by adjusting its policy rate. The central bank steers actual inflation if the treasury digests whatever interest cost it's served.

[1] I had fruitful discussions with Michael Woodford, Eric Leeper, Espen Henriksen while working on this paper. Christopher Sims, Knut Anton Mork, Kai Leitemo, David Andolfatto, and Martin Sandbu have helpfully commented on drafts. I benefitted from discussing an issue with John Cochrane. Colleges have given useful advice. I bear sole responsibility for errors.

Introduction

Recent observations seem to conflict with widely held beliefs about what determines inflation. In the US the policy rate has been below 0.5 percent since early 2009, the stock of base money[2] has increased vastly, and the unemployment rate has tumbled to its pre-recessionary level. Yet contrary to monetarist and Keynesian predictions – of old and new varieties – the Federal Reserve's main current problem is that inflation runs below its annual 2 percent target.[3] The evidence from Japan, Switzerland, the Eurozone and the UK is broadly similar.

Policy rate, base money, unemployment rate, and core inflation

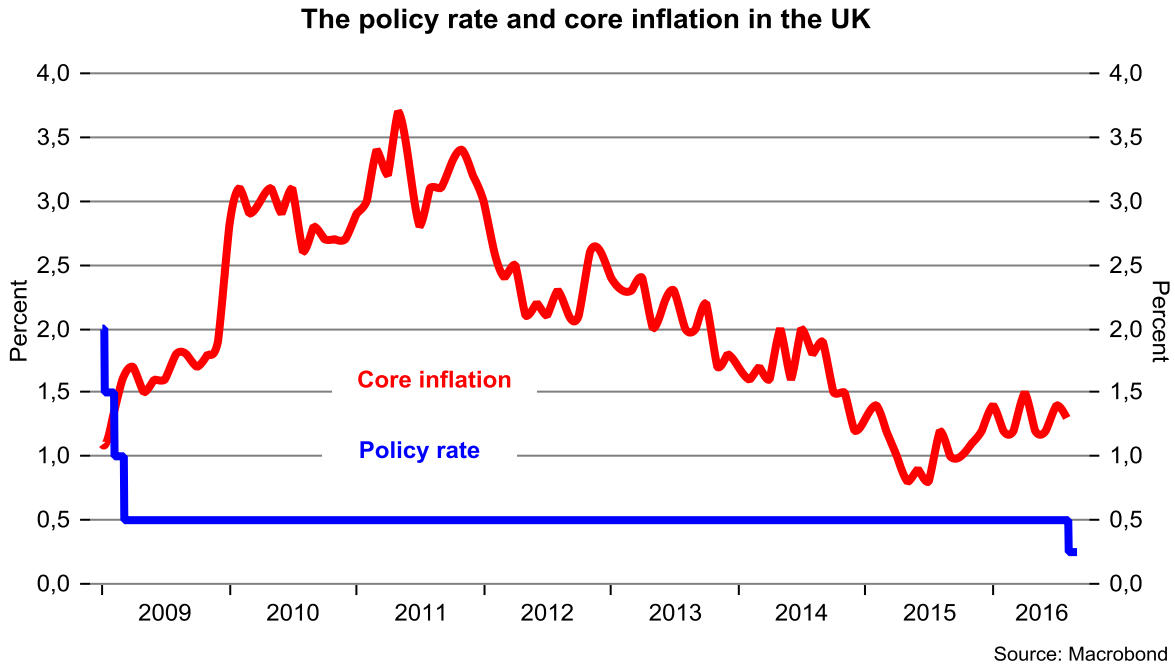


Source: Macrobond

Mainstream monetary theory faces another conundrum. With minor exceptions policy rates have been stable since 2009. According to the Taylor principle[4], a central bank can only stabilize inflation if the policy rate changes more than 1 for 1 when inflation deviates from the target. Since early 2009 the Taylor principle has been inoperative. Yet, when inflation has deviated from the target, it hasn't progressively strayed away. That is, without a Taylor principle leach, price level fluctuations have been tame.

The UK's experience illustrates this phenomenon. The Bank of England's policy rate was cut to 0.5 percent in 2009. Inflation rose above the 2 percent target in late 2009. However, inflation topped out in 2011, and since 2014 it has been below the Bank of England's target, without falling progressively. This inflation behaviour doesn't square with a dormant Taylor principle.

[2] Base money is the amount of currency and central bank deposits.
[3] I focus on core inflation. This eliminates short-term price level noise due to volatile food and energy prices.
[4] The Taylor principle originated in Taylor (1993). It's a key ingredient in mainstream monetary models. It was formulated in a New Keynesian context, i.e. in a model with sticky prices. The Taylor principle's applicability to an economy without sticky prices is argued in Gali (2008).



There is a theory that might explain these observations. It's called the fiscal theory of the price level. This theory expounds that the price level is determined by the amount of government debt and the present value of expected real primary surpluses.[5] The theory implies that the central bank steers inflation if fiscal policy passively allows the policy interest rate determine the growth of the government debt. If the fiscal theory is correct, inflation is, to paraphrase Milton Friedman, always and everywhere a fiscal phenomenon. The fiscal theory has been explored in academic papers.[6] I attempt to explain the fiscal theory's logic in plain English and apply it to current events.

Preliminaries

To simplify the exposition I assume flexible prices and rational expectations.[7] I also assume that all government debt is short-term debt.[8] I begin by clarifying some fiscal and monetary concepts.

The treasury issues debt when there's an overall budget deficit and retires debt when the overall budget balance is positive.[9] Primary expenditures are treasury-spending net of interest expenses. If revenues are higher than primary expenditures, there's a primary surplus. The expected real primary surplus during a year is the nominal surplus divided by the expected price level that year.[10] Discounting the expected stream of real primary surpluses by the expected long run real interest rate[11], one gets its present value.

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[5] The fiscal theory of the price level was developed by Leeper (1991), Sims (1994), Woodford (1995), and Cochrane (2001).
[6] Cochrane (2014) is the first attempt to explain the role of monetary policy in the fiscal theory.
[7] Cochrane (2015) models the fiscal theory with sticky prices.
[8] Cochrane (2001) explains the role of long-term debt.
[9] I don't distinguish between local and central government debt, assuming that the treasury and the central bank issue all government debt. I ignore foreign currency debt and index-linked debt.
[10] As measured by the CPI or another broad price index, such as the GDP or the PCE deflators.
[11] The expected long run real interest rate is the expected long run average of short-term real interest rates.

Prices are expressed in a monetary unit, which is usually defined in terms of central bank's liabilities, i.e. currency and central bank deposits. However, since the central bank, de jure or de facto, is owned by its government,[12] central bank liabilities are a part of the government's debt. It is therefore more accurate to define the monetary unit in terms of the government's overall liabilities.[13] That is, the monetary unit, such as the dollar, is a denomination of government debt.

There are two sources of government debt: The treasury and the central bank. The central bank issues government debt when it emits new liabilities. Most new liabilities are typically issued by purchasing treasury debt from the private sector. Then there's no effect on the consolidated government debt.[14] But the central bank augments the debt when it pays interest on central bank deposits, since such interest is paid by increasing the central bank deposits. By arbitrage the current and expected policy rate determine the coupon on new treasury debt. Thus, for a given stream of real primary surpluses the government issues more debt when the policy rate is hiked and it emits less debt when the policy rate is lowered.[15]

Simplifications

It is easier to explain the fiscal theory when all policy decisions are thought of as being undertaken by a single authority. So I simplify.

Assume that the central bank stops issuing currency and that firms and households swap currency for commercial bank liabilities. Banks deposit all the currency in the central bank, which credits their accounts. Furthermore, assume that the treasury emits overnight T-bills and soaks up all privately held central bank deposits. Being the central bank's sole creditor, the treasury absorbs its assets and shuts it down. All government debt is then treasury debt.[16] Assume the treasury converts all its debt to overnight T-bills, issued in denominations that can be used as media of exchange.[17] The interest rate on these T-bills is the government's policy rate.[18] It's determined by fiat, similarly to how central banks implement monetary policy by decrees. I explain below why this is the case.

In such an economy firms and households transact using commercial bank liabilities or T-bills, and banks settle interbank claims in T-bills. Government expenditures are

[12] Thus, while their member banks formally own the Federal Reserve Banks, the Board of Governors and the Federal Open Market Committee are federal agencies.
[13] Central bank liabilities to the private sector are debt. By holding base money, i.e. central bank deposits and currency, the private sector lends resources to the public sector.
[14] Central bank purchases of private assets, and bank lending, don't increase the net government debt.
[15] The consolidated government debt shrinks for a given stream of real primary surpluses if the deposit rate is negative.
[16] Banknotes and coins denominated in the government's monetary unit may still exist, but then as claims on currency-issuing commercial banks.
[17] Imagine that the private sector has accounts with the treasury and transfer balances electronically using online banking or treasury-issued debit cards. The amount of T-bills held on these accounts equals the treasury debt.
[18] Instead of overnight debt, the government can issue perpetual floating rate debt, i.e. debt whose interest is determined each morning and that matures to the extent that the government runs a budget surplus. Overnight debt and perpetual debt with a floating interest rate are functionally equivalent.

paid in T-bills, and revenues are collected in T-bills. Individuals can shed T-bills by swapping them for goods and services. But in the aggregate the private sector must hold stock of public debt – unless the treasury spends less than it taxes.

An equity analogy

Government debt is different from private debt; it's more akin to private equity. Aside from buy-back programs, equity shares aren't redeemed. In the aggregate equity holders are stuck with their shares – unless the firm is liquidated or sold. There are other similarities. An understanding of how the government steers the price level is aided by an equity analogy.[19]

Suppose Apple creates its own unit of account by denominating its shares in "iOwns". Assume the economy begins to use such shares as a medium of exchange. Thus, there is an iOwn price level.[20] Since the real value of Apple's equity is tied to the present value of its expected real profits, the iOwn-measured price level has a real anchor. If Apple launches a killer gadget, the price level dives, i.e. each iOwn buys more goods and services. If the product flunks, however, the price level spikes, i.e. the purchasing power of an iOwn drops. This, as I'll try to show below, is equivalent to how real world price levels are anchored in the present expected value of the government's real primary surpluses.

Suppose Apple decides to pay new shares to its shareholders at a rate of 2 percent per share per year. Let's call such a continuous stock-split a "nominal dividend".[21] How does it affect the iOwn's real value of each? Let's ignore the equity premium and assume that Apple's real rate of return is equal to a constant real interest rate of 2 percent. Also, except for Apple's "nominal dividend", there are no other dividends. The iOwn's real value is then constant if the nominal dividend is 2 percent. More iOwns compensates for the real growth rate of the firm's equity. If Apple's nominal dividend is hiked to 4 percent, the iOwn's purchasing power falls 2 percent per year. Since the growth rate of iOwns is higher than the real growth rate of Apple's equity, 2 percent annual inflation is necessary to keep the real value of Apple's shares equal to the present value of expected real profits. If Apple's nominal dividend is cut to zero, the iOwn's purchasing power increases 2 percent per year. 2 percent deflation is required to keep the real value of a growing number of shares equal to the equity's real value. I try to elucidate below how the government tinkers with the price level by varying the nominal interest rate on its debt for given present value of expected real primary surpluses.

[19] The equity analogy is explored in Cochrane (2005). See also Sims (1999).

[20] If transactions are costly, the use of iOwn shares as a medium of exchange adds a non-pecuniary value to Apple's equity, i.e. each iOwn has a liquidity premium. That is, since people use shares of Apple's equity as a medium of exchange, they might be willing to hold them for a while even if they are neither stock investors nor Apple aficionados. If transaction costs are small, however, or if there are close substitutes to the iOwns, the non-pecuniary value of iOwn shares is minute. I assume that the iOwn's liquidity premium is zero on the margin.

[21] Sims (2011) uses an example that comes close to such a scenario.

Price level determination

Just as the real value of a firm's equity is determined by the present value of its expected real profits, the real value of government debt is determined by the present value of expected real primary surpluses.

Real revenues in excess of real primary expenditures enable the government to pay a real rate of return on its debt. And households willingly hold the debt at the current price level if the expected real rate of return is comparable to other investments.[22] Note that the flip side of real primary surpluses is tax revenues sufficient to generate the real surpluses. Households willingly hold real debt equal to the present value of expected real taxes needed to cover future real public interest expenses.

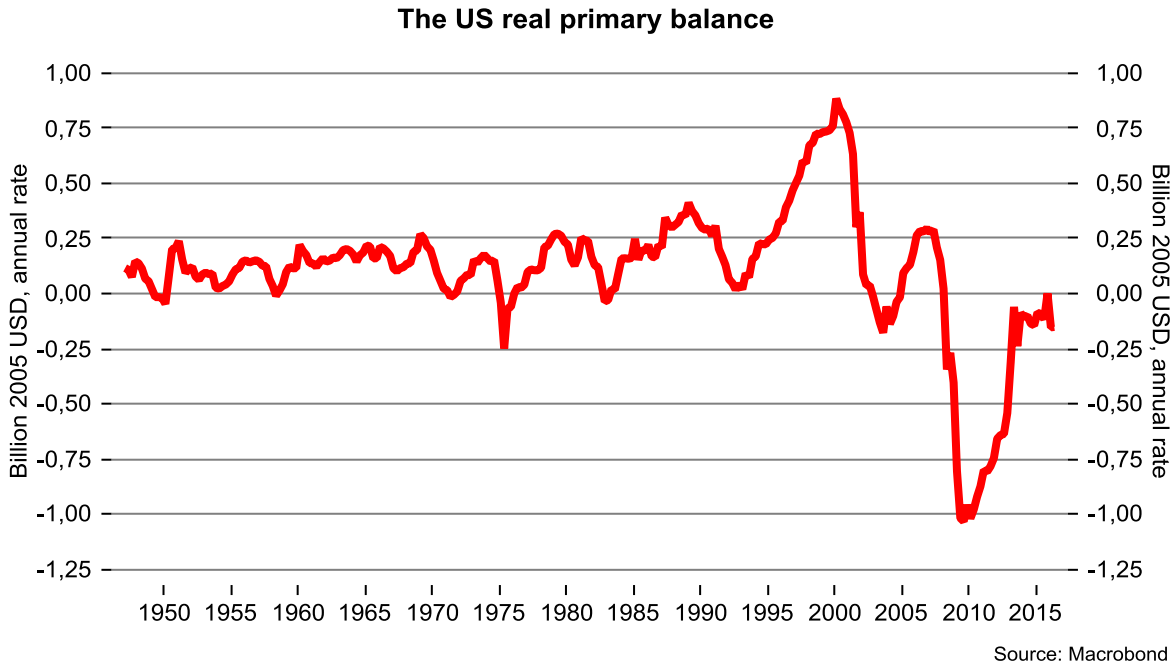
What happens if the real value of the debt differs from the present value of expected real primary surpluses? The two amounts are equilibrated by the price level.[23]

Suppose that the present value of expected real primary surpluses is lower than the real value of the T-bills? With the real value of debt too high, the private sector tries to get rid of T-bills. In the aggregate there's an insufficient demand to hold T-bills and an excess demand for goods and services. Equilibrium is restored when the price level rises, decreasing the real value of each T-bill. Before the price level jump people hold more debt than the present value of expected real taxes. Households feel wealthy and try to increase their expenditure. They thus bid prices up until the real value of the debt equals the present value of expected real taxes.[24]

If the real value of the debt is lower than the present value of expected public real primary surpluses, there's excess demand to hold T-bills and an insufficient demand for goods and services. Then the price level falls until the excess demand to hold T-bills disappears. Now the wealth effect works in reverse. At the initial price level, the present value of expected future real transfers to the government is higher than the real value of debt. Hence people cut their demand for goods and services and try to accumulate more T-bills. Since the amount of debt is given, the general price level falls until the real value of the debt matches the present value of expected real taxes.

With budget deficits being the rule since the financial crisis it's easy to forget that advanced economy governments typically have real primary surpluses. The chart below shows the US's real primary balance since 1947.

[22] The real rate of return must be adjusted for risk and liquidity, factors that I ignore here.
[23] With long-term debt, the nominal value of the debt absorbs in part a shock to the present value of expected real primary surpluses. This implies that the price level adjusts with a lag. See Cochrane (2001).
[24] The wealth effect is a disequilibrium phenomenon; it evaporates in equilibrium.



Fiscal policy and the price level

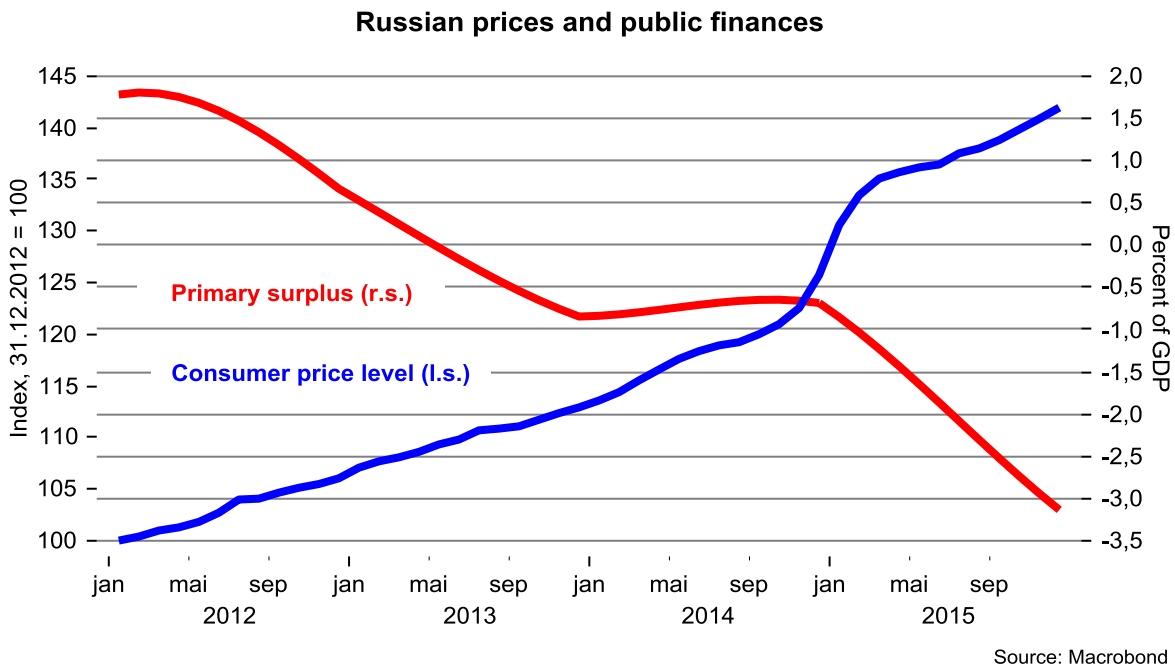
The amount of government debt can change without affecting the price level.

With fixed tax rates and stable expenditure programs the primary balance fluctuates with the business cycle. If a period of below-trend real primary surpluses is expected to be followed by a period of above-trend real primary surpluses, the present value of the surpluses is stable. Counter-cyclical fiscal policies too need not affect the price level. Suppose tax rates are cut and new public expenditure programs are initiated in a recession. If households expect a policy reversal after the recession, they willingly hold more government debt at the initial price level.

Whether fiscal policy impacts the price level depends upon expectations. Current fiscal extravagance doesn't matter if compensatory adjustments are in the pipeline, and current fiscal tranquillity is irrelevant if fiscal trouble is on the horizon. The trigger of fiscally induced shifts in the price level is events that alter the outlook for fiscal policy.

Russia's recent upward shift in the price level might have been due to a fiscal shock and deteriorated prospects for future government finances. Being a huge producer and exporter of petroleum, Russia's state finances were hit by the oil price slump in 2014. Finances were simultaneously adversely affected by foreign policy adventures. Households likely deemed it doubtful that Kremlin would be able to adjust is fiscal house. Hence, the present value of expected real primary surpluses didn't square with to the initial real value of the government's debt. This necessitated a price level shift, which occurred from October 2014 to March 2015. [25]

[25] The ruble dropped on foreign exchange markets. But the ruble fell for a reason, and although the ruble depreciated before the price level spike, the depreciation didn't cause the price level spike. The underlying cause of both phenomena was in all likelihood a bleaker outlook for public finances. Unlike currency values, prices on goods and services are sticky. Hence the international purchasing power of the ruble dropped before its domestic purchasing took a dive.



Hyperinflations – and moderate deflations

Hyperdeflations are caused by an expected breakdown in government finances. If people believe that the government is unable to ever deliver real primary surpluses, the real value of the government's debt drops to zero.

It is often argued that hyperinflation is caused by monetization, i.e. by having the central bank finance government deficits. This is not correct. The price level surges, if the government issues debt without promising to back the real value of the debt by increasing the present value of expected real primary surpluses. But it's irrelevant what *kind* of debt the government issues.[26] And if the government credibly promises fiscal backing, issuing central bank deposits instead of treasury debt is equivalent to issuing T-bills instead of T-bond. It's debt management policy with no repercussions for the price level.

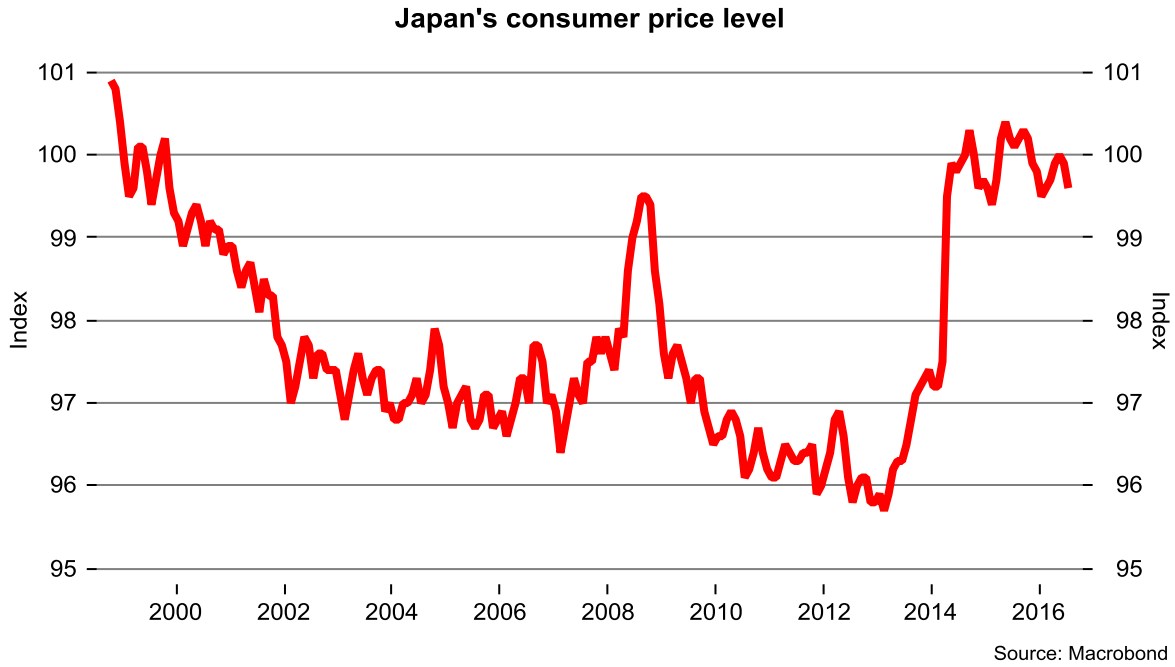
Consider US policy since 2008. Until recently the treasury ran huge deficits, and the Federal Reserve purchased a substantial part of treasury debt, financing it by issuing central bank deposits. Economically it's as if the treasury had borrowed directly from the Federal Reserve. Yet, inflation has been too low for comfort.[27]

While there have been some sharp drops in the price level, e.g. during the 1920-21 US recession, when the price level fell about 20 percent over two years, there are no records of anything close to "hyperdeflation". That is, no economy has disappeared in

[26] The duration of the government debt to influence how fast the price level spike, though. The less duration the government debt has, the faster the price level increases. But the eventual shift in the price level does not depend upon the maturity structure of the government's debt.

[27] Fiscally stressed governments shorten the duration of their debt by emitting short-term treasury debt or by issuing base money. Hence monetization might herald high inflation. With long-term debt, the nominal price of bonds falls before the price level spikes; with short-term debt the impact of a negative fiscal outlook is more immediately on the price level. Monetization hastens hyperinflation. People swap treasuries for base money when they attempt to flee government debt. Thus base money accounts for a growing proportion of the debt during hyperinflations.

a deflationary black whole. Deflations are mild. Japans brush with a falling price level is illustrative. The annual rate of deflation from the CPI's peak in 1998 to its nadir in 2013 was 0.4 percent.



Deflations are modest since the real value of the government debt increases when the price level falls. The debt's real value doubles if the price level drops 50 percent. This can only occur if the present value of expected real primary surpluses doubles.

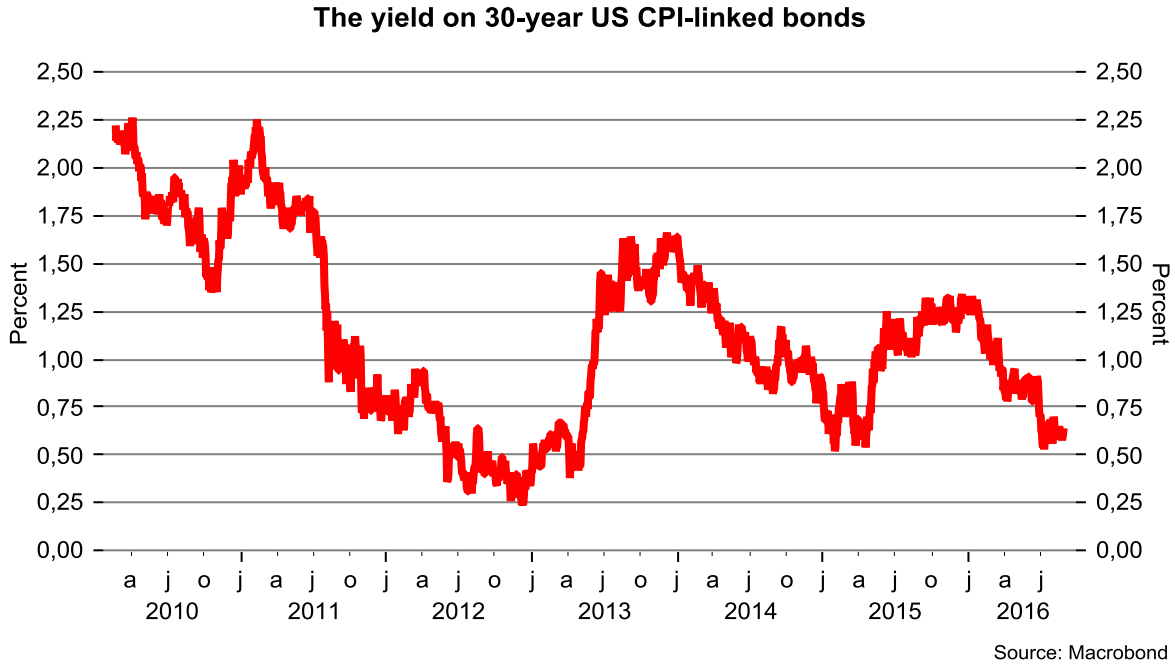
The real interest and the price level

As noted above the expected stream of real primary surpluses is discounted by the expected long run real interest rate on government debt. So what's the price level impact of a change in the discount rate?

Suppose the expected long run real interest rate is 2 percent and that expected real primary surpluses are 2 percent of the debt. The surpluses present value is equal to the real value of the government debt, and price level is stable. Assume the expected long run real interest drops from 2 percent to 1 percent. If real primary surpluses are slashed to 1 percent of the debt, their present value still equals the real value of the debt. The price level remains stable. But if expected real primary surpluses remain at 2 percent of the debt, their present value doubles. Then the price level decreases 50 percent.

Since the expected long run real interest moves with the long-run economic outlook, increasing when trend growth speeds up and decreasing when trend growth slows down, one would expect fiscal policy to adjust in the warranted direction in order to keep the price level stable: Given tax rates and expenditure programs, higher trend growth makes for higher expected real primary surpluses. And lower trend growth creates lower expected real primary surpluses.

Since 2009 the yield on CPI-adjusted bonds has dropped. Hence, the discount rate has fallen. If expected fiscal policy concurrently hadn't become looser, this would have caused price levels to fall. Since price levels didn't fall during this period – except a bit in Japan, which had deflation before long run real interest rates began to slide – fiscal policy seems to have been calibrated as warranted. Hence, while the price level has increased at a slow pace during since 2009, an insufficiently loose fiscal policy is likely not the main culprit.[28]



Nominal interest rate determination

How come governments can determine a short-term nominal interest rate by decree? The reason is that nominal interest on government debt is like a continuous currency reform.[29]

Suppose the interest rate on overnight T-bills is zero and the government reforms its currency. Let's focus on the US. Instead of denominating its liabilities in dollars, the treasury denominates its liabilities in a new unit of account, called the "rallod". Suppose the treasury announces one day that the next day overnight dollar T-bills will be redeemed in rallod T-bills at a rate of $\sqrt[365]{1.04}$ rallods per dollar. That is, each dollar T-bill is redeemed in 1.0001 rallod T-bills. This is equivalent to deciding that dollar T-bills have a one-day annualised interest rate of 4 percent. Assume the US government continuously changes the name of its unit of account. Each day it pays $\sqrt[365]{1.04}$ T-bills denominated in a new unit of account for each T-bill denominated in yesterday's unit of account. Economically this is equivalent to continuously paying 4 percent interest rate on dollar denominated T-bills – and less confusing.

[28] If efficiency growth picks up, on the other hand, and desired investment rises more than planned saving, the long run real interest rate increases. Should expected real primary surpluses remain constant this pushes the price level up.
[29] I read Woodford (2001) as an explanation of nominal interest determination along these lines.

Thus, nominal interest determination is all about naming. The government rules the roost by owing an amendable yardstick.[30]

The nominal interest rate and inflation

The Fisher equation[31] links expected inflation to the nominal interest rate and the real interest rate. Equilibrium implies that expected inflation equals the nominal interest rate minus the real interest rate. This means that if the nominal rate is 4 percent and the short-term real rate is 2 percent, expected annual inflation is 2 percent.[32] This implies that if the policy interest rate is lifted for a given real rate, expected inflation increases. Expected inflation falls, on the other hand, if the policy rate is lowered for a given real interest rate.

But how can the policy interest rate steer *actual* inflation? [33] It accomplishes this if the expected path for real primary surpluses is given. Then the policy rate determines the growth rate of the public debt.

Consider an economy in monetary tranquillity. Assume that initially both the real and the nominal overnight interest rates are 2 percent. Suppose that the overall budget is expected to remain forever balanced and that the primary surplus each year is expected to be 2 percent of the debt. The present value of expected real primary surpluses equals the real value of the public debt at the current price level. Hence both expected and actual inflation is zero.

Suppose the T-bills rate is lifted to 3 percent while the real interest rate remains at 2 percent. The nominal primary surplus no longer covers interest expenditures, and the overall budget has a deficit equal to 1 percent of the debt. Hence, more T-bills are issued, and the nominal amount of debt starts to grow at a rate of 1 percent per year. With a constant price level the present value of real primary surpluses undershoots the real value of the debt by a factor of 1.01 per year. The price level must increase 1 percent per year in order to keep the debt's real value stable.[34] [35]

Suppose the T-bills rate is instead cut to 1 percent while the real interest rate remains 2 percent. Now nominal primary surpluses dwarf interest expenses, and a part of this is used to retire public debt. It shrinks 1 percent per year. The present value of real

[30] This was not the case when monetary units referred to a specific amount of a commodity, e.g. when the sterling was defined as a pound of silver. As Keynes (1930, p. 5) wrote, the nature of money changed when governments "claimed the right not only to enforce the dictionary but also to write the dictionary".

[31] Irving Fisher first elucidated this equation. See Fisher (1930).

[32] I assume that the real interest rate is determined independently of the nominal interest rate. See Williamson (2016) for a lucid an explanation of what happens to expected inflation when shifts in the nominal interest rate temporarily have an impact on the real interest rate.

[33] The view that inflation is determined by the divergence between the nominal interest rate and the real interest rate has recently been dubbed Neo-Fisherian. See Williamson (2016). This is misleading. The Fisher effect pertains to *expected* inflation. Expected inflation does not determine *actual* inflation.

[34] The price level is adjusted by the same disequilibrium mechanism that causes the price level to jump or dive when the present value of primary surpluses falls for a given amount of public debt.

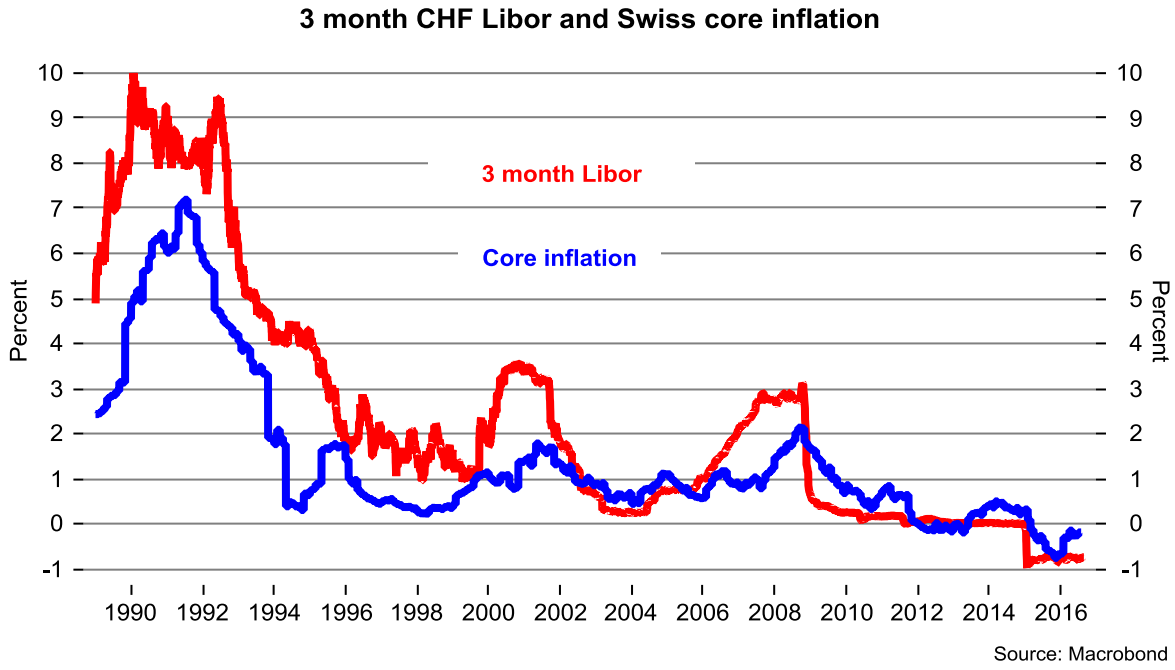
[35] What happens to real primary surpluses? The hike in the T-bills rate causes nominal revenues and primary expenditures to grow 1 percent per year. But adjusted for 1 percent expected annual inflation and discounted by a 2 percent real interest rate, the present value of the surpluses is constant.

primary surpluses then progressively overshoots the real value of the debt. To eliminate this discrepancy the price level must decline 1 percent per year.[36]

What's crucial here is that the expected path of real primary surpluses doesn't adjust as the nominal interest rate is altered.[37] If fiscal policy isn't passive when interest rate policy is active, nominal interest rate policy only steers expected inflation.

Interest rate policy causes continuous changes in the price level through the same mechanism that determines the price level at a point in time. It's always about the interplay between the nominal amount of government debt and the present value of real primary surpluses.

If the fiscal theory is correct, the standard interpretation of the observed correlation between nominal interest rates and inflation is flawed. Contraintuitively, causality runs from nominal interest rates to inflation, not the other way around. Switzerland's recent inflation history might illustrate this implication of the fiscal theory.



Assume that the Swiss government has not been afflicted by a fiscal shock and that expected real primary surpluses have adjusted to changes in the expected long run real interest rate. If so, and if the fiscal theory is correct, the observed fluctuation in Swiss inflation is caused by a variable spread between nominal and real short term interest rates.[38] In the early 90ties a high nominal interest rate relative to the short-term real rate caused high inflation. Since 2015 policy rate that has been a bit below the short-term real interest rate, have caused a mildly declining price level.

[36] Nominal revenues and primary expenditures now decline 1 percent per year. Adjusted for 1 percent expected deflation, and discounted by a real interest rate of 2 percent, however, the present value of expected real primary surpluses is constant.

[37] When fiscal policy is passive households have a non-Ricardian response to the fiscal consequences of interest rate policy. That is, households do not expect that a more debt to a higher nominal policy will result in higher future real taxes.

[38] The Swiss National Banks uses the 3-month CHF Libor rate as its policy rate. Lately its deposit rate has been equal to the target for the 3-month CHF Libor.

Inflation targeting

Most advanced economy governments target 2 percent annual inflation. In order to keep inflation on target the nominal interest rate must adjust pari passu with changes in the real interest rate.

Assume the real interest rate is initially 2 percent and that the overnight T-bills rate is 4 percent. Expected and actual inflation is 2 percent. If the real rate dips to 1 percent, the T-bills rate must be lowered to 3 percent to keep inflation on target. If the T-bills rate stays at 4 percent, both expected and actual inflation rate increases to 3 percent. If the real rate picks up to 3 percent, the T-bills rate must be raised to 5 percent. If not, expected and actual inflation falls to 1 percent.[39]

As the real interest rate typically falls in a recession and rises in a boom, and since governments normally cut the nominal rate in recessions and increase it in booms, interest rate policies are implemented as set out above. However, traditional thinking has it that if the nominal interest rate is not cut in a slump, inflation undershoots the target, and if the nominal interest rate is not raised in a boom, inflation overshoots the target. If the fiscal theory is correct, this is mistaken; "hawkishness" in recessions then implies higher inflation, and "dovishness" in booms causes lower inflation.[40]

Central banking

The discussion has abstracted from central banking. This simplified the analysis, and showed that a government can control the price level and its evolution over time without a central bank. Having the central bank determine the policy rate has an advantage, though. By outsourcing nominal interest determination to its central bank, the government makes transparent the distinction between fiscal and interest rate policies.

Fiscal policy is typically not meant to adjust the price level. Its primary role is to raise or slash the government's use of resources. Thus alterations of government debt due to fiscal policy are supposed to signal correspondingly higher or lower expected real primary surpluses. Interest rate policy, on the other hand, is primarily concerned with steering the price level. Hence when a change in the policy rate increases or decreases the path of the government's nominal debt, this is not supposed to signal an altered future real fiscal stance.[41]

It gets complicated if the treasury outsources nominal interest determination to its central bank and adopt its own nominal target. An incoherent overall nominal policy makes it difficult to pin down expected inflation. Here's what I have in mind.

Assume a stationary economy where the real interest is expected to be 1 percent. Initially there's nominal harmony between the treasury and the central bank. When

[39] I assume that there is no direct effect of the change in the real interest rate on the price level. This is the case if the real interest rate fluctuates around a given long run trend. It's also the case if fiscal policy adjusts if the expected long run trend changes.

[40] I here disregard the potential short-term effects of sticky prices and sticky inflation expectations.

[41] Cochrane (2014) draws an analogy to the distinction between a public offer of new shares a stock split and.

the market closes on 31 December 2016, the government's debt is 100 and the price level is 1. At 11pm on New Year's Eve, the central bank announces that the nominal interest on the debt will forever be 1 percent per year. It does this to ensure that expected and actual inflation is zero. An hour later the treasury announces that for each and every year its purchases of goods and services will be 99, interest will be 1 and tax revenue will be 100. Fiscal policy is then aligned with interest rate policy and both expected and actual inflation are zero during 2017.

New Year's Eve 2017 ends in nominal tension. At 11pm the central bank changes its mind. Its new governor, Ms. Inflationista, wants 1 percent annual inflation, lifts the nominal interest rate to 2 percent and pledges to keep it there forever. An hour later the treasury, ruled by Mr. Austerity, says that the nominal debt won't be allowed to increase. Not content with targeting the real value of the debt, i.e. the debt to nominal GDP ratio, he states that tax rates will be hiked sufficiently to cover the increased interest cost imposed by the central bank. What happens when the market opens in 2018?

I ignore the potential initial price level adjustment and focus on expected inflation.[42] The Fisher equation implies that with the nominal interest rate at 2 percent and the real interest rate at 1 percent, there's 1 percent expected inflation per year. But since the treasury keeps the nominal debt constant, annual inflation in fact turns out to be zero. Thus fiscal policy suggests zero expected inflation. With an intragovernmental nominal tug of war, how is expected inflation determined? I don't have an answer to this puzzle. It's unlikely to be a real world dilemma, but it illustrates the necessity of having a coherent nominal policy.

Is the fiscal theory falsifiable?

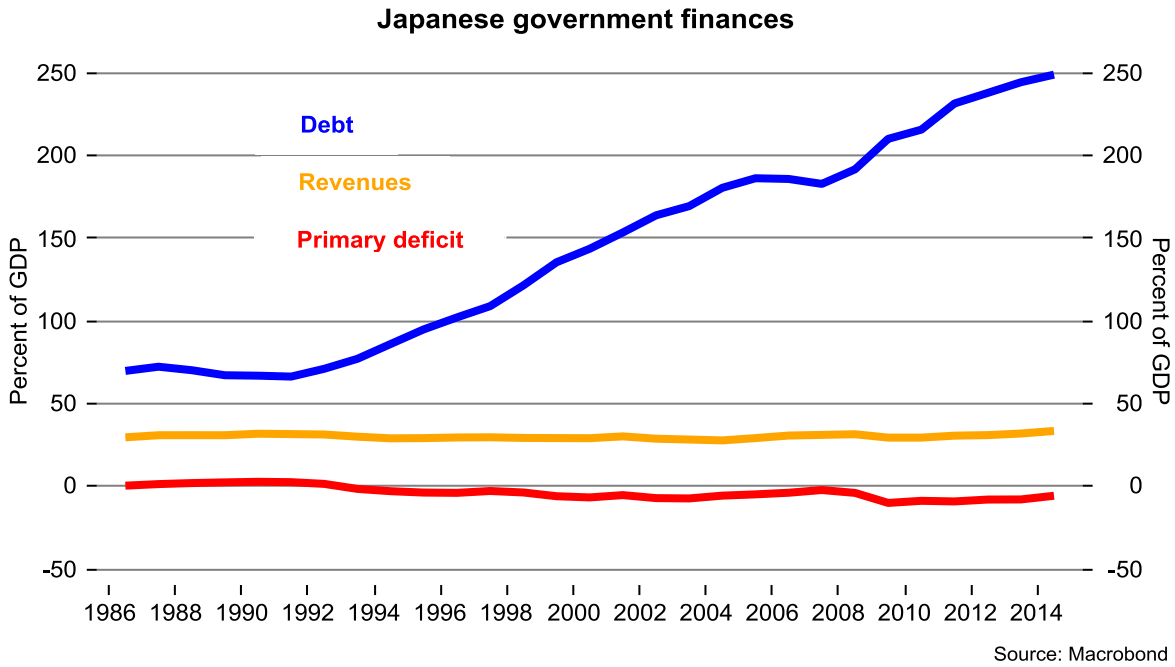
Using the fiscal theory to understand price level jumps *ex post*, as I did with respect to Russia, might provide insights. But it doesn't put the theory to test. What falsifiable conditional predictions follow from the fiscal theory?

Pronouncing that unsustainable government finances lead to a price level jump isn't informative. How does one identify unsustainability *ex ante*?

Japan might seem to be slouching toward Gomorrah. The government's debt is about 250 percent of GDP, and the primary balance has been negative since the early 90-ties. But does this does not imply that the emperor's finances are unsustainable. Note that government revenues are quite modest – about 30 percent of GDP. Hence tax rates are relatively low, and more tax revenues can in all likelihood be raised by hiking tax rates. If the private sector anticipates higher tax rates and real primary surpluses, it willingly holds the debt at its current price level.

I'm not aware of research that provides good guidance with respect to how to identify unsustainable government finances. And since shocks to the price levels, according to the fiscal theory, is due to unanticipated events that alter the expected path of government finances, it's unclear whether it's possible to predict them.

[42] I ignore the initial price level effect because what happens depends upon what's the right answer to the puzzle described below.



The fiscal theory fares better, I think, when used to conditionally predict inflation.

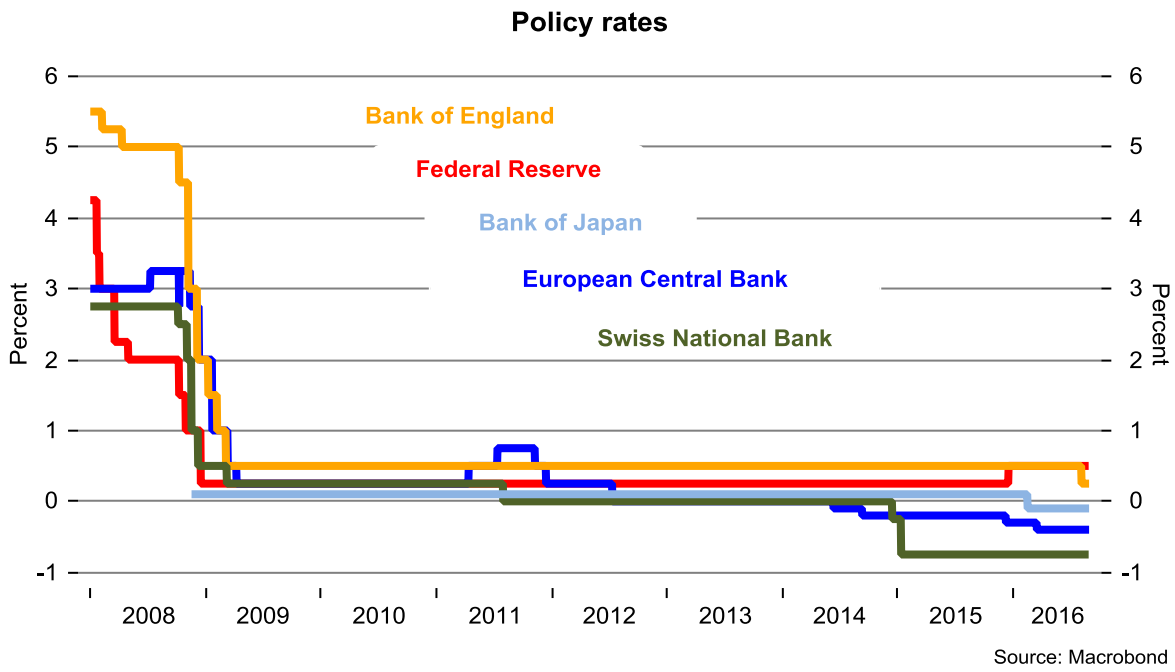
The major central banks have held their policy rates around zero since 2009, and some have pledged to keep them there for the foreseeable future. The rationale for this policy is that it's necessary to get inflation back on track. Some "hawks" fear that inflation might get out of hand.

If the fiscal theory, as outlined in this paper, is correct, such fears are misplaced. Close to zero interest rate policies imply further disinflation and eventually deflation if the spread between the nominal interest rate and the real interest rate shrinks and turns negative. And the spread likely shrinks and turn negative if policy rates remain around zero and the recovery from the recession continues.[43] Hence the "doves" risk being "vindicated" by their own "dovishness".

So here is a falsifiable conditional prediction: If present interest policies persist, and if the expansion pulls up real interest rates rise, there will be deflation.[44]

[43] I assume here that a prolonged period of rising real interest rates do not shrink the discount factor. If this is not the case, zero interest rates and an increase in real interest rates drag the price level in opposite directions. Zero interest policy implies disinflation and eventually deflation. A lower discount factor necessitates a lower real value of government debt, which pushes the price level up.

[44] The Federal Reserve hiked its policy rate 25 basis points in December 2015, and has since then signaled that an upward trajectory for the policy rate. To the extent that the central bank deliver on those signals and hikes the policy rate more than the real interest rate rises, inflation should tick up in the US.



Concluding remark

Milton Friedman wrote that monetary theory just had advanced one derivative since David Hume.[45] Hume first set out the quantitative theory of money, i.e. the idea that the price level is primarily driven by the stock of money. Friedman's point was that while Hume focused on the price level, latter day quantity theorists, i.e. monetarists, focused on the rate of change in the price level.[46] Advocates of the fiscal theory go one derivative back and question the wisdom of Hume. Inspired in part by empirical anomalies they attempt to build a new theory of the price level then and its rate of change over time. Hume, the great empiricist and sceptic, would likely have viewed that as intellectual progress.

[45] See Friedman (1975).
[46] A problem with Keynesian monetary theory, which, old and new, rightly eschews the quantity theory, is that there is no attempt to ground the inflation in a theory of the price level. Keynesian theories start with the derivative. See for example Gali (2008).

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