

Inflation, Debt, and the Zero Lower Bound

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Abstract

We analyse the macroeconomic effects of a protracted period of low and falling inflation rates when monetary policy is constrained by the zero lower bound (ZLB) on nominal interest rates and the private sector is indebted in nominal terms (debt-deflation channel). Even cost-push shocks that in normal circumstances would reduce inflation and stimulate output are found to have contractionary effects on economic activity, once the interplay of ZLB and debt deflation is considered.

JEL classification: E20; E44; E52.

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***PRELIMINARY AND INCOMPLETE. PLEASE DO NOT QUOTE.** Usual disclaimers hold. E-mail: stefano.neri@bancaditalia.it; alessandro.notarpietro@bancaditalia.it. Address: Economic Outlook and Monetary Policy Directorate, Banca d'Italia. Via Nazionale 91, 00184 Rome, Italy.

1 Introduction

Euro-area inflation reached a minimum of 0.5%, measured in annual terms, in March 2014 (Figure 1)¹; core inflation was as low as 0.7%, down from 1% only a few months earlier.

According to the March 2014 ECB staff macroeconomic projections (MPE), annual HICP inflation will be on average about 1.0% in 2014, 1.3% in 2015 and 1.5% in 2016, in a context of a broad-based weakness of the economy, a high degree of unutilised capacity and subdued money and credit creation. The latest Survey of Professional Forecasters that are periodically polled by the ECB provides a similar picture; the probability that inflation will stay below 1.4% in 2016 is assessed to be about 45%, 10 p.p. higher than in January. Against this background of falling inflation, in the course of 2013 the Governing Council reduced the rate on the main refinancing operations (MRO) by 50 basis points, to 0.25%. The reaction of the nominal 3-month money market rate was limited since, in a context of ample excess liquidity, it is anchored to the rate on the deposit facility; the latter was lowered to 0.00% in July 2012. The real 3-month money market rate, which was -1.4% in June 2013 (when inflation stood at 1.6%), increased to -0.4% in April 2014, reflecting the decline in expected inflation (Figure 2).

With low and decreasing inflation expectations, the short-term real interest rate is likely to get closer and closer to zero, implying increasingly less accommodative monetary conditions. Moreover, given that the overall size of euro-area private sector debt as a share of nominal GDP has remained broadly constant at a high level since 2009 (Figure 3), increasing real rates would imply higher real repayment costs for borrowers, thus weighing on the euro-area economic recovery. This paper analyses the macroeconomic effects for the euro area of a protracted period of low and declining inflation rates, taking into account the proximity of policy rates to their effective zero lower bound and the high level of private sector debt. In principle, the effects on the real economy of a fall in inflation may be both positive and negative. On the positive side, a lower inflation rate may support real income, just as higher inflation reduces it: "low inflation supports the real disposable income especially of those people who have a fixed nominal income" (President Draghi, Introductory Statement, 8 May 2014).

¹A lower value had only been reached in the summer of 2009. However, on that occasion inflation reflected rapidly falling oil prices effects.

The list of negative consequences is much longer.² First, a protracted fall in inflation may move the economy closer to the zero lower bound on nominal interest rates, preventing the central bank from inducing more monetary accommodation through a reduction of the policy rates, if such stimulus is needed. Second, lower inflation can hamper adjustments in the labour market. While a sufficiently high inflation rate facilitates the adjustment of real wages, low inflation may hamper it (Tobin, 1972). This is due to the downward rigidity of nominal wages; evidence of such asymmetry can be found, e.g., in the report of the Wage Dynamics Network (WDN) of the Eurosystem: both micro data and the survey carried out by the WDN point to the existence of significant downward rigidity in base wages in the EU countries. Third, lower inflation interferes with private sector debt deleveraging: "with low inflation, the real value of debt does not go down as fast as it would if inflation were higher, so it makes the adjustment of the debtors, the deleveraging, more difficult" (President Draghi, Introductory Statement, 8 May 2014). Since debt contracts are usually fixed in nominal terms, a fall in inflation increases the real debt burden for borrowers in terms of principal repayment and interest payments, and induces the private sector to reduce its amount of debt, leading to a fall in asset prices. In turn, private sector's net worth collapses, leading to a decrease in output and a further fall in inflation - which may quickly turn into deflation - and to a contraction in lending, thus generating a downward spiral. Such mechanism is known as the debt-deflation channel (Fisher, 1932, 1933). Fourth, if inflation remains low for too long, inflation expectations may de-anchor from the target: "the longer is the period, the bigger are the risks for a de-anchoring of inflation expectations" (President Draghi, Introductory Statement, 8 May 2014). While this risk may still be perceived as low, long-term (2018) inflation expectations from the Survey of Professional Forecasters of the ECB have declined in each of the last five rounds, by 0.14 p.p. to 1.8 per cent. Notably, the last two elements may interact and result in a potentially dangerous spiral. As President Draghi recently noted: "In this situation, there is a risk that disinflationary expectations take hold. This may then cause households and firms to defer expenditure in a classic deflationary cycle - especially when monetary policy is at the effective lower bound and so cannot steer the nominal rate down to compensate. In addition, an unexpected period of low inflation and low nominal income results in a higher actual and expected future real debt burden. Unless compensated for by expectations

²Bank of England (2004) provides a summary of the costs of deflation.

of higher future income, firms may reduce investment and households consumption.” The analysis in this paper focuses on two of the channels through which a fall in inflation exerts a negative impact on the real economy: the zero lower bound (ZLB) and the debt-deflation channel. The simulations are carried out with a simplified version of the model developed in Gerali, Neri, Sessa and Signoretti (2010).

2 Disentangling the effects of negative shocks to inflation

This section illustrates the responses of the economy to a negative cost-push shock to the inflation rate. The nature of the shock is such that it may or may not be accompanied by a fall in economic activity. This choice is based on two considerations. First, it resembles the current situation in the euro area, in that a sequence of negative surprises has resulted in falling inflation, while at the same time economic activity has been slowly recovering. Second, that shock encompasses consumer price movements that are not related to the output gap but are due, for instance, to the dynamics of energy and commodity prices; the current prolonged decline in inflation is indeed partly due to the moderation in the price of commodities (in euro). Under normal conditions, a cost-push shock such as the one considered here drives inflation and output in opposite directions and temporarily modifies the trade-off facing the central bank between stabilizing the inflation rate and closing the output gap. A negative cost-push shock raises real disposable income and allows consumers to buy more goods, resembling a positive supply shock that drives inflation below its steady-state level. In normal circumstances, the central bank can easily contrast the latter development by adjusting the policy rate. When this cannot be done because the ZLB is binding, the debt-deflation mechanism may result in a negative reaction of economic activity, as shown by the simulations below. In order to illustrate how the transmission of a negative inflation shock is affected by the state of the economy, the following cases are considered. First, it is assumed that the central bank can freely adjust the nominal interest rate in response to the shocks. Second, the impulse responses of the main macroeconomic variables are compared to those obtained when all debt contracts are indexed to the inflation rate, so that unexpected changes in inflation do not affect the real cost of servicing debt. The comparison aims at highlighting the relative contribution of the debt-deflation channel to the transmission

of the shock. Third, it is assumed that the central bank is constrained by the ZLB, so that the policy rate can be barely reduced after the shock. Finally, also in the latter case the response of the economy with indexed debt contracts is investigated. The simulations carried out in this paper are meant to be only illustrative and do not provide a necessarily accurate quantification of the macroeconomic effects of a declining inflation rate in the euro area in the current situation. However, they clearly signal that the interaction between the debt-deflation channel and the ZLB is likely to result in a negative cost-push shock to inflation having negative effects on the economy.

2.1 The model

The economy is composed of three types of agents: patient households, impatient households and entrepreneurs. Impatient households and entrepreneurs act as net borrowers, facing borrowing constraints that link the value of their collateral (housing and the capital stock, respectively) to the maximum amount of funds they can obtain from patient households (the savers).³ Debt is issued in the form of one-period contracts. When debt contracts are fixed in nominal terms, unexpected changes in inflation cause ex-post fluctuations in the real interest rate paid by borrowers. The economy features nominal and real rigidities.⁴ Monetary policy is set by the central bank; in normal times it adjusts the policy rate according to a Taylor-type rule that is a function of output growth and inflation.

2.2 A negative cost-push shock under normal conditions

Figure 4 reports the responses of inflation and the policy rate to a negative inflation shock (green line; all results are in terms of deviations from the baseline, which coincides with the steady-state). Inflation falls on impact by between 20 and 30 basis points and gradually returns to steady state. The central bank lowers the policy rate and the real interest falls. Consumption, investment and output rise above their steady-state levels for more than two years (Figures 5 and 6). With debt contracts indexed to the inflation rate (blue line), the effects of the shock are qualitatively similar;

³The model does not include a banking sector, but rather assumes that lenders directly finance borrowers.

⁴Nominal rigidities are introduced in the form of price and wage stickiness. Real rigidities include habit formation in consumption and adjustment costs on investment.

the response of consumption and output is somewhat more front-loaded (Figures 5 and 6, solid blue line). The difference is due to the redistribution effect induced by the change in inflation: with nominal debt contracts, the initial fall in inflation results in a transferring of wealth from the borrowers to the lenders, who are more patient and do not immediately increase consumption and investment. Therefore, when debts contracts are indexed, the response of consumption and investment is more rapid. The initial increase in output is larger and the response of the demand components is less persistent (Figures 5 and 6).

2.3 A negative cost-push shock at the zero lower bound

This subsection considers the case in which the central bank cannot adjust the policy rate in response to the shock. Short-term rates are assumed to be at very low levels, so that the room for further downward adjustment is almost nil; this resembles the current situation in the euro area. Given the ZLB, the real interest rate increases after a negative cost-push shock, thus counteracting the expansionary effects on aggregate demand of the decrease in the price level. The debt-deflation channel operates as an amplification mechanism: the higher real level of debt and hence real repayment cost reduces the disposable income of the borrowers and induces a fall in asset prices and in the value of collateral, resulting in an acceleration of the deleveraging process. In such circumstances, consumption and investment fall, reflecting the transfer of wealth from borrowers to lenders (Figure 5, grey line). The overall effect on output becomes negative (Figure 6), as opposed to what is observed when the central bank can lower the policy rate. If debt contracts are indexed to the inflation rate, the effects on output are still negative but comparatively small (Figure 6, dashed red line): the real value of outstanding debt remains unchanged. However, the higher real interest rates still reduce aggregate demand, inducing a fall in asset prices and a decline in the value of collateral. A clear message emerges from these simulations. A shock that drives inflation and output in opposite directions when the interest rate is free to react can instead induce a fall in both variables at the ZLB. In addition, the combination of the ZLB with the debt-deflation channel amplifies the contractionary effects on economic activity. Some observations are in order. First, the assumption of one-period debt contracts implies that all existing debt is rolled over in each period and the issuance of new bonds

immediately adjusts to the shock. With longer debt maturities, the effects of a negative inflation shock on economic activity may be stronger and more persistent. Second, the model does not include the possibility of default for borrowers. Therefore, unexpected variations in the real cost of servicing debt only affect consumption and investment decisions, but do not trigger any choice over debt restructuring. Including the latter may imply that prolonged periods of falling inflation rates at the ZLB would increase the probability of default, so that the contractionary effects of the initial shock could be further magnified. Finally, two features of the model are particularly relevant for the transmission of the shock. On the nominal side, the presence of downward wage rigidity may alter the impact of the shock and modify the response of inflation and output. A sensitivity analysis was performed by varying the degree of nominal wage stickiness in the simulations where the debt-deflation channel is at work and monetary policy is constrained by the zero lower bound. The baseline case (in which wages are adjusted every 5 quarters) is compared to an alternative set up in which the adjustment takes place every 2 quarters. The effects of varying the degree of nominal wage rigidity are limited. A thorough modelling of downward wage rigidities may shed more light on this issue.⁵ On the real side, a relevant role is played by the degree of private sector indebtedness. Two parameters are particularly relevant: the loan-to-value (LTV) ratios and the relative share of indebted agents in the economy. Sensitivity analysis was carried out by varying these two parameters. The results of the simulations remain valid. Clearly, with a lower LTV ratio, the deleveraging effect induced by the shock has a smaller impact on the economy; both inflation and output fall by a smaller amount compared to the baseline case. Analogously, a smaller share of indebted agents in the economy acts reduces the amplification of the shock to inflation.

3 Conclusions

We analyse the possible macroeconomic consequences of a prolonged period of falling inflation when the economy is close to the zero lower bound (ZLB) on nominal interest rates and the private sector is indebted in nominal terms. The interaction of the ZLB and the debt-deflation channel can turn upside down the implications of a "good" shock, i.e., a shock that in normal

⁵See Fahr and Smets (2010) on the role of downward wage rigidity in a monetary union.

circumstances would lower the inflation rate and expand economic activity. Given that current macroeconomic conditions in the euro area are arguably closer to the case in which the economy is at the ZLB and the debt-deflation channel is at work, further negative shocks to euro area inflation may imply a contraction of economic activity and a decline of inflation to levels close to zero.

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Figure 1. HICP Inflation in the euro area and contribution of components

(monthly data; 12-month percentage changes and percentage points)

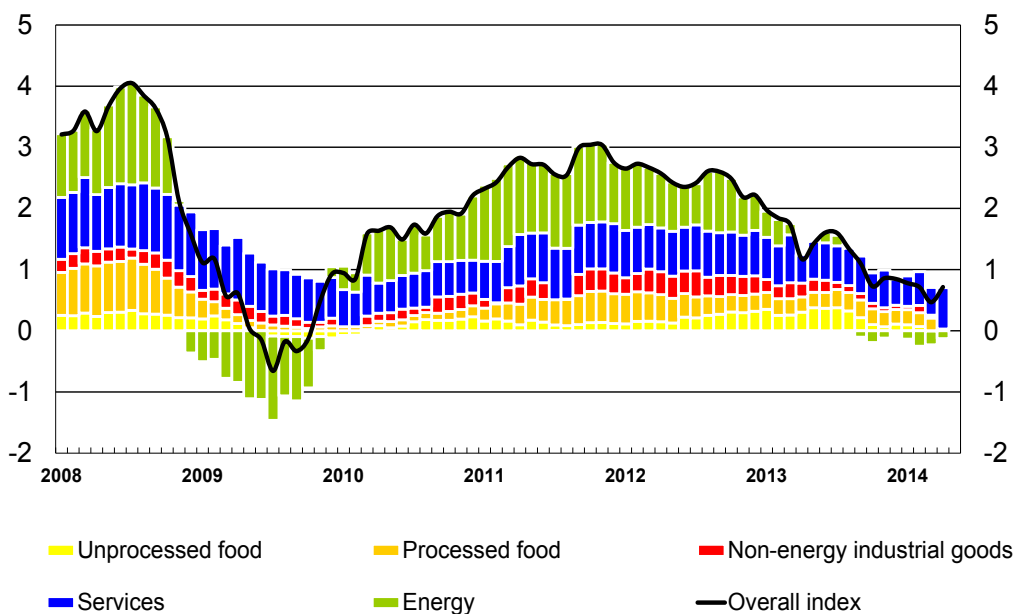
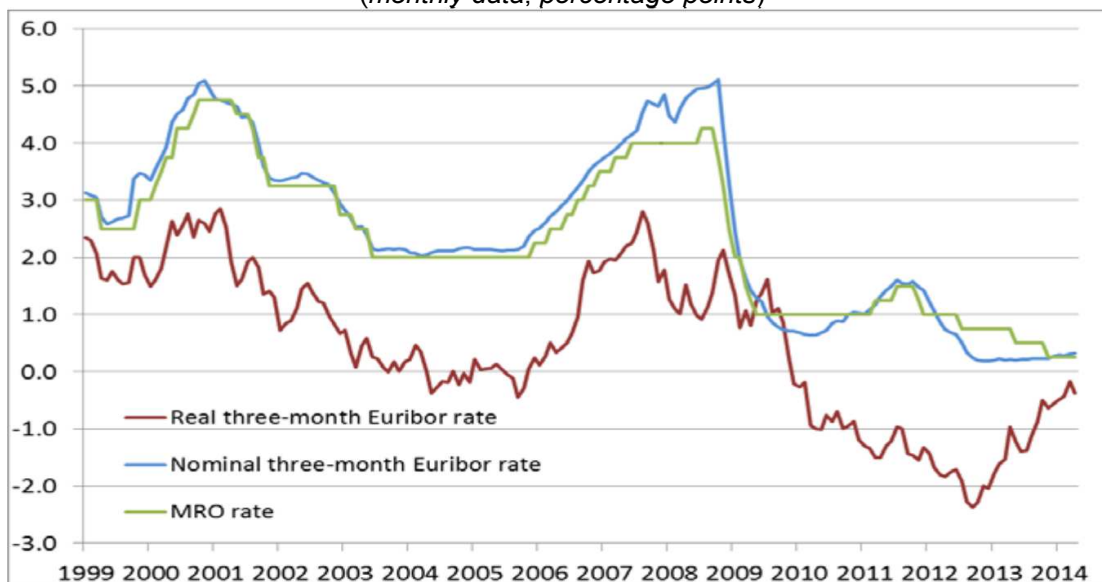


Figure 2. Nominal and real short-term money market rate

(monthly data; percentage points)



Note: the real rate is calculated as the nominal Euribor rate minus one-quarter ahead inflation expectations from Consensus Economics (linearly interpolated at monthly frequency).

Figure 3. Real interest rate and private sector debt

(quarterly data)

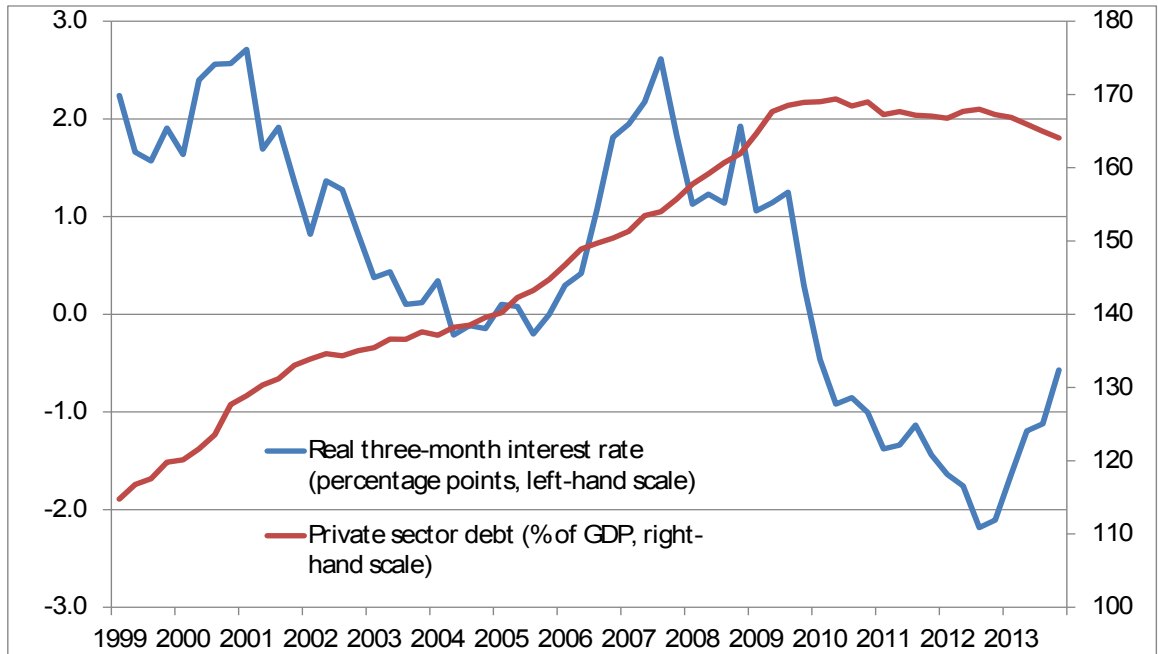


Figure 4. Response of inflation and policy rate

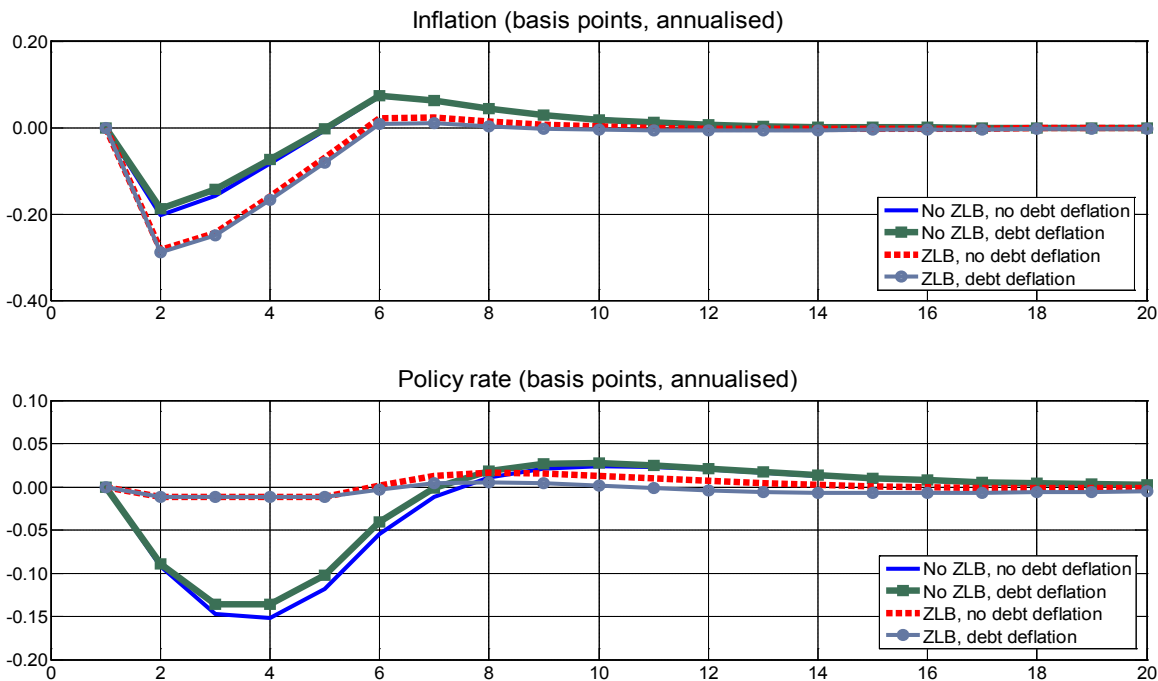


Figure 5. Responses of consumption and investment

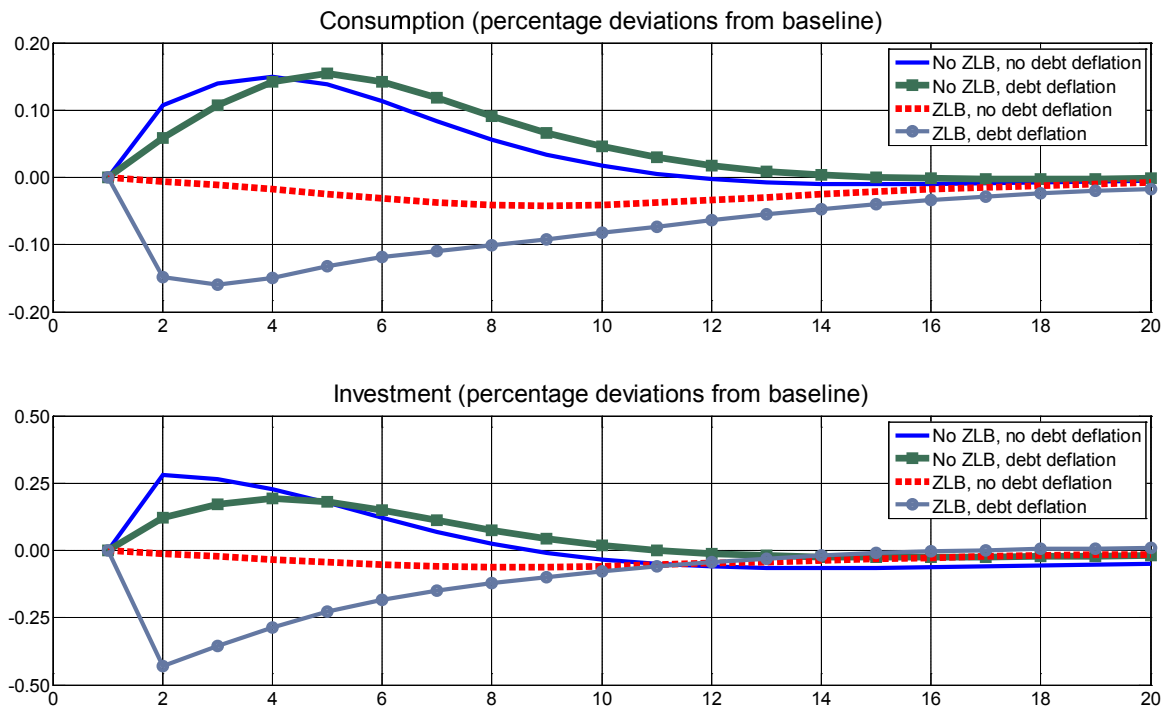


Figure 6. Response of output

