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# Short Run Effects of Fiscal Policy on GDP and Employment: Swedish Evidence

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## Swedish Evidence[1]

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# Abstract

Since the financial crisis, there has been a surge in theoretical and empirical studies on the macroeconomic effects of fiscal policy. Moreover, the protracted state of low demand since 2008 together with constrained monetary policy have put emphasis on non-linear effects of fiscal policy. In this paper, we use a newly published quarterly Swedish data set on fiscal variables and estimate the effects on GDP and employment for the period 1980q1–2015q3. We examine the linear and non-linear short run effects of shocks to government consumption, investments, transfers to households, indirect taxes on consumption goods and direct taxes on household income. We find that fiscal policy generally has Keynesian effects although often insignificant. The multipliers are on average greater when estimated during the period of flexible exchange rate, 1993q1–2015q3. Shocks to government investments were found to have the greatest effect on both GDP and employment. Looking at non-linear effects it was interestingly found that all three fiscal spending variables have rather substantial positive effects on employment in slumps while the employment effects of shocks to taxes are small indeed. However, the non-linear results are sensitive both to the instrument used and the definition of "slump".

# Sammanfattning

Sedan finanskrisen har ett stort antal teoretiska och empiriska studier publicerats kring finanspolitikens makroekonomiska effekter. Dessutom har den långa perioden av lågkonjunktur tillsammans med penningpolitiska begränsningar medfört ett ökat fokus på icke-linjära effekter av finanspolitik. I denna studie används nypublicerad kvartalsdata för finanspolitiska variabler i Sverige och kortsiktiga effekter på BNP och sysselsättning för perioden 1980q1–2015q3 estimeras. Linjära och icke-linjära effekter av störningar till offentlig konsumtion, offentliga investeringar, transfereringar till hushåll, indirekta skatter på konsumtionsvaror och direkta skatter på hushåll analyseras. Vi finner att finanspolitik generellt har Keynesianska effekter även om dessa ofta inte är signifikanta. Multiplikatorerna är i genomsnitt större när perioden med rörlig växelkurs, 1993q1–2015q3, estimeras. Störningar till offentliga investeringar har störst effekt på både BNP och sysselsättning. När det gäller icke-linjära effekter är ett intressant resultat att störningar till samtliga tre utgiftsvariabler har relativt stora positiva effekter på sysselsättningen i lågkonjunkturer medan sysselsättningseffekterna av störningar till skatter har mycket små effekter. När det gäller icke-linjära effekter av finanspolitik på BNP är resultaten däremot känsliga både för vilken finanspolitisk variabel som studeras och definitionen av lågkonjunktur.

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# 1 Introduction

Before the financial crisis, the consensus view both at academic and policy institutions was that monetary policy is responsible for stabilizing the economy and that fiscal policy should only act through automatic stabilizers. This view has come to be challenged with increasing strength the last decade as central banks in several countries have struggled to restore full employment. Furman (2016) compares "The Old View" with "The New View" and offers the most recent description of how the tide is about to turn among an increasing number of economists.

The financial crisis and its aftermath with high unemployment and, due to the zero lower bound (ZLB), constrained monetary policy are important reasons for the surge in both theoretical and empirical studies on fiscal multipliers. In theory, there are straightforward reasons for non-linear fiscal multipliers, e.g. depending on the degree of idle resources in the economy and/or due to central banks being constrained by the ZLB (see e.g. Eggertsson and Krugman, 2012, Erzeg and Lindé, 2014 and Canzoneri et al., 2016). The empirical evidence on non-linear multipliers depending on the state of the business cycle is, however, mixed and varies across methods and fiscal instruments (see, among others, Auerbach and Gorodnichenko, 2012, 2013, Baum et al., 2012, Gechert and Rannenberg, 2014, Huidrom et al., 2016, Jordà and Taylor, 2016, and Ramey and Zubairy, 2014, 2016).

In this paper, commissioned by the Swedish government, we estimate linear and non-linear fiscal multipliers in the Swedish economy using newly released quarterly data on fiscal variables starting in 1980. Based on the request of the government, the study focus on short run multipliers of GDP and employment and considers the impact of the state of the business cycle. We mainly apply the Blanchard and Perotti (2002) approach to identify structural fiscal policy shocks. The GDP and employment multipliers are calculated using the Jordà (2005) methodology which only recently has been applied to fiscal policy (see Auerbach and Gorodnichenko, 2012, 2013, Jordà and Taylor, 2016 and Ramey and Zubairy, 2014, 2016). This method is recommended for calculating impulse-response functions by Ramey (2016) in a chapter in Handbook in Macroeconomics (forthcoming).

We examine GDP and employment multipliers stemming from shocks to five fiscal policy variables (all for general government): consumption, investments, transfers to households, indirect taxes on private consumption goods and direct taxes on households. We also calculate multipliers arising from changes in the cyclically adjusted budget balance. Furthermore, we extend the Jordà (2005) methodology and examine the sensitivity of the results to the inclusion of exogenous contemporaneous variables in the estimation of multipliers.

The paper is structured as follows. In Section 2, we describe the methodology to identify structural fiscal policy shocks and to calculate multipliers. In Section 3, we describe the data – both fiscal and macroeconomic variables. In Sections 4 and 5, we present the estimated GDP and employment multipliers, respectively, and compare the results with previous studies. Finally, Section 6 concludes.

# 2 The methodology

Different approaches have been used to measure the effects of fiscal policy on economic aggregates, like GDP or employment. One approach is to identify fiscal policy shocks using large-scale structural macroeconomic models, see e.g. Christiano et al. (2011). Here we make use of the more frequently employed approach to estimate Vector Autoregressive (VAR) models to assess the effects of fiscal policy shocks on the economy. A variety of techniques have been used to identify the effects of fiscal policy using VAR models and in Section 2.1 we describe, and motivate our choices. When the shocks have been identified the question remains how to calculate fiscal multipliers. In this study we use the Local Projection approach proposed by Jordà (2005) to calculate the multipliers. This method is described in Section 2.2 and the data transformations used in this study are discussed in Section 2.3.

## 2.1 Identification of structural fiscal shocks

There are at least three frequently adopted approaches to identify policy shocks in the literature on VAR models.

Following the work of Ramey and Shapiro (1998), parts of the literature have tried to avoid the identification problem inherent in structural VAR (SVAR) analysis and have instead examined fiscal episodes which can be seen as exogenous with respect to the state of the economy.[2] The idea behind this approach, often referred to as the "narrative approach", is that if these fiscal episodes are truly exogenous and unanticipated there is no need to impose other potentially controversial identifying assumptions: a reduced form regression is sufficient. The drawback is that other, potentially important, shocks are not controlled for which may weaken the identification of the fiscal shock (see e.g. Caldara and Kamps, 2008).

Another approach, advocated by e.g. Mountford and Uhlig (2005), identifies fiscal policy shocks via sign restrictions on the impulse responses. Unlike the recursive approach and the Blanchard-Perotti approach (described below), the sign restrictions approach does not impose linear restrictions on the contemporaneous relation between reduced-form and structural disturbances. Rather, restrictions are imposed directly on the shape of the impulse responses and the results from this approach relies therefore strongly on the rather subjective choice of the form of the impulse responses. By simulating a large number of impulse responses and throwing away those that do not have the same shape as the predetermined ones, typically a majority of the potentially important draws are rejected (see e.g. Canova, 2007).

Because of the drawbacks of the above approaches, and the lack of big Swedish exogenous events to build narrative cases on, our identification of fiscal policy shocks is mainly based on the methodology originally proposed by Blanchard and Perotti (2002).[3] The main idea is to exploit fiscal policy decision lags to identify discretionary

[2] Using US data, these fiscal episodes typically consist of the Korean war military buildup, the Vietnam war buildup, and the Reagan fiscal policy expansion.

[3] Following e.g. Blanchard (1993) and Alesina and Ardagna (2009), we also examine the effect on GDP to changes in the cyclically adjusted budget balance, see Section 4.

fiscal policy shocks, which are unaffected by the macroeconomic variables in the VAR model.

To exemplify, consider a VAR model in reduced form:

$$X_t = C(L)X_{t-1} + U_t, \qquad (1)$$

where $C(L)$ is a lag polynomial of order $L$, $X_t = [\, G_t \quad T_t \quad Y_t \quad R_t]'$ are government consumption ($G$), direct taxes ($T$), GDP ($Y$) and the real interest rate ($R$). $U_t$ is a vector of reduced-form residuals, $U_t = [u_t^G \quad u_t^T \quad u_t^Y \quad u_t^R]'$. The variance-covariance matrix $\sum = E[uu']$ is, however, not diagonal which means that we cannot identify the effects of a shock to, say, government consumption on GDP in this specification. That is, a shock to government consumption will also affect other variables in the VAR system because of the (non-zero) covariances. This identification problem is solved here using the method proposed by Blanchard and Perotti (2002). It is standard in the literature to identify shocks by introducing contemporary restrictions on the vector $U_t$ in order to derive a vector of structural shocks $V_t$, orthogonal to each other and to the variables in the model. The following relationship applies between $U_t$ and $V_t$ (see Amisano and Giannini, 1997):

$$AU_t = BV_t, \qquad (2)$$

where the matrix $A$ describes the contemporary relationship between the variables and the matrix $B$ describes the linear relationship between the reduced-form residuals and structural ones. In this case, we can write (2) as:[4,5]

$$\begin{bmatrix} 1 & -\alpha_T^G & -\alpha_Y^G & -\alpha_R^G \\ -\alpha_G^T & 1 & -\alpha_Y^T & -\alpha_R^T \\ -\alpha_G^Y & -\alpha_T^Y & 1 & -\alpha_R^Y \\ -\alpha_G^R & -\alpha_T^R & -\alpha_Y^R & 1 \end{bmatrix} \begin{bmatrix} u_t^G \\ u_t^T \\ u_t^Y \\ u_t^R \end{bmatrix} = \begin{bmatrix} \beta_G^G & \beta_T^G & \beta_Y^G & \beta_R^G \\ \beta_G^T & \beta_T^T & \beta_Y^T & \beta_R^T \\ \beta_G^Y & \beta_T^Y & \beta_Y^Y & \beta_R^Y \\ \beta_G^R & \beta_T^R & \beta_Y^R & \beta_R^R \end{bmatrix} \begin{bmatrix} v_t^G \\ v_t^T \\ v_t^Y \\ v_t^R \end{bmatrix}. \, (3)$$

The reduced-form residuals have little economic significance in this case because they are linear combinations of the structural shocks. Especially, the reduced form fiscal shocks $u_t^G$ and $u_t^T$ are assumed to be linear combinations of three types of "underlying" shocks, namely:

- *Automatic stabilizers*. How taxes and spending "automatically" react to changes in GDP.
- *Systematic discretionary fiscal policy*. Active fiscal policy response to the change in GDP.
- *Random discretionary fiscal policy*. Uncorrelated "true" structural shocks.

[4] To identify the system in equation (3) with $k = 4$ variables, $2 * 4^2 - \frac{4(4+1)}{2} = 22$ restrictions are needed, see Lütkepohl (2005).

[5] In the recursive approach (so called Cholesky decomposition), primarily used prior to Blanchard and Perotti (2002), A is a lower triangular matrix and B is an identity matrix.

Then contemporaneous relationship between the two fiscal variables is modelled through the structural shocks, that is, $\alpha_T^G = \alpha_G^T = 0$ in equation (3). The reduced form fiscal shocks $u_t^G$ and $u_t^T$ can then be decomposed as:

$$u_t^G = \alpha_Y^G u_t^Y + \alpha_R^G u_t^R + \beta_T^G v_t^T + v_t^G$$
$$u_t^T = \alpha_Y^T u_t^Y + \alpha_R^T u_t^R + \beta_G^T v_t^G + v_t^T,$$

where the coefficients $\alpha_Y^G$ and $\alpha_Y^T$ capture both the automatic response of economic activity to government spending and taxes and any systematic discretionary adjustment of the fiscal policy in response to unexpected movements in GDP. The coefficients $\beta_T^G$ and $\beta_G^T$ measure how the structural shock to government spending and direct taxes contemporaneously affects taxes and spending, respectively.

The main interest of this study is to study the response of GDP (and employment) to the structural shocks $v_t^G$ and $v_t^T$. To identify these two structural shocks we need to impose further restrictions on the system above. Here we make use of the observation made by Blanchard and Perotti (2002) that it takes policymakers more than a quarter to react to a GDP shock. Given that we are using quarterly data, this virtually eliminates the possibility of contemporary discretionary fiscal policy adjustments to GDP shocks and $\alpha_Y^G$ and $\alpha_Y^T$ only capture the automatic elasticity of the government spending and direct taxes to GDP.

Due to the correlation between the reduced-form residuals and the structural shocks, it is not possible to estimate $\alpha_Y^G$ and $\alpha_Y^T$ by OLS. Reduced-forms of residuals in government consumption and direct taxes can however be displayed in the form of cyclically adjusted reduced innovations:

$$u_t^{G,adj} = u_t^G - \left(\alpha_Y^G u_t^Y + \alpha_R^G u_t^R\right) = \beta_T^G v_t^T + v_t^G$$
$$u_t^{T,adj} = u_t^T - (\alpha_Y^T u_t^Y + \alpha_R^T u_t^R) = \beta_G^T v_t^G + v_t^T .$$

Due to the quarterly frequency, $\alpha_R^G = \alpha_R^T = 0$ and, following e.g. Flodén (2009) and Cugnasca and Rother (2015), we use the elasticities for $\alpha_Y^G$ and $\alpha_Y^T$ proposed in Giorno et al. (1995) for the period 1980q1–1994q4, Girouard and André (2005) for the period 1995q1–2004q4 and Mourre et al. (2014) for the period 2005q1–2015q3.[6]

To identify this system we need to make a decision about the order of the fiscal variables. If we want to impose the restriction that government spending decisions come first, we need to set $\beta_T^G = 0$, whereas if we want tax decisions to come first we set $\beta_G^T = 0$. Perotti (2002) argues that neither of the alternatives has any theoretical or empirical basis. Assuming that $\beta_T^G = 0$, the cyclically adjusted reduced shocks are:

$$u_t^{G,adj} = v_t^G$$

and

$$u_t^{T,adj} = \beta_G^T v_t^G + v_t^T .$$

[6] An HP trend, using λ=1 600, was used to smooth the $\alpha{:}s$.

The structural shock $v_t^T$ can be recovered by estimating the above relationship with OLS and using the residuals. The $AB$ matrix in (3) may now be written as:

$$\begin{bmatrix} 1 & 0 & -\alpha_Y^G & 0 \\ 0 & 1 & -\alpha_Y^T & 0 \\ -\alpha_G^Y & -\alpha_T^Y & 1 & 0 \\ -\alpha_G^R & -\alpha_T^R & -\alpha_Y^R & 1 \end{bmatrix} \begin{bmatrix} u_t^G \\ u_t^T \\ u_t^Y \\ u_t^R \end{bmatrix} = \begin{bmatrix} \beta_G^G & 0 & 0 & 0 \\ \beta_G^T & \beta_T^T & 0 & 0 \\ 0 & 0 & \beta_Y^Y & 0 \\ 0 & 0 & 0 & \beta_R^R \end{bmatrix} \begin{bmatrix} v_t^G \\ v_t^T \\ v_t^Y \\ v_t^R \end{bmatrix}. \quad (4)$$

The identified structural shocks for the five fiscal instruments (government consumption, government investments, transfers, indirect taxes and direct taxes), using the structural VAR (SVAR) method described in this section, are shown in Figure 52–Figure 61 in Appendix B.[7]

## 2.2 Estimation of impulse responses, Local Projections

Jordà (2005) proposes a method to calculate impulse responses from shocks identified in various models and has recently been used to study the effects of fiscal policy.[8] The method is called "Local Projection" (LP) and is recommended in a forthcoming chapter in the Handbook of Macroeconomics (Ramey, 2016). To see how it works, we assume that we have identified a vector of structural shocks, $shock_{t-h}^g$ for government consumption, $g_t$, from e.g. the structural VAR model in Section 2.1. To calculate the effect on GDP, $y_t$, we estimate equation (5) by OLS:

$$y_t = \alpha_{t-h}^y + \beta_{t-h}^y(L) * shock_{t-h}^g + \gamma_{t-h-1}^y(L) * C_{t-h-1} + \mu_{t-h}^y * trend_{t-h}, \quad (5)$$

where $C$ is a vector of control variables, see Appendix C.[9,10] The estimated parameters $\beta_{t-h}^y$ show how GDP is affected in period $t$ by a shock to government consumption in period $t-h$. By estimating $h$ OLS regressions and forming a vector for $\beta_{t-h}^y$, $h = 1, \dots, n$, we get the impulse responses. This compares with the corresponding shocks identified by other methods, i.e. $shock_{t-h}^g$ is replaced and a new $\beta_{t-h}^y$ vector is obtained. The LP method has the following properties and advantages:

- The control variables on the right hand side in (5) are "free of choice" but must remain the same when the impulse responses from various methods of structural shocks are compared.

[7] For government consumption and direct taxes, we estimate four variable VARs as displayed in the text. For the other three fiscal instruments, we estimate five variable VARs including the fiscal variable in question plus government consumption, direct taxes, GDP and the real interest rate.

[8] See Jordà and Taylor (2016), Ramey and Zubairy (2014, 2016) and Auerbach and Gorodnichenko (2012, 2013).

[9] The full equations with control variables are given in Appendix C.

[10] The results reported in this paper seem relatively robust to other specifications, e.g. adding export market growth, inflation measures, weighted output gaps, adding more/fewer lags, removing the real interst rates. The results are available from the authors upon request.

- Included variables and the number of lags are selected with information criteria as recommended by Ramey and Zubairy (2014).

- The variable on the left hand side of (5) does not need not be expressed on the same form as the right hand side variables. That is, the variable on the left hand side of (5) might be expressed in log levels and be a function of e.g. variables expressed as shares of potential GDP.

- Lagged values of the structural shock are included in order to take care of autocorrelation (Ramey, 2016).

- Confidence bands for the impulse responses are easily calculated using the estimated standard errors of $\beta^{y}_{t-h}$.

- The LP model is based on the literature of "direct forecasting", see Bhansali (2002) for an overview. This literature has shown that the method is consistent and that the forecasting performance is better than alternatives, see Jordà (2005).

- In a VAR model, impulse responses are non-linear functions of the VAR parameters. This is optimal if the VAR model represents the true data generating process (DGP). Monte Carlo simulations in Jordà (2005) show that efficiency losses are small even if the VAR would be the true DGP.

- When the VAR model is not the true DGP the specification errors get worse the longer the horizon of the impulse response function (IRF), see Phillips (1998). The Jordà method puts no restrictions on the IRFs and is therefore less vulnerable to model misspecification, see Ramey and Zubairy (2014).

- A major advantage with the LP method which deserves further explanation is that LP easily enables estimation of non-linear multipliers. For instance, to estimate the difference between the multipliers in recessions and booms, positive and negative shocks or small and big shocks. This can be analyzed within the LP framework by estimating equation (6) by OLS:[11]

$$\begin{aligned} y_t = \; & I_{t-h-1}\left[\alpha^{y}_{t-h} + \beta^{y}_{t-h}(L) * shock^{g}_{t-h} + \gamma^{y}_{t-h-1}(L) * C_{t-h-1}\right] \\ & +(1 - I_{t-h-1})\left[\alpha'^{y}_{t-h} + \beta'^{y}_{t-h}(L) * shock^{g}_{t-h} + \gamma'^{y}_{t-h-1}(L) * C_{t-h-1}\right] \\ & +\mu^{y}_{t-h} * trend_{t-h}, \qquad (6) \end{aligned}$$

where $C$ is a vector of control variables, $I_{t-h-1}$ is a dummy variable that indicates which "state" that the economy is in, e.g. $I_{t-h-1} = 1$ if the economy is in a recession and vice versa. The multipliers in "state" $I_{t-h-1}$ and $(1 - I_{t-h-1})$ are $\beta^{y}_{t-h}$ and $\beta'^{y}_{t-h}$ respectively.

[11] It is also possible to allow the dummy variable to be a smooth transition between two different states, see Auerbach and Gorodnichenko (2012). However, in this approach one must make assumptions about when to switch from one state to the other. Auerbach and Gorodnichenko (2012) calculate their impulse responses under the assumption that the economy stays in its current state for at least 20 quarters. Ramey and Zubairy (2014) criticize this assumption and the method has not been employed here.

There are also disadvantages using the LP method, see Ramey and Zubairy (2014):

- Since there are no restrictions on how the IRFs are related on the horizons $h, h+1, \ldots$, the LP method loses efficiency and can become irregular, oscillatory and imprecise when the horizon increases. However, Owyang et al. (2013b) shows that it is only after 16 quarters that the IRFs become ineffective.[12]

- Observations are lost using the LP method. When the horizon is extended one step, one observation is lost etc.

## 2.3 Data transformations

In order to be able to directly read the size of the multiplier of the estimates, Ramey (2016) recommends expressing GDP, employment and fiscal variables (but not the shocks) as:

$$Z_t = log(X_t) \qquad (7)$$

and/or as shares of potential GDP:

$$Z_t = {X_t}/{Y_t^*} \qquad (8)$$

$Z_t$ is deflated by the GDP deflator and $Y_t^*$ is potential GDP based on a quadratic trend. The impulse responses using transformation (8) look qualitatively similar to those using log levels in equation (7), but often have more narrow confidence bands (Ramey, 2016). Multipliers calculated on data in log levels are vulnerable to trending relationships between fiscal variables and GDP, but transformation (8) is sensitive to the subjective choice of $Y_t^*$, see the discussion in Owyang et al. (2013a). In this paper the log specification is our main choice as Swedish fiscal variables are not trending as shares of GDP for the period studied. On occasions we employ and compare both transformations.[13]

# 3 Data

In the study, we use newly released quarterly Swedish data on fiscal variables for the period 1980q1–2015q3.[14]. We consider six fiscal variables (all concerning general government): consumption, investments, transfers to households, direct taxes on households, indirect taxes on consumption goods and the change in two measures of the cyclically adjusted budget balance (CAB). All variables but the CAB are deflated by the

[12] Therefore, there should be no problem for the purpose of this paper which focuses on multipliers on shorter horizons, see Section 4.2.

[13] Transformation (8) is used when GDP effects of changes in cyclically adjusted budget balance is examined.

[14] The data is official statistics from Statistics Sweden and was released in May 2015, see SCB (2016).

GDP deflator and seasonally adjusted using Tramo-Seats. The fiscal data are displayed in logarithms and as shares of potential GDP in Figure 35-Figure 44 in Appendix A.

In the estimations we also use six macroeconomic variables: GDP, employment, real interest rate, OECD output gap and two Swedish output gaps – one from NIER (see Hjelm and Jönsson, 2010, Section 2.2) and one using a HP filter ($\lambda = 1600$). These are displayed in Figure 45-Figure 51 in Appendix A.

# 4 GDP multipliers

First we define the cumulative GDP multiplier in Section 4.1. In Section 4.2 we compare the multipliers stemming from the entire sample (1980q1–2015q3) with those from the flexible exchange rate period (1993q1–2015q3). In Section 4.3, we extend the Jordà (2005) framework to include a contemporary exogenous variable (OECD output gap). In Section 4.4 we analyze how the multipliers are affected by the state of the business cycle. Finally, the results are compared with previous studies in Section 4.5.

## 4.1 Definition

In the literature there are unfortunately no consensus on how multipliers, $m$, should be defined. The following three options are the most common:

- "The peak multiplier" compares the maximum effect of a variable (here $y$ in period $h$) of a shock to a variable (here: $g$) that takes place in period 0, that is:

$$m^{max} = \frac{\Delta y_h^{max}}{\Delta g_0}.$$

- "The impact multiplier" analyzes the initial effect in period 0:

$$m^{imp} = \frac{\Delta y_0}{\Delta g_0}.$$

- "The cumulative multiplier" compares the integral of the effect on two variables of a shock:

$$m_h^{cum} = \frac{\sum_{t=0}^{h} \Delta y_t}{\sum_{t=0}^{h} \Delta g_t}. \qquad (9)$$

The cumulative multiplier has subscript $h$, and is thus a vector of cumulative multipliers covering successively longer periods of time. According to e.g. Fisher and Peters (2010), Ramey (2016) and Uhlig (2010), the cumulative multiplier is preferable to the alternatives and is our main choice in this study. The cumulative multiplier answers the relevant policy question: "how is cumulative production affected by a certain cumulative change in government spending or taxes"?

To calculate the cumulative multiplier with respect to GDP, $y_t$, using the Local Projection framework and the logarithmic specification outlined in Section 2.2, the following regressions are estimated:

$$ln\, y_t = \alpha^y_{t-h} + \beta^y_{t-h}(L) * shock^g_{t-h} + \gamma^y_{t-h-1}(L) * C_{t-h-1} + \mu^y_{t-h} * trend_{t-h} \quad (10)$$

$$ln\, g_t = \alpha^g_{t-h} + \beta^g_{t-h}(L) * shock^g_{t-h} + \gamma^g_{t-h-1}(L) * C_{t-h-1} + \mu^g_{t-h} * trend_{t-h}, \quad (11)$$

where $\beta^y_{t-h}$ and $\beta^g_{t-h}$ show how GDP and government consumption, $g_t$, are affected in period $t$ of a shock to government consumption in period $t-h$. The cumulative multiplier is calculated in line with (9) above, multiplied by the relative size of GDP ($\bar{y}/\bar{g}$). Thereby the multiplier is hence defined as the cumulative GDP response in Swedish kronor (SEK) divided by the cumulative government consumption response in SEK (see equations (10) and (11)):[15,16]

$$m^{cum}_h = \left(\frac{\bar{y}}{\bar{g}}\right)\left(\frac{\sum_{t=0}^{h}\beta^y_{t-h}}{\sum_{t=0}^{h}\beta^g_{t-h}}\right) = \left(\frac{\bar{y}}{\bar{g}}\right)\left(\frac{\sum_{t=0}^{h}\Delta ln(y_t)}{\sum_{t=0}^{h}\Delta ln(g_t)}\right). \quad (12)$$

## 4.2 The role of the exchange rate regime

The newly released quarterly data on Swedish fiscal variables starts the first quarter of 1980. Hence, the sample (1980q1–2015q3) covers two exchange rate regimes: the fixed exchange rate regime 1980q1–1992q4 and the flexible exchange rate regime 1993q1–2015q3. In theory, the effect of fiscal policy is smaller in a flexible exchange rate regime as an expansionary fiscal policy in general implies a contractionary monetary policy response which strengthens the exchange rate. There is also some empirical evidence supporting this prediction (see, e.g., Ilzetki et al., 2013).

It is important to remember, however, that it is not only the exchange rate regime that differs between the two estimation periods. The structure of the Swedish economy – the credit market, the institutions on wage formation, the fiscal framework, the tax system etc. – has changed to a great extent between the two periods, which may also affect the multipliers. Due to policy relevance, we are primarily interested in the size of the multipliers in the current regime. Nevertheless, including results for the entire sample can give additional insights.

We that believe the logarithmic transformation of the data is preferable (see Section 2.3). For comparison, results from two other common types of estimations are shown

[15] The term $\bar{y}/\bar{g}$ is not used when calculating cumulative multipliers stemming from the transformation in equation (8).

[16] It is possible to calculate confidence bands for the cumulative multiplier, see Ramey (2016). In this paper, we have chosen only to calculate confidence bands for the step $h$ multipliers in equations (10) and (11), see Appendix D for $h = 0 - 11$.

in this section: Local Projection with variables as a share of potential GDP[17] and Blanchard and Perotti's (2002) SVAR with variables in logarithms.

As outlined in the Introduction, we focus on short run effects of fiscal policy. Multipliers up to 8 quarters (corresponding to horizon 0–7 in the figures) are shown in the main text. Eight quarters approximately coincides with the number of quarters the fiscal variables respond significantly to its own shock. For example, a shock to government consumption has a significant effect on government consumption for about 8 quarters (see Figure 3 below).[18] Moreover, the confidence bands of GDP responses often widens considerably after two years (see Figure 4 below).

### GOVERNMENT CONSUMPTION

Using the Local Projection method, the cumulative multiplier is greater for all three specifications in the period with a flexible exchange rate (see Figure 1 and Figure 2). In our preferred logarithmic specification, the multiplier after 8 quarters (i.e. horizon 7 on the x-axis) is about 1 when considering the entire sample and slightly above 1,6 in the flexible exchange rate period (see the thick, solid lines). A cumulative multiplier of 1,6 after 8 quarters implies that the cumulative increase in GDP is 1,6 times greater than the cumulative increase in government spending during the same period (see equation (12)).

These findings are roughly in line with the results of the specifications when we divide the variables with potential GDP (see the dashed lines). The SVAR-multiplier is however considerably lower when considering the entire sample while being only slightly lower than the two other specifications during the flexible exchange rate period.

**Figure 1 Cumulative GDP multiplier**
Entire sample: 1980q1-2015q3

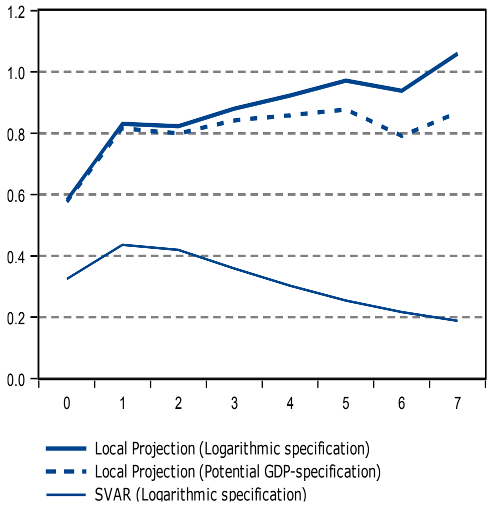
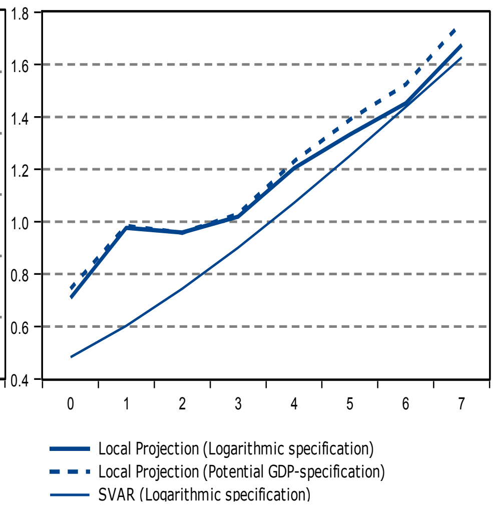



**Figure 2 Cumulative GDP multiplier**
Flexible exch. rate period: 1993q1-2015q3




[17] Potential GDP is taken from NIER, see Section 2.3 in Hjelm and Jönsson (2010) for a description of that measure.

[18] The size of the response is declining as the horizon increases and is close to zero after 8 quarters in the majority of the estimations. Hence, the shock has only temporary effects on the level of the fiscal variable in question.

In Figure 3 and Figure 4, we show the point estimates that are used to calculate the cumulative multipliers (i.e. $\beta_{t-h}^{y}, \beta_{t-h}^{g}$ from equations (10) and (11)). In Figure 3, the response of government spending to a government spending shock is significant for about 8 quarters (i.e. horizon 7 on the x-axis). This is a common pattern for the other responses of fiscal variables to their own respective shocks. Moreover, although the GDP response to a government spending shock is not significant at any horizon at the 95 percent level in Figure 4, the uncertainty around the estimates increases considerably after 8 quarters. This is also a common pattern for the GDP point estimates stemming from other fiscal shocks. In Appendix D, point estimates including 95 percent confidence bands up to 12 quarters are shown.[19]

**Figure 3 Government consumption**
Point estimate, percent

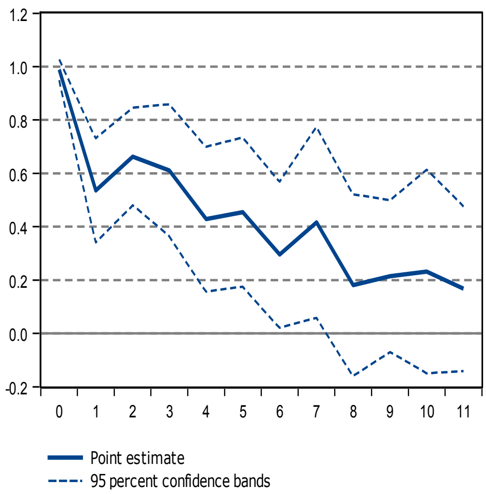
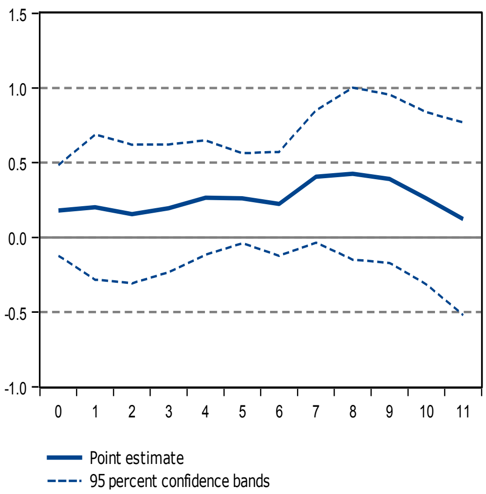



**Figure 4 GDP**
Point estimate, percent




#### GOVERNMENT INVESTMENTS

As for government consumption, we find that the multiplier of government investments is greater during the period with flexible exchange rate (see Figure 5 and Figure 6). The difference between the two periods is however much greater. The multiplier for our preferred logarithmic specification during the flexible exchange rate regime is about 2 after 8 quarters compared to about –0,4 for the entire sample (see the thick, solid lines).[20] The same apply for the other two specifications, the cumulative GDP multiplier is larger in the flexible exchange rate period.

[19] Longer horizons can be received from the authors on request.

[20] For the point estimates including confidence bands, see Figures 88 and 89 in Appendix D.

**Figure 5 Cumulative GDP multiplier**
Entire sample: 1980q1-2015q3

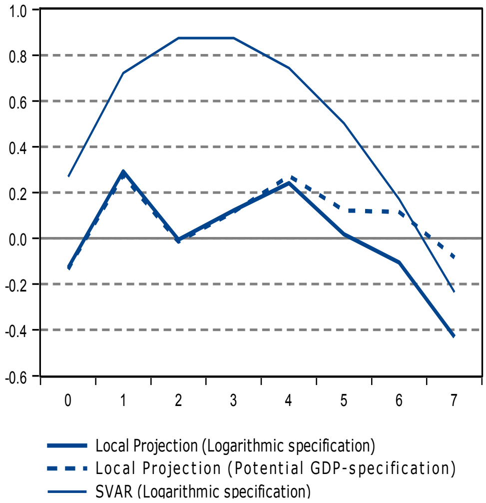
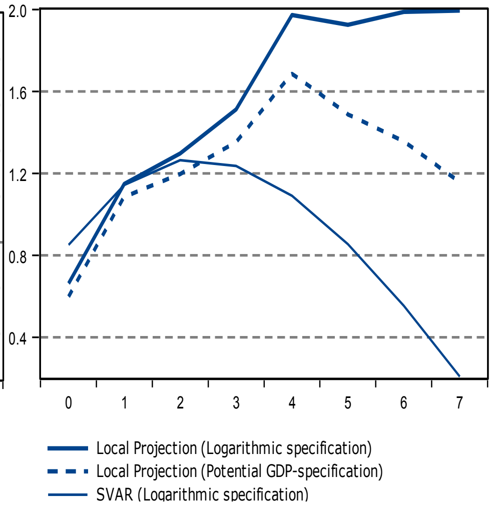



**Figure 6 Cumulative GDP multiplier**
Flexible exch.rate period: 1993q1-2015q3




### TRANSFERS TO HOUSEHOLDS

Contrary to consumption and investments, the GDP multiplier of shocks to transfers is smaller during the flexible exchange rate period (see Figure 7 and Figure 8). This is true at all horizons for the two Local Projection models. The cumulative multiplier is about 2,3 and 1,5, respectively, after 8 quarters when using our preferred logarithmic specification.[21] The result from the SVAR model is more ambiguous. The GDP multiplier is similar on impact for the two samples but diminishes when using the entire period unlike the GDP multiplier for the flexible exchange rate period that instead increases.

**Figure 7 Cumulative GDP multiplier**
Entire sample: 1980q1-2015q3

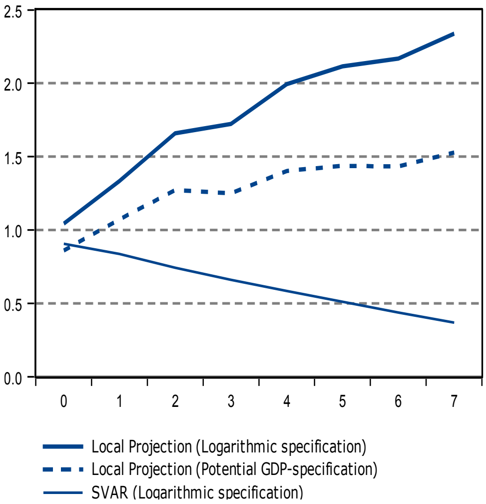
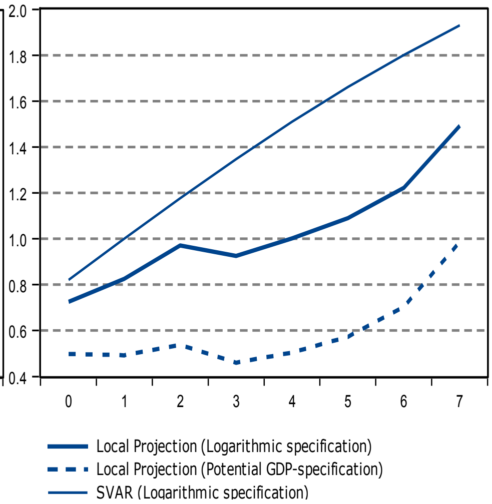



**Figure 8 Cumulative GDP multiplier**
Flexible exch.rate period: 1993q1-2015q3




[21] For the point estimates including confidence bands, see Figures 90 and 91 in Appendix D.

#### INDIRECT TAXES ON CONSUMPTION GOODS

The GDP multipliers associated with shocks to indirect taxes on consumption goods are shown in Figure 9 and Figure 10. For the sake of consistency, we have put a minus sign on the responses so that a positive multiplier continues to refer to a Keynesian response. Using our preferred logarithmic specification, the multiplier is greater at all horizons in the flexible exchange rate period. After 8 quarters the multiplier is about 2 compared to about 1 in the entire sample.[22]

**Figure 9 Cumulative GDP multiplier**
Entire sample: 1980q1-2015q3

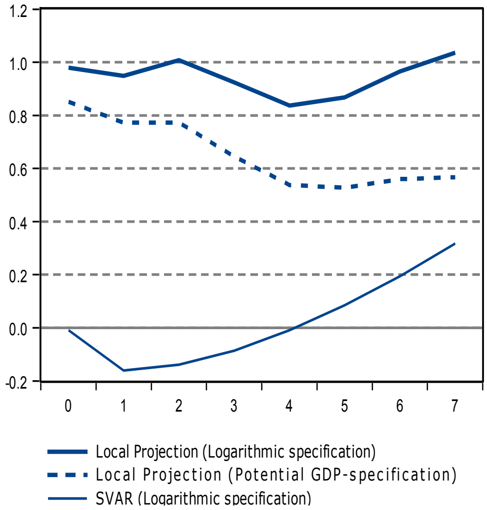
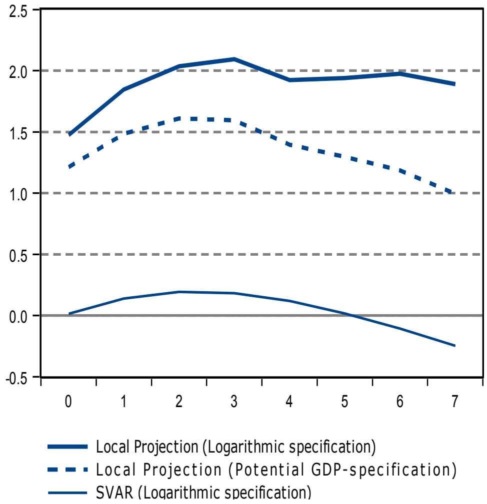



**Figure 10 Cumulative GDP multiplier**
Flexible exch.rate period: 1993q1-2015q3




#### DIRECT TAXES ON HOUSEHOLDS

So far, the multipliers associated with shocks to consumption, investments, transfers and indirect taxes have all been Keynesian. That is, GDP has been increasing (decreasing) after expansionary (contractionary) fiscal shocks. We now turn to the effects of tax shocks on households and, as for indirect tax shocks above, put a minus sign on the responses so that a positive GDP response still refers to a Keynesian multiplier. A negative shock to direct taxes increase GDP in the short run (see thick, solid lines in Figure 11 and Figure 12), but the multiplier turns non-Keynesian after 4–5 quarters for our preferred specification.[23] In Section 4.3 we elaborate more on this result and find alternative specifications where the non-Keynesian results are less pronounced.

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[22] The point estimates are significantly non-zero on impact in both cases, see Figures 94 and 95 in Appendix D.

[23] The point estimates are also significantly non-zero, see Figures 92 and 93 in Appendix D.

**Figure 11 Cumulative GDP multiplier**
Entire sample: 1980q1-2015q3

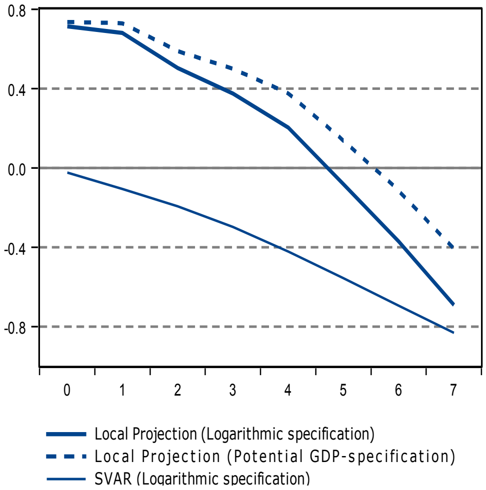
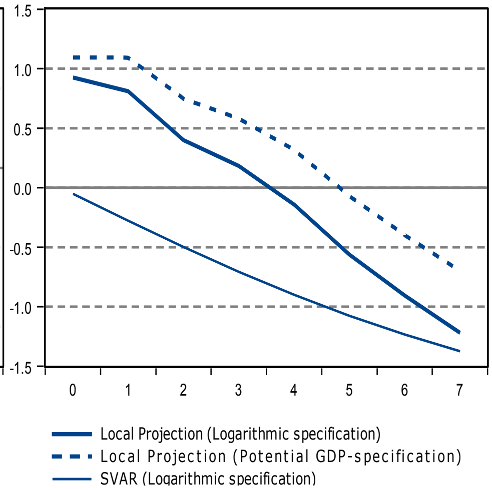



**Figure 12 Cumulative GDP multiplier**
Flexible exch.rate period: 1993q1-2015q3




### CYCLICALLY ADJUSTED BUDGET BALANCE

We now turn to examining how changes in the cyclically adjusted budget balance (CAB) affect GDP. As is evident from the results so far, GDP multipliers vary depending on fiscal instruments. As changes in the CAB cannot be derived to a specific fiscal policy instrument, it is probably of less value for policy makers. Still, multiplier analysis of changes in CAB is rather common in the literature (see, among others, Alesina and Perotti, 1995, Alesina and Ardagna, 2009, and Fatàs and Summers, 2016).

Like the output gap, there are several measures of the CAB. We consider two of them and compare the results. The first is based on Blanchard (1993). This method calculates what the budget balance would have been in period $t$ if unemployment, $U$, had been the same as in period $t-1$. That is, we estimate:

$$\left(\frac{CAB}{Y^*}\right)_t = \alpha_0 + \alpha_1 * Trend + \alpha_2 * U_t + \varepsilon_t,$$

where $Y^*$ is potential GDP from NIER (see Hjelm and Jönsson, 2010). Then we calculate:

$$\left(\frac{CAB}{Y^*}\right)_t^{U(t-1)} = \widehat{\alpha_0} + \widehat{\alpha_1} * Trend + \widehat{\alpha_2} * U_{t-1} + \widehat{\varepsilon_t}.$$

The fiscal shock is then defined as:

$$Fiscal\ shock_t = \left(\frac{CAB}{Y^*}\right)_t^{U(t-1)} - \left(\frac{CAB}{Y^*}\right)_{t-1}.$$

The second method, suggested in this paper, constructs a time-varying budget elasticity, $\beta_t$, defined as the sum of government consumption, investments and transfers divided by GDP. The CAB is then defined as:

$$\left(\frac{CAB}{Y^*}\right)_t = \left(\frac{BB}{Y}\right)_t + \beta_t * Output\ gap_t,$$

where $BB$ is the budget balance of the general government less one-off effects and the output gap is NIER's measure (see Hjelm and Jönsson, 2010, Section 2.2).[24] The fiscal shock is then defined as the change in CAB.

$$Fiscal\ shock_t = \Delta\left(\frac{CAB}{Y^*}\right)_t$$

Figure 13 and Figure 14 show the cumulative GDP multipliers for the Blanchard (1993) and NIER methods for the entire sample and the flexible exchange rate period, respectively.[25] The cumulative multipliers are small and often non-Keynesian when applying the entire sample. The multipliers turn Keynesian when considering the flexible exchange rate period only, which is consistent with a weighted composite of the five fiscal instruments examined above.[26] The two cumulative multipliers are about 0,7 and 0,4, respectively, at horizon 7 (see Figure 14).

**Figure 13 Cumulative GDP multiplier**
Entire sample: 1980q1-2015q3

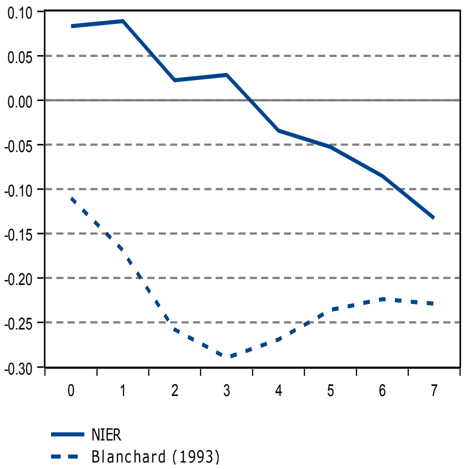
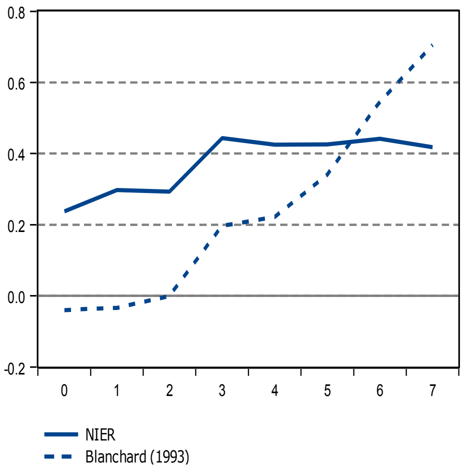



**Figure 14 Cumulative GDP multiplier**
Flexible exch.rate period: 1993q1-2015q3




Summing up the results concerning time period and exchange rate regime, we have found that:

- There are some notable differences between multiplier estimates stemming from the entire sample and the flexible exchange rate period.
    - GDP multipliers are greater and more Keynesian for shocks to consumption, investments and indirect taxes during the latter period. The biggest difference is for government investments. Flexible exchange rate periods should, in theory, be associated with *lower* multipliers not higher as we find here. As discussed in Section 4.2, however, there are several other institutional differences in the economy between the periods which may affect the multipliers.

---

[24] Examples of one-off effects are unexpected windfall gains from insurances in local governments and periodization of the EU fee.

[25] In these estimations, variables are expressed as a share of potential GDP in line with the definitions of the CAB measures.

[26] We show weighted composite calculations in Section 4.5 (Table 3) when comparing the results with previous studies.

  - The multiplier is smaller during the flexible exchange rate period for the two instruments directly affecting the disposable income of households: transfers and direct taxes.
- Multipliers are, with a few exceptions, greater when using the Local Projection method compared to the SVAR approach.
- There are no clear patterns concerning the difference in the magnitude of multipliers between our preferred logarithmic specification and the specification with variables expressed as shares of potential GDP. For the rest of this paper, we will only focus on the logarithmic specification.[27]

## 4.3 Effect of including the contemporary OECD output gap

In Section 2.2, the Local Projection method to calculate multipliers was outlined (see equation (5) and (6)). A fundamental ingredient in this method is that the right hand side variables are measured up to period $t-h-1$ (except the structural shock which has subscript $t-h$) when estimating the multiplier at horizon $h$. This type of specification has so far been applied in the literature (Auerbach and Gorodnichenko, 2012, 2013, Jordà, 2005, Jordà and Taylor, 2016, Ramey and Zubairy, 2014, 2016). In this section, we suggest an extension to this set-up, arguably potentially important for small open economies like Sweden.

It is clear that the development of the world economy is independent of the Swedish economy. It is also clear that the reverse is *not* true – the development of the Swedish economy is very dependent of the development in the world economy. This fact together with the standard Local Projection specification can potentially pose a problem when estimating multipliers.

Assume that, either by choice or by coincidence, politicians with some degree of regularity have chosen an expansionary (contractionary) fiscal policy when the world economy is supposed to be improving (deteriorating). Not controlling for the development in the world economy in such periods means that the estimated multiplier will be too high (low).

The following two examples – both during the flexible exchange rate regime – are illustrative in the Swedish case. First, direct taxes increased by over 1,5 percent of potential GDP as part of the Swedish consolidation 1994–1998. At the same time, the OECD output gap improved by about 2 percentage points. Second, a substantial tax reform was pursued during the years 2007–2012 and direct taxes decreased by over 2 percent of potential GDP. At the same time the OECD output gap deteriorated by about 5 percentage points due to the financial crisis. These two occurrences cover a great deal of the flexible exchange rate period starting in 1993. If not controlling for the OECD output gap, it is likely that GDP multipliers associated with shocks to direct taxes will be underestimated.

[27] Parallel results when defining variables as shares of potential GDP can be received from the authors on request.

In order to reduce this problem, we extend the Jordà (2005) framework with a measure of the business cycle in the world economy, here an output gap of the OECD, up to period $t$ (see equation (5b) below). As the OECD only publishes output gaps at yearly frequency, we apply a HP filter on quarterly data on GDP for the OECD as a whole for 1980q1–2015q3. The modified Local Projection specification is hence:

$$lny_t = \alpha_{t-h}^{y} + \beta_{t-h}^{y}(L) * shock_{t-h}^{g} + \gamma_{t-h-1}^{y}(L) * C_{t-h-1} + \delta_t^{y} * OECDgap_t + \mu_{t-h}^{y} * trend_{t-h}, \quad (5b)$$

where $C$ is a vector of control variables. In Figure 15–Figure 20, we compare the multipliers stemming from the flexible exchange rate period above in Section 4.2 with the ones we get using the extended specification in equation (5b). The inclusion of the OECD output gap affects the size of the multipliers, often to a non-negligible extent. For shocks to government consumption, investments, transfers and indirect taxes, the GDP multipliers are smaller, especially at longer horizons. The difference is greatest for shocks to indirect taxes (see Figure 19) and the smallest difference, and with opposite sign, is for changes in CAB.

Contrary to the other fiscal measures, the effects of shocks to direct taxes get more Keynesian when including the OECD output gap (see Figure 18). This result is in line with the above hypothesis concerning the timing of the tax increases (1994–1998) and tax decreases (2007–2012) during the flexible exchange rate period. The GDP multiplier is however still non-Keynesian at longer horizons when we include the OECD output gap (see dashed line). As will be apparent in the next section where we estimate non-linear multipliers, the results are often sensitive to the method chosen for calculating the output gap. In order to highlight this sensitivity, we also show the effects of including another measure of the OECD output gap when estimating GDP multipliers of shocks to direct taxes. The alternative measure is derived by interpolating the yearly output gap series published by the OECD to a quarterly frequency. The GDP multiplier then becomes even more Keynesian (see thin, solid line in Figure 18).[28]

Summing up the results when including the OECD output gap, we can note that with one exception (direct taxes), including the OECD output gap decrease the estimated multiplier. This implies that, for four out of five fiscal instruments, expansionary (contractionary) fiscal shocks have coincided with booms (slumps) in the OECD economy. When including the OECD output gap, the multipliers of shocks to direct taxes instead turn more Keynesian, especially when using OECD's definition of the output gap. We believe that this is due to the timing of large tax increases and decreases during the flexible exchange rate period.

Although we believe that the inclusion of the OECD output gap in the LP regressions is appropriate and improves the estimates, we will continue to show parallel results without the OECD output gap. The reason is that the inclusion of contemporaneous exogenous variables has not been applied using the method by Jordà (2005) before.

[28] Multipliers stemming from the other four fiscal variables are not that sensitive to choice of OECD output gap. They all get somewhat less Keynesian when including any of the two definitions of the OECD output gap.

**Figure 15 Cumulative GDP multiplier**
Shock to government consumption

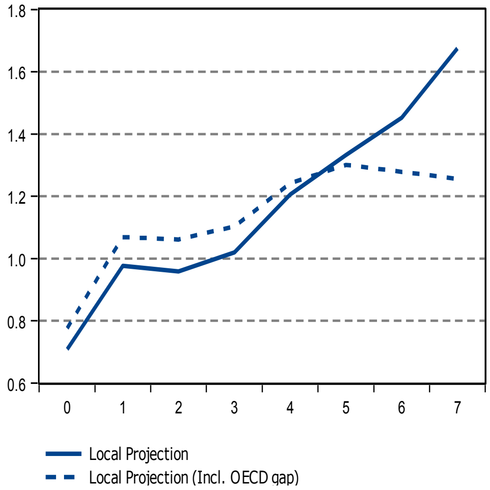



**Figure 16 Cumulative GDP multiplier**
Shock to government investments

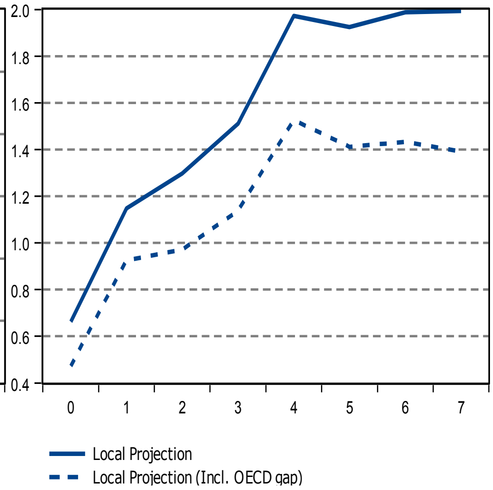



**Figure 17 Cumulative GDP multiplier**
Shock to transfers

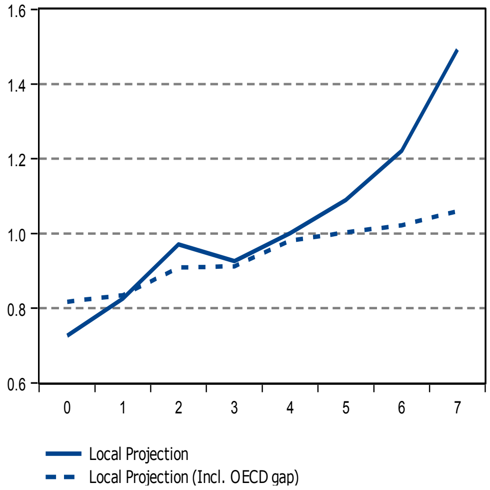



**Figure 18 Cumulative GDP multiplier**
Shock to direct taxes

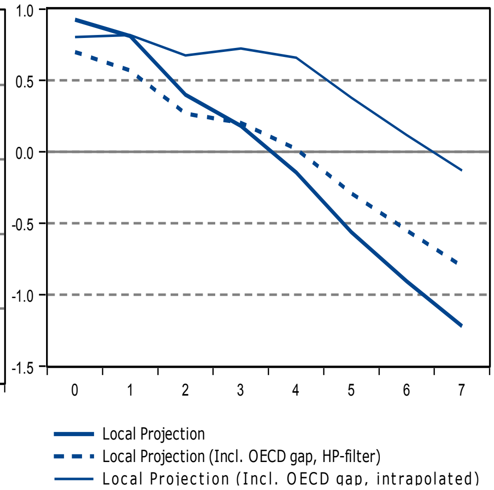



**Figure 19 Cumulative GDP multiplier**
Shock to indirect taxes

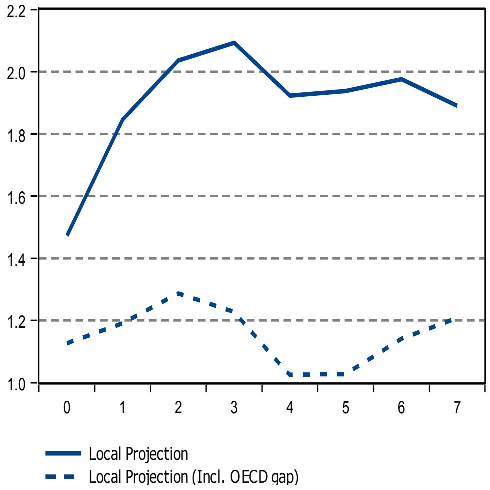
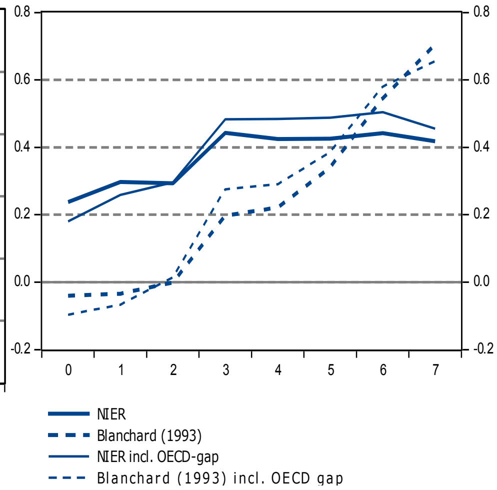



**Figure 20 Cumulative GDP multiplier**
Change in CAB



## 4.4 Non-linear multipliers due to the business cycle

The literature on estimation of non-linear multipliers has expanded greatly since the financial crisis (see, among others, Auerbach and Gorodnichenko, 2012, 2013, Baum et al., 2012, Caggiano et al., 2015, Gechert and Rannenberg, 2014, Huidrom et al., 2016, Jordà and Taylor, 2016, and Ramey and Zubairy, 2014, 2016). In theory, the case for non-linear multipliers is rather straightforward – the greater amount of idle resources in the economy and the more mute monetary policy response, the lesser crowding out and hence the larger multipliers.

Although this line of reasoning has been confirmed in several empirical studies, it is no consensus in the empirical literature. For example, in a meta study, Gechert and Rannenberg (2014) find that the GDP multipliers of some fiscal instruments (government consumption and transfers) increase in slumps while others GDP multipliers decrease (investments and taxes). Other studies not supporting higher multipliers in slumps are Caggiano et al (2015) and Ramey and Zubairy (2014, 2016), where the latter authors raise econometric issues that question the finding that multipliers are considerable higher in slumps by Auerbach and Gorodnichenko (2012, 2013).

When controlling for the business cycle, some authors control for upturns and downturns, i.e. the change in the output gap (see, e.g., Auerbach and Gorodnichenko, 2012, 2013). Others focus on the level of the output gap, i.e booms and slumps (see, e.g., Baum et al., 2012). In the meta study by Gechert and Rannenberg (2014), studies using the level and the change in the output gap are lumped together.

We examine how slumps affect the multiplier estimates in this paper. As the results previously have been shown to be sensitive to the definition of the output gap (see Ramey, 2016), we present parallel results using two estimates: one based on a HP filter and another based on NIER's method (see Appendix A).[29] As will be evident, the size of the multipliers in slumps is rather sensitive to the choice of output gap (and thereby the definition of 'slump').

We continue to focus on the flexible exchange rate period as it is more relevant for the purpose of this paper, i.e. being a useful basis for today's policy makers in Sweden.[30] We also continue to focus on our preferred specification, i.e. the Local Projection method with variables expressed in logarithms.[31] We include parallel estimates with and without the inclusion of a contemporaneous (HP filter based) OECD output gap in the Local Projection specification.

#### GOVERNMENT CONSUMPTION

Cumulative multipliers are shown in Figure 21 (OECD output gap not included) and Figure 22 (OECD output gap included).[32] First thing to note is that the non-linearity

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[29] If the output gap based on the HP filter is negative, the observation is coded as a "slump". The same is true when the NIER output gap is smaller than –1,8 which is the average during the flexible exchange rate period. The NIER output gap is described in Hjelm and Jönsson (2010, Section 2.2).

[30] Parallell results for the entire sample can be received from the authors on request.

[31] Parallell results using the specification in which the variables are expressed as share of potential GDP can be received from the authors on request.

[32] The corresponding point estimates including confidence bands up to 12 quarters are available upon request.

of the GDP multiplier stemming from shocks to government consumption is sensitive to the measure of the output gap – a finding that will be repeated for other fiscal shocks. Applying the HP filter, the GDP multiplier is greater in slumps at most horizons, especially when including the OECD output gap in the regressions. On the contrary, the multiplier is, with a few exceptions, smaller in slumps when applying the NIER measure of the output gap.

**Figure 21 Cumulative GDP multiplier**
OECD output gap not included

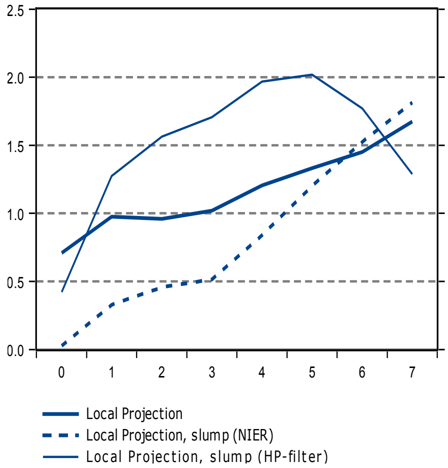
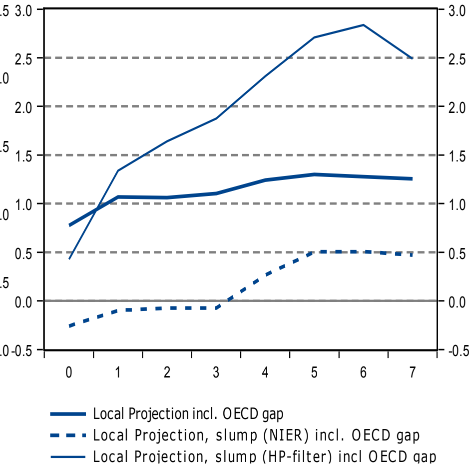



**Figure 22 Cumulative GDP multiplier**
OECD output gap included




### GOVERNMENT INVESTMENTS

As for government consumption, the effects of shocks to government investments are sensitive to the output gap measure (see Figure 23 and Figure 24). The multiplier is somewhat lower using the NIER measure while it is considerably higher using the HP filter approach to define slumps.

**Figure 23 Cumulative GDP multiplier**
OECD output gap not included

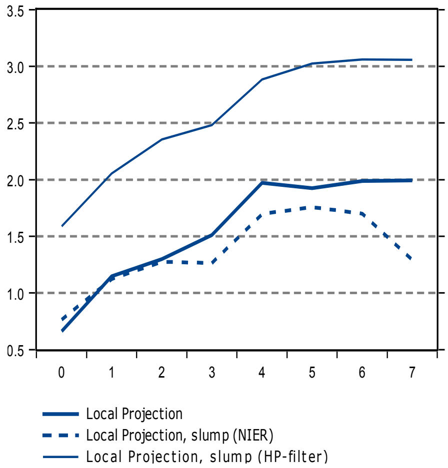
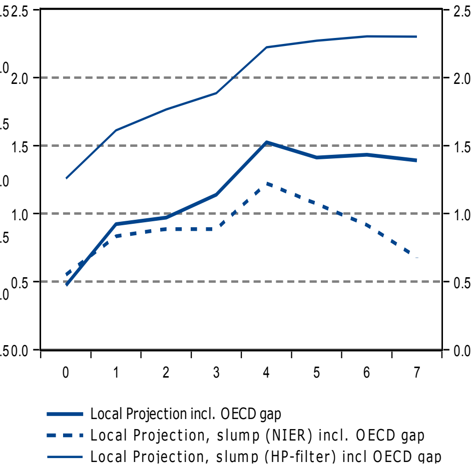



**Figure 24 Cumulative GDP multiplier**
OECD output gap included




### TRANSFERS TO HOUSEHOLDS

Contrary to shocks to consumption and investments, the multipliers of shocks to transfers are lower when the HP filter output gap is negative (see Figure 25 and Figure 26). This time, the NIER output gap shows the same pattern as the gap based on the HP filter.

**Figure 25 Cumulative GDP multiplier**
OECD output gap not included

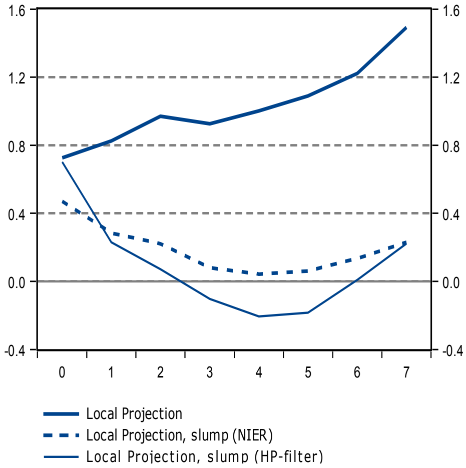
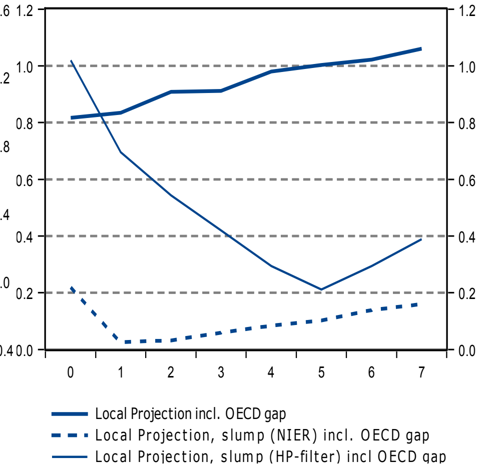



**Figure 26 Cumulative GDP multiplier**
OECD output gap included




## INDIRECT TAXES ON CONSUMPTION GOODS

Turning to indirect taxes, the picture is mixed and sensitive to both the definition of the Swedish output gap and the inclusion of the OECD output gap in the Local Projection regressions. When not including the OECD output gap (see Figure 27), the multiplier is greater in slumps using both output gap measures. However, when controlling for the OECD output gap (see Figure 28), the multiplier is only greater in slumps when we apply the NIER definition of the output gap.[33]

**Figure 27 Cumulative GDP multiplier**
OECD output gap not included

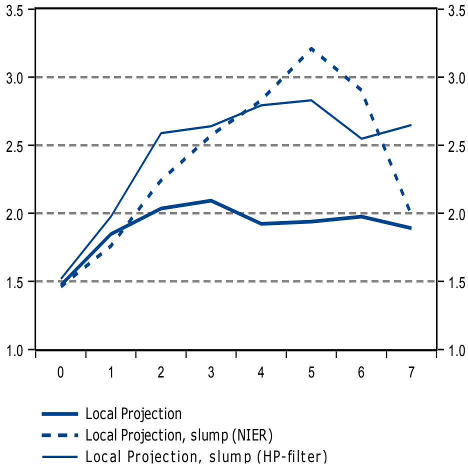
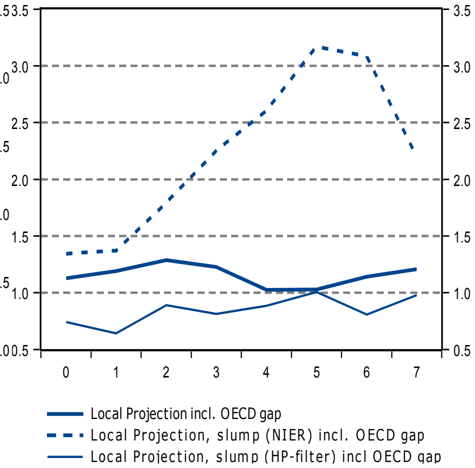



**Figure 28 Cumulative GDP multiplier**
OECD output gap included




## DIRECT TAXES ON HOUSEHOLDS

The results are also sensitive to the output gap definition for shocks to direct taxes. Using the NIER measure, negative output gaps are associated with larger multipliers whereas the multiplier is not affected that much when applying the HP filter (see Figure 29 and Figure 30).

[33] The point estimates are generally significantly non-zero on impact. Figures are available upon request.

**Figure 29 Cumulative GDP multiplier**
OECD output gap not included

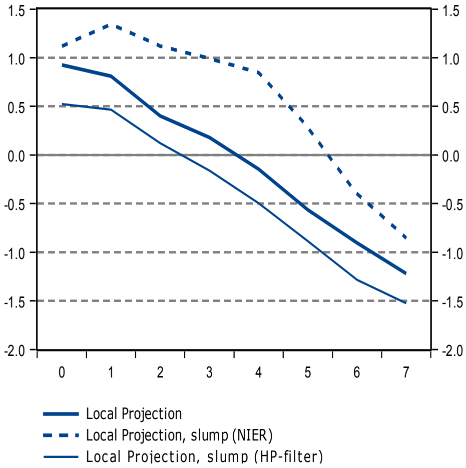
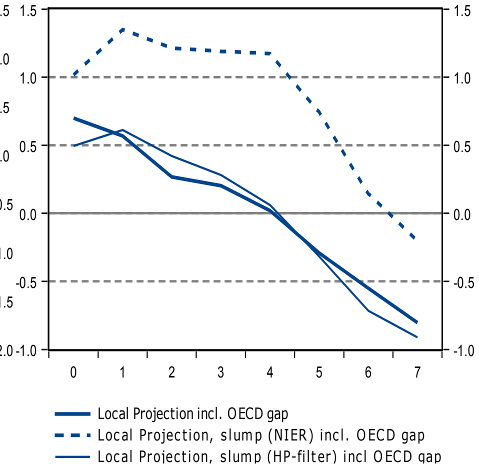



**Figure 30 Cumulative GDP multiplier**
OECD output gap included




**CYCLICALLY ADJUSTED BUDGET BALANCE**

Finally, we examine the effect of changes in the cyclically adjusted budget balance (CAB). We continue to use the two measures of CAB described in Section 4.2. Using the HP filter, the multiplier is larger in slumps when not including the OECD output gap (see Figure 31 and Figure 33) and about the same when including the OECD output gap (see Figure 32 and Figure 34).

When using the NIER measure of the output gap, the multiplier is considerably lower when including the OECD output gap (see Figure 32 and Figure 34)).

**Figure 31 Cumulative GDP multiplier**
Blanchard's (1993) CAB measure.
OECD output gap not included

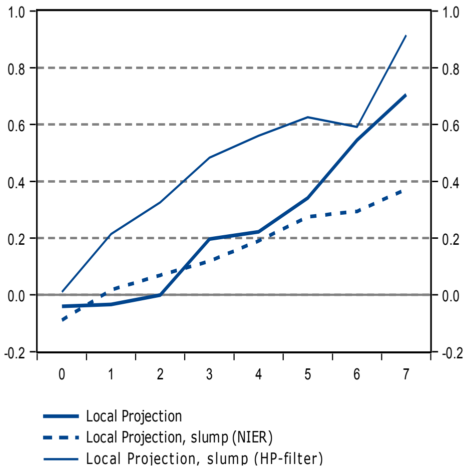



**Figure 32 Cumulative GDP multiplier**
Blanchard's (1993) CAB measure.
OECD output gap included

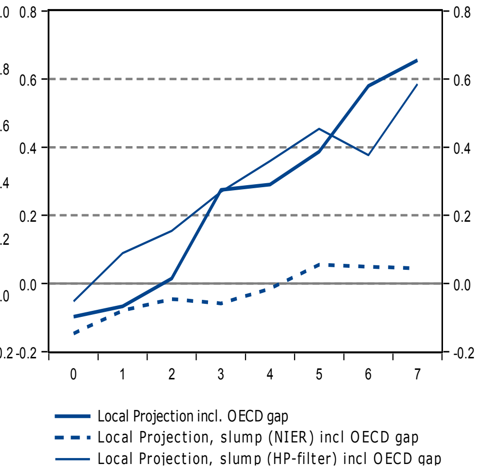


**Figure 33 Cumulative GDP multiplier**
NIER's CAB measure.
OECD output gap not included

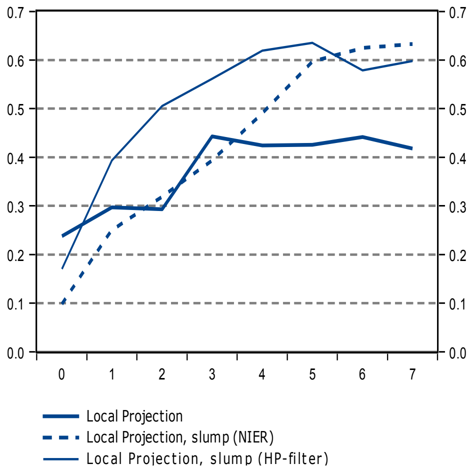
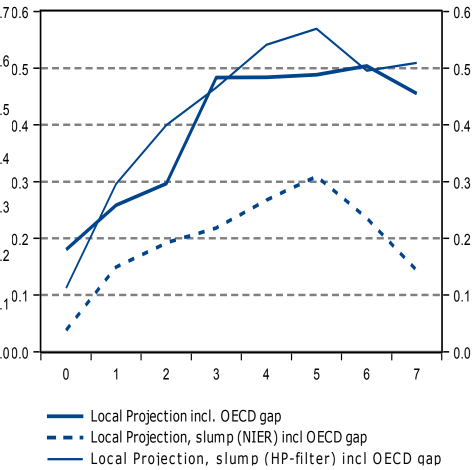



**Figure 34 Cumulative GDP multiplier**
NIER's CAB measure.
OECD output gap included




Summing up the results concerning how the stance of the business cycle affects estimated multipliers, we have found that:

- There are no general results concerning the effects of the state of the business cycle that hold for all fiscal instruments. The impact of slumps on specific fiscal instruments is ambiguous as the two applied measures (NIER method and the HP filter) often yield different results. This sensitivity to the state of the business cycle definition is also noted in Ramey (2016).
- If applying the HP filter, multipliers stemming from shocks to consumption, investments and indirect taxes are higher in slumps.
- If applying the NIER-measure of the output gap, multipliers stemming from shocks to indirect and direct taxes are higher in slumps.
- The impact of slumps is not that sensitive to the inclusion of the OECD output gap.

## 4.5 Comparison with previous studies

The literature on fiscal multipliers is extensive and has been surveyed several times (see, among others, Batini et al., 2014, Gechert and Rannenberg, 2014, Hemming et al., 2002, Ramey, 2013, 2016, and Spilimbergo et al., 2009). A major problem when summarizing this literature is the vast number of methods applied for identifying structural shocks and impulse-response functions. Moreover, there is no consensus on how to report multipliers in the papers – impact, peak or cumulative multipliers (see Section 4.1 for definitions of these).[34]

[34] Bergman (2010) estimate fiscal multipliers using Swedish data 1971q1–2008q4 using the Blanchard and Perotti (2002) methodology. He finds significant Keynesian effects of tax shocks and non-significant effects of spending shocks. The data is however interpolated for the majority of the observations, 1971q1–1992q4. This is arguably a major drawback as the identification of structural shocks hinges on shocks actually taking place at a quarterly frequency. It is therefore not fruitful to compare with the results presented in this paper.

#### EMPIRICAL STUDIES

We believe that our results are best compared with those in the survey of Gechert and Rannenberg (2014) who, as we do, calculate cumulative multipliers at 8 quarter horizon. Gechert and Rannenberg (2014) carry out a meta study covering 98 studies and 1882 observed multiplier values. They analyze how multipliers vary with estimation methods, identification methods, state of the business cycle and several other factors. Their preferred baseline specification concerns cumulative multipliers 8 quarters ahead, using Blanchard and Perotti (2002)-identification scheme and no controls for the state of the business cycle, i.e. similar to the baseline estimations in this paper.

As shown in Table 1, the estimated *linear* GDP multipliers in the present study are on average larger for shocks to all four fiscal instruments – consumption, investments, transfers and taxes[35] compared to the meta study. The largest multiplier is associated with shocks to investments, closely followed by shocks to consumption and transfers.

In the Swedish data, *non-linear* estimates are rather similar to linear estimates. The average multiplier is slightly higher for shocks to consumption, investments and taxes while being lower for shocks to transfers. This is in line with Caggiano et al. (2015) and Ramey and Zubairy (2016) but contrary to Auerbach and Gorodnichenko (2012, 2013), Baum et al. (2012) and Huidrom et al. (2016) who find, sometimes considerable, higher multipliers in slumps.

Compared to the results of the meta study, the average non-linear multiplier in the present study is considerably greater for all shocks but shocks to transfers. Turning to the specific components, shocks to government consumption and investments have on average greater impact on GDP compared to transfers and taxes – this is true for both the linear and non-linear averages.

**Table 1 Cumulative GDP multipliers, 8 quarter horizon**

| | Cons | Invest | Transf | Taxes |
|---|---|---|---|---|
| **Gechert/Rannenberg (2014, Table 4, column 1)** | | | | |
| Baseline (linear) | 0.4 | 1.4 | 0.3 | 0.3 |
| Downswing[1] (non-linear) | 0.9 | 1.0 | 1.7 | −0.5 |
| **This study (Flexible exchange rate period)** | | | | |
| Baseline | 1.7 | 2.0 | 1.5 | 0.7 |
| Baseline incl. OECD output gap | 1.3 | 1.4 | 1.1 | 0.8 |
| *Average, linear multipliers* | *1.5* | *1.7* | *1.3* | *0.8* |
| Slump[2] | 1.8 | 2.1 | 0.9 | 1.2 |
| Slump incl. OECD output gap | 1.7 | 1.7 | 0.7 | 0.9 |
| *Average, non-linear multipliers* | *1.6* | *1.9* | *0.8* | *1.1* |

Note: [1] "Downswing" is the term used by Gechert and Rannenberg (2014) whose meta study includes papers that consider slumps and/or downturns. [2] "Slump" is an average of two multiplier estimates in which the NIER output gap and the HP-output gap, respectively, is included (see fotnot 29). The "Tax" multiplier of "This study" corresponds to a weighted average of the multipliers stemming from shocks to indirect taxes and direct taxes, respectively. "OECD output gap" corresponds to estimations in which the HP filter based OECD output gap is included, see Section 4.3.

Source: Gechert and Rannenberg (2014) and own calculations.

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[35] Gechert and Rannenberg (2014) do not have separate multipliers for indirect and direct taxes. We therefore calculate an average of our two tax estimates, weighted with their relative size.

### "THE BUCKET APPROACH" APPLIED TO SWEDEN

We also find it relevant to compare our results using the methodology put forward by Batini et al. (2014). They document how multiplier estimates vary in the literature depending on certain characteristics such as trade openness and exchange rate regime (see further below). Then, by examining these characteristics for a specific country, they get a "guesstimate" of how large the multiplier might be – without carrying out any empirical analysis on data for the country in question. Countries with similar characteristics are hence bunched into groups (or "buckets") and end up with similar multiplier "guesstimates".

This method can be applied to countries where no estimates are available (perhaps due to lack of data). It can also serve as a cross-check to existing empirical estimates (like those presented in this paper) for a specific country. The method is designed to evaluate the first-year multiplier although Batini et al. (2014) suggest that the second-year multiplier can be approximated to be 10–30 percent higher.

The method is as follows. In the first step, Batini et al. (2014) assess six structural characteristics. The country in question gets score "1" if it fulfills a characteristic that is associated with a large multiplier, otherwise it gets score "0". In step two, the score of the country is added up and the sum determines in which multiplier category ("high", "medium" or "low") the country belongs to in "normal times". In the third step, the normal times-multiplier is adjusted with respect to two conjunctural characteristics – the cyclical stance and the monetary policy stance.

So, starting with the first step and applying the analysis to the Swedish conditions, we get the following evaluation (see Batini et al., 2014, for references on each topic):

1. *Trade openness*: The less open to trade, the higher multiplier. The suggested cut-off point is imports to domestic demand of 30 percent.
    - Swedish score: 0. (Imports to domestic demand is 43 percent in 2015).

2. *Labor market rigidities*: The more rigid, the less *nominal* impact of fiscal policy and thereby the greater *real* impact.
    - Swedish score: 1. (Industrial relations law index above average, see Botero et al., 2004).

3. *Small automatic stabilizers*: The lower ratio of public spending to nominal GDP, the greater multiplier. A suggested cut-off point of 40 percent.
    - Swedish score: 0. (Public spending to GDP is 49 percent in 2015).

4. *Exchange rate regime*: Fixed exchange rate regimes are associated with higher multipliers.[36]
    - Swedish score: 0. (Flexible exchange rate since November 1992).

5. *Level of public debt*: Low debt levels are associated with higher multipliers. Suggested cut-off point is 100 percent in advanced countries.

[36] Although this seems not to be the case for Sweden; see the results in Section 4.2.

- Swedish score: 1. (The gross debt level is 43 percent in 2015).

6. *Efficiency of public expenditure management and revenue administration*: Greater efficiency is associated with higher multipliers.
    - Swedish score: 1. (Assumed, no PEFA assessment[37] for Sweden available).

In the second step, we find that the sum of the Swedish score is 3. The limits suggested by Batini et al. (2014) are displayed in Table 2. The Swedish score is at the higher end of the "low" category and at the lower end of the "medium" category. In order to simplify the description below, we categorize Sweden in the group with medium size multipliers, bearing in mind that this might be a slight overstatement.

**Table 2 Multipliers according to the "Bucket approach"**

In "normal times".

| Country Category | Score | First-year | Second-year |
|---|---|---|---|
| Low multiplier | 0–3 | 0.1–0.3 | 0.12–0.36 |
| Medium multiplier | 3–4 | 0.4–0.6 | 0.48–0.72 |
| High multiplier | 4–6 | 0.7–1.0 | 0.84–1.20 |

Note: Second-year multiplier is 20 percent higher than first-year multiplier which is the mid-point of the suggestion by Batini et al. (2014).

Source: Batini et al. (2014) and own calculations.

The third and final step is to adjust the multipliers in Table 2 to two conjunctural characteristics.

1. *State of the business cycle*: The weaker state of the business cycle, the greater multiplier.
    - Currently, in 2016, the Swedish economy is roughly in balance. Hence, no adjustment of the multiplier in Table 2 is needed.

2. *Monetary policy stance*: The weaker the supposed monetary policy response to fiscal policy actions, the greater multiplier.
    - In 2016–2017, monetary policy in Sweden is constrained by a lower band for the repo rate. Currently it is –0,5 and, although it is unclear exactly how low it can go, it will probably not be much lower. Batini et al. (2014) suggest that the multiplier from normal times should increase by at most 30 percent due to constrained monetary policy.

Let the Swedish multiplier in normal times ("NT") be labeled $M^{NT}$. Due to the conjunctural characteristics above, $M^{NT}$ is adjusted in the following way:

$$M = M^{NT} \cdot (1 + cycle) \cdot (1 + MP),$$

[37] PEFA is a tool for assessing the status of public financial management supported by, among others, the European Commission and the IMF. See pefa.org for more information.

where $M$ is the multiplier, $cycle = 0$ and $MP$=monetary policy=0,3 from the discussion above. Hence, if we take the midpoint of the first-year multiplier in the "medium multiplier" category, we get:

$$M = 0{,}5 \cdot (1 + 0) \cdot (1 + 0{,}3) = 0{,}65.$$

Doing the same operation for the second-year multiplier gives 0,78. These "guesstimates" might be of some interest for the current policy discussion in Sweden.

How do the implied multipliers of the "bucket approach" for the Swedish economy square with the empirical results presented in this paper? The multipliers of the "bucket approach" provide an estimate when government spending and revenues are used in the same amount. We carry out two types of comparisons with our estimates.

First, we compare a composite of the estimates presented above. More specifically, we take the average of the GDP multipliers of the three fiscal spending variables and weigh them according to the relative sizes of the fiscal instruments. We do likewise for the two fiscal variables of government revenue. Then we weigh the resulting spending and revenue multipliers equally and evaluate the GDP multipliers at the 1 and 2 year horizon.[38] In this calculation, we use the estimated linear multipliers using the sample with flexible exchange rates and the logarithmic specification. We average over the estimates with and without the inclusion of the OECD output gap.

Second, we use the GDP multipliers based on changes in the Cyclically Adjusted Budget balance (CAB). Here we assume that, on average, these changes are equally due to changes in spending and revenues. We take the average of four GDP multipliers: the estimations using the Blanchard (1993) and NIER methods, averaging over estimates with and without the inclusion of the OECD output gap.

The comparison with the "Bucket approach" is shown in Table 3. In general, our composite estimates based on the identification of Blanchard and Perotti (2002) imply larger GDP multipliers compared to "Bucket approach", both when excluding and including the OECD output gap in the LP-specification. When defining shocks as the change in the cyclically adjusted budget balance (CAB), the GDP multipliers are much more similar (somewhat lower) compared to the "Bucket approach".

[38] For the 1 year horizon, we evaluate the average cumulative multiplier for horizons 0–3 quarters, i.e. the first to fourth quarters. For the 2 year horizon, we evaluate the average cumulative multiplier for horizons 4–7 quarters.

**Table 3 Swedish GDP multipliers according to the "Bucket approach" and Local Projection**

| Method | First-year | Second-year |
|---|---|---|
| Application of Bucket approach Batini et al. (2014) | 0.4–0.6 | 0.48–0.72 |
| Linear estimation, LP method composite measure[1] | 1.2 | 1.2 |
| Linear estimation, LP method, composite measure incl. OECD output gap[1] | 0.9 | 0.7 |
| Linear estimation, LP method, change in CAB[2] | 0.2 | 0.5 |
| Linear estimation, LP method, change in CAB incl. OECD output gap[2] | 0.3 | 0.5 |

Note: Sample 1993q1–2015q3. [1] Weighted multiplier of the five fiscal instruments. [2] Average of the multipliers using the Blanchard (1993) and NIER methods. See the main text for more information.

Source: Batini et al. (2014) and own calculations.

# 5 Employment multipliers

In this section, we present employment multipliers of shocks to the five fiscal instruments – consumption, investments, transfers, indirect and direct taxes. As for the analysis of GDP multipliers above, we examine the impact of the exchange rate regime (Section 5.2), the development of the world economy (Section 5.3) and the state of the business cycle (Section 5.4). We compare our results with previous studies in Section 5.5.

## 5.1 Definition

The empirical literature on employment multipliers are considerably less voluminous compared to the GDP counterpart. This is probably one reason why there is no standard way to define the employment multiplier. It is important to acknowledge that employment is a *stock* variable while the fiscal instrument (and hence cost) is a *flow* variable. We believe that it is most useful, especially for governments, if the definition of the multiplier acknowledges the full (i.e. accumulated) fiscal cost for the estimated employment effect. Our chosen multiplier is therefore in line with the one put forward by Monacelli et al. (2010, Table 1, page 536). More specifically, the employment multiplier of fiscal instrument $G$, $m_h^{E,G}$, is:

$$m_h^{E,G} = \left[\frac{ln\left(E_h/E_h^{Base}\right)}{\left(\sum_{t=0}^{h} ln(G_t/G_t^{Base})\right)\left(\frac{\bar{G}}{\bar{Y}}\right)}\right], \qquad (13)$$

where $ln\left(E_h/E_h^{Base}\right)$ is the logarithmic deviation of the employment level at horizon $h$ compared to base scenario. The denominator of equation (13) measures the fiscal shock as a percentage of GDP, where $\sum_{t=0}^{h} ln(G_t/G_t^{Base})$ is the accumulated cost up to horizon $h$ necessary to achieve the effect on employment at horizon $h$. The multiplier should therefore be interpreted as the percentage change in employment in response to a fiscal shock of 1 percent of GDP. In the tables below, we will show the multipliers after one year (four quarters, $h = 3$) and two years (eight quarters, $h = 7$).

As argued in Section 2.2, the impulse-responses of Jordà's (2005) Local Projection method are more likely to oscillate across horizons compared to VAR-approach. The reason is that, contrary to VARs, there is no formal connection between the successive impulse-responses. For example, $ln(E_6/E_6^{Base})$ stems from one OLS regression and $ln(E_7/E_7^{Base})$ from another, so it is in principle possible to find discrete "jumps" in multipliers (i.e. OLS coefficients) between successive horizons. In order to check the robustness of the multiplier calculated for the 4th and 8th quarter, respectively, using equation (13) above, we also present calculations of the *average* 1 and 2 year multipliers, respectively. That is, we relate the *average* employment effect during 1 and 2 year to the total cost:

$$m_{year\ 1}^{E,G} = \left[ \frac{\left(\sum_{t=0}^{h=3} ln(E_t/E_t^{Base})\right)/4}{\left(\left(\sum_{t=0}^{h=3} ln(G_t/G_t^{Base})\right)\right)\left(\frac{\bar{G}}{\bar{Y}}\right)} \right], \qquad (14a)$$

$$m_{year\ 2}^{E,G} = \left[ \frac{\left(\sum_{t=0}^{h=7} ln(E_t/E_t^{Base})\right)/8}{\left(\left(\sum_{t=0}^{h=7} ln(G_t/G_t^{Base})\right)\right)\left(\frac{\bar{G}}{\bar{Y}}\right)} \right]. \qquad (14b)$$

## 5.2 The role of the exchange rate regime

In Section 4.2, we found that the GDP multipliers of shocks to consumption, investments, indirect taxes and CAB were larger during the flexible exchange rate period. The greatest increase in the multiplier was for government investments. Multipliers were on the contrary somewhat lower for transfers and direct taxes during the flexible exchange rate period.

This picture is broadly confirmed in Table 4 where we present employment multipliers. Columns denoted '(1)' use multiplier definition (13) and columns denoted '(2)' use multiplier definition (14a and 14b). With only a few exceptions, employment multipliers are larger when considering the flexible exchange rate period only. This is perhaps not surprising as the unemployment rate during the flexible exchange rate period has been considerably higher than the unemployment during the whole period and, hence, more resources were available.

Shocks to government investments have greatest effect on employment followed by shocks to transfers when considering a simple average for 4 and 8 quarters. It is also worth noting that, in spite of a considerable GDP multiplier, shocks to government consumption do not affect employment to any important extent. It has actually the lowest employment multipliers among the five fiscal instruments. As we shall see in Section 5.4, this conclusion will change when we control for different states of the business cycle.

**Table 4 Linear employment multipliers**

| | Consumption | | Investments | | Transfers | | Indirect taxes | | Direct taxes | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Entire sample (1980q1-2015q3)** | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| 4 quarters | 0.0 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| 8 quarters | -0.1 | -0.1 | 0.2 | 0.1 | 0.2 | 0.1 | 0.1 | 0.1 | -0.0 | -0.0 |
| | | | | | | | | | | |
| **Flexible exchange rate (1993q1-2015q3)** | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| 4 quarters | 0.1 | 0.1 | 0.5 | 0.3 | 0.3 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 |
| 8 quarters | 0.1 | 0.0 | 0.4 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |

Note: (1)-columns show multipliers defined in equation (13). (2)-columns show multipliers defined in equations (14a,b).

Source: Own calculations.

## 5.3 Effect of including the contemporary OECD output gap

In Section 4.3 we found that GDP multipliers were somewhat lower when including a contemporaneous OECD output gap in the LP regressions (the exception was direct taxes to households). In Table 5 we compare the employment multipliers, defined as equation (13, shown in the (1)-columns) and equations (14a,b, shown in the (2)-columns).[39] Contrary to the GDP multipliers, there is no clear pattern concerning the size of the employment multipliers. Shocks to the majority of the fiscal instruments are associated with a slightly larger employment multiplier when including the OECD output gap for a given GDP response.

In Section 5.2 above, we found that shocks to investment and transfers had the greatest employment multipliers. This still holds when including a contemporaneous OECD output gap (see last two rows of Table 5). The one-year employment multiplier for shocks to indirect taxes is also substantial while it is rather modest for shocks to consumption and direct taxes.

**Table 5 Linear employment multipliers**

| | Consumption | | Investments | | Transfers | | Indirect taxes | | Direct taxes | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Flexible exchange rate (1993q1-2015q3)** | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) | (1) | (2) |
| 4 quarters | 0.1 | 0.1 | 0.5 | 0.3 | 0.3 | 0.1 | 0.2 | 0.1 | 0.2 | 0.1 |
| 8 quarters | 0.1 | 0.0 | 0.4 | 0.2 | 0.2 | 0.1 | 0.1 | 0.1 | 0.1 | 0.0 |
| **Including OECD output gap** | | | | | | | | | | |
| 4 quarters | 0.1 | 0.0 | 0.5 | 0.4 | 0.5 | 0.3 | 0.3 | 0.2 | 0.1 | 0.1 |
| 8 quarters | -0.0 | -0.0 | 0.4 | 0.3 | 0.4 | 0.2 | 0.1 | 0.1 | 0.1 | 0.0 |

Note: (1)-columns show multipliers defined in equation (13). (2)-columns show multipliers defined in equations (14a,b).

Source: Own calculations.

[39] The first two rows of Table 5 are the same as the last two rows of Table 4.

## 5.4 Non-linear multipliers due to the business cycle

In Section 4.4, we could not draw any general conclusions concerning how GDP multipliers are affected by the state of the business cycle. The results were sensitive to several factors; the fiscal instrument, the output gap definition and the inclusion of a contemporaneous OECD output gap. In this section, we examine how employment multipliers vary with the state of the business cycle.

In order to easier visualize the results, we show only one of the two multiplier definitions (see equations (14a,b)) for two LP-specifications; with and without the inclusion of the contemporaneous OECD output gap (columns (a) and (b), respectively, in Table 6).

For the spending components (consumption, investments and transfers) the multipliers are in general higher in slumps using both output gap measures (HP filter and NIER) compared to the linear multipliers in Table 5 above.[40] This is especially true for shocks to government consumption. These results are not sensitive to the inclusion of a contemporaneous OECD output gap.

No general conclusions can be drawn concerning how the state of the business cycle affects employment multipliers of tax shocks. Employment multipliers are higher than linear counterparts for shocks to indirect taxes when applying the HP filter. The opposite is true when applying the NIER measure of the output gap. Finally, there are small and non-regular differences in the multipliers stemming from shocks to direct taxes.

**Table 6 Non-linear employment multipliers**
Flexible exchange rate period 1993q1–2015q3.

| | Consumption | | Investments | | Transfers | | Indirect taxes | | Direct taxes | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Slump (HP filter)** | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) |
| 4 quarters | 0.6 | 0.5 | 0.4 | 0.5 | 0.1 | 0.4 | -0.0 | -0.1 | 0.2 | 0.2 |
| 8 quarters | 0.4 | 0.4 | 0.3 | 0.3 | 0.1 | 0.2 | 0.0 | -0.1 | 0.1 | 0.1 |
| **Slump (NIER measure)** | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) | (a) | (b) |
| 4 quarters | 0.3 | 0.2 | 0.6 | 0.6 | 0.2 | 0.4 | 0.2 | 0.3 | 0.1 | 0.1 |
| 8 quarters | 0.3 | 0.3 | 0.5 | 0.4 | 0.2 | 0.3 | 0.1 | 0.3 | 0.0 | 0.0 |

Note: All multipliers are calculated using the definition in equations (14a,b). (a)-columns show multipliers when OECD output gap is not included in the Local Projection estimations. (b)-columns show multipliers when OECD output gap is included in the Local Projection estimations.

Source: Own calculations.

## 5.5 Comparison with previous studies

Compared to the large number of studies concerning GDP multipliers, there are considerably fewer studies on employment multipliers. Even fewer studies calculate multipliers according to the definitions (13) and (14a,b) above. One exception is Monacelli

[40] This is not surprising though for consumption and investment shocks when applying the output gap based on the HP filter. The GDP multipliers were then considerably higher in times of slumps (see Section 4.4).

et al. (2010) who calculate cumulative *un*employment multipliers of shocks to government spending, similar to equation (13). They find a multiplier of –0,3 after one year and –0,4 after two years. It is not straightforward though to compare these multipliers with the ones in Table 5 as the development of the labor force is explicitly included in unemployment but not in employment. Still, if weighing the multipliers of consumption, investment and transfers in Table 5 (both with and without the inclusion of the OECD output gap, employing the (1)-columns), we get an average employment multiplier of 0,5 (4 quarters) and 0,3 (8 quarters).[41]

In a survey, Ramey (2013) find that positive shocks to government spending lower unemployment and increase employment. No cumulative multipliers are calculated. Instead, peak multipliers of –0,2 to –0,5 for unemployment and somewhat lower for employment (of course with the opposite sign). Giordano et al. (2007) find similar results using Italian data. The employment multiplier to a shock to government purchases (i.e. not transfers) is about 0,2 on impact and peaks at 0,5 after 4 quarters. The employment multiplier vanishes when they consider shocks to government wages.

Ravn and Simonelli (2007) set up a SVAR and identifies four structural shocks where one is to government spending. Using US data, they find approximately no employment effect for the first year. Reading from their graphs (Figure 1-D), a multiplier defined as equation (13) after 8 quarters is small, about 0,1.

Brückner and Pappa (2012) apply a SVAR-identification methodology, similar to the one we have, on 10 countries (among them Sweden, using imputed quarterly data) and find that in the majority of the countries (including Sweden), employment responds negatively to a shock to government spending. This is clearly at odds with the results we find in this paper and other papers considered here.

# 6 Conclusions

Using a newly released quarterly data set of fiscal variables for Sweden, we estimate short run GDP and employment multipliers using six fiscal instruments. We employ the Blanchard and Perotti's (2002) method to identify structural shocks and the Jordà (2005) Local Projection method to calculate impulse responses. The latter has increased in popularity in recent years and is advocated by Ramey (2016) in a forthcoming Handbook chapter.

Before summarizing the results, it is important to stress that the majority of the impulse-responses of GDP and employment to fiscal shocks are insignificant at the 95 percent level. The estimated multipliers are hence in general uncertain. Having this caveat in mind, we find the following empirical results.

First, GDP multipliers are Keynesian in general – both in normal times and in times of slumps. An exception to this pattern is shocks to direct taxes on households which turn non-Keynesian after about one year. It turns out, however, that this result is moderated or even overturned when controlling for the contemporaneous output gap of the OECD.

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[41] Note the opposite sign as we estimate employment multipliers wheras Monacelli et al. (2010) estimate unemployment multipliers.

Second, estimated multipliers differ, often considerably, between the fixed and flexible exchange rate period. GDP multipliers are greater for shocks to consumption, investments and indirect taxes in the period with a flexible exchange rate. The multipliers are on the other hand smaller during the same period for the two instruments directly affecting the disposable income of households: transfers and direct taxes.

Third, GDP multipliers are in general somewhat larger compared to studies which surveys and compiles estimated multipliers in the literature. The largest multiplier stems from a shock to government investment, ranging between 1,5 and 2 after 8 quarters. The multipliers of shocks to government consumption and transfers to households are about 1,5 while being somewhat below 1 for shocks to taxes.

Fourth, there are no general patterns concerning the size of multipliers and the state of the business cycle. The effect of fiscal shocks in periods of slumps depends both on the fiscal instrument in question and the measure chosen for the output gap.

Fifth, shocks to transfers and, especially, government investment, are associated with the largest employment multipliers. Despite relatively substantial GDP multipliers of shocks to government consumption, the employment multiplier is negligible on average. This result changes quite substantially, however, when controlling for the state of the business cycle. The employment multiplier is positive and relatively large for shocks to government consumption in slumps (regardless of output gap measure). Non-linear multipliers for shock to taxes are, however, sensitive to the choice of output gap measure.

There are many directions in which the present paper can be extended. As mentioned, the effect of the state of the business cycle is ambiguous. Here one could dig deeper into both other measures of the business cycle as well as altering threshold values. For example, it would be interesting to investigate how survey based measures of business activity affects multipliers. Another avenue of future research would be to investigate more disaggregated measures of the fiscal variables used in this paper. For example, government consumption could be divided into wage and non-wage related outlays. Wage outlays could, in turn, be divided into numbers employed and wage per employed. Finally, the confidence bands for the cumulative multipliers could be calculated.

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# Appendix A. Data

**FISCAL VARIABLES**

**Figure 35 Government consumption**
Logarithmic specification

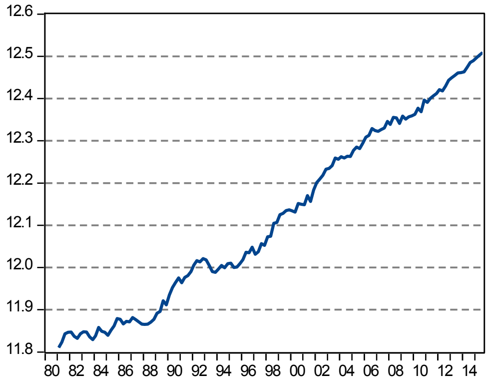



**Figure 36 Government consumption**
Share of potential GDP

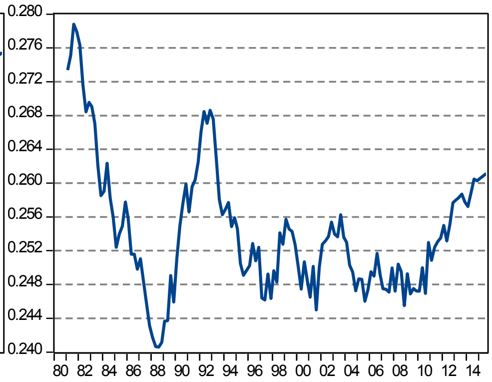



**Figure 37 Government investments**
Logarithmic specification

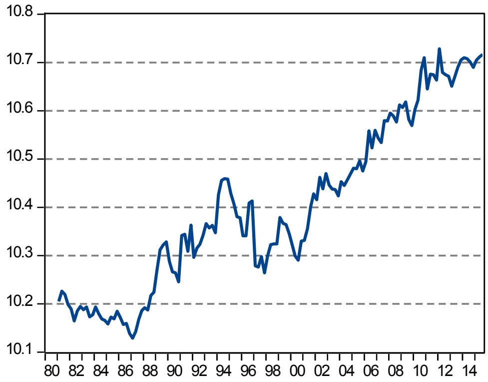



**Figure 38 Government investments**
Share of potential GDP

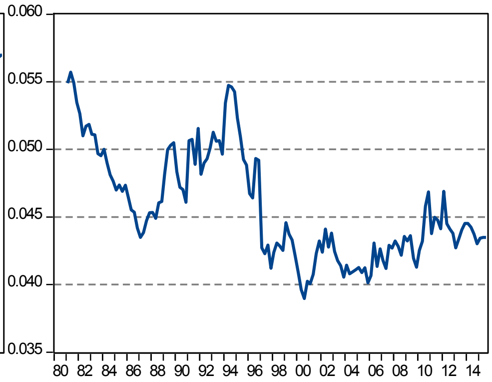



**Figure 39 Transfers to households**
Logarithmic specification

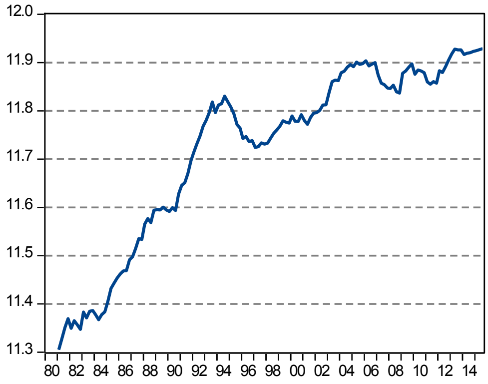



**Figure 40 Transfers to households**
Share of potential GDP

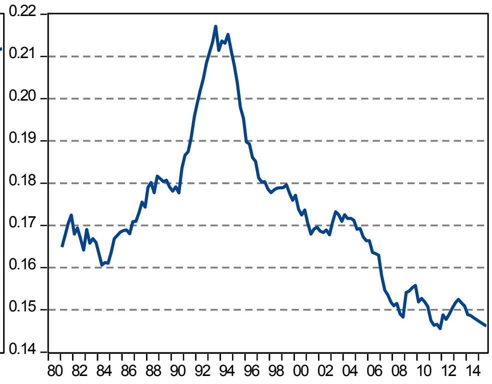


**Figure 41 Direct taxes to households**
Logarithmic specification

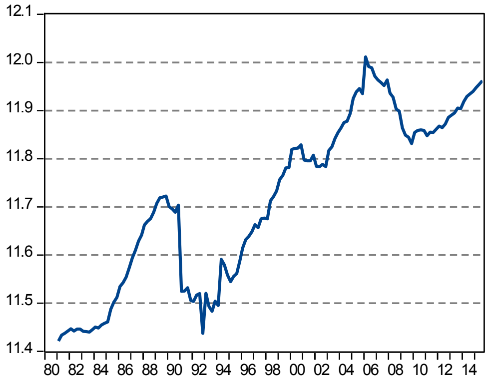



**Figure 42 Direct taxes to households**
Share of potential GDP

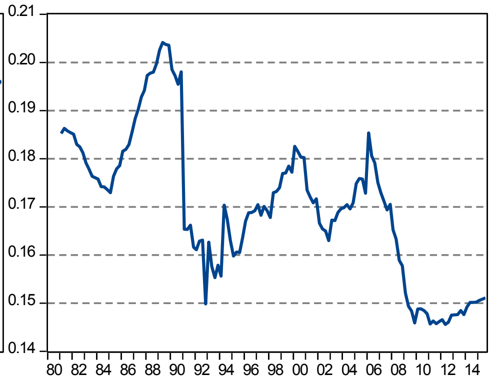



**Figure 43 Indirect taxes on consumption**
Logarithmic specification

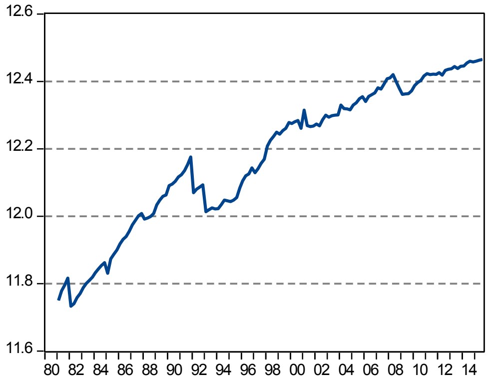
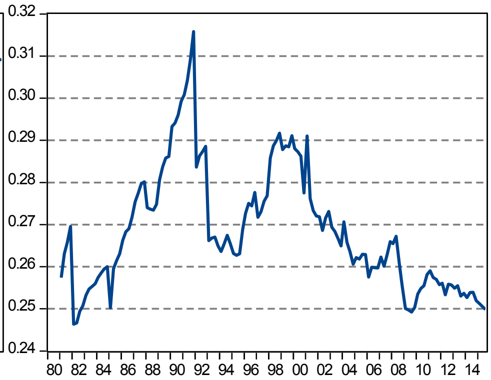



**Figure 44 Indirect taxes on consumption**
Share of potential GDP




**MACROECONOMIC VARIABLES**

**Figure 45 GDP**
Logarithmic specification

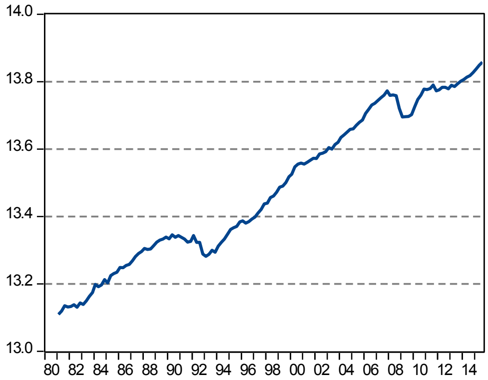



**Figure 46 GDP**
Share of potential GDP

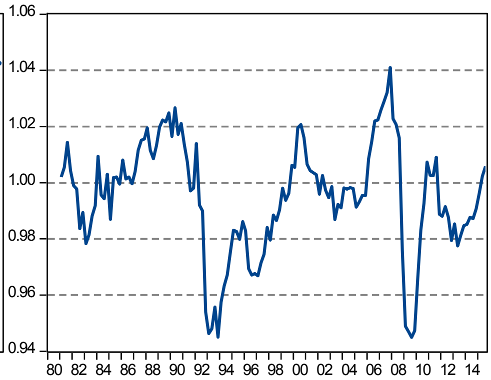


**Figure 47 Employment**

Logarithmic specification

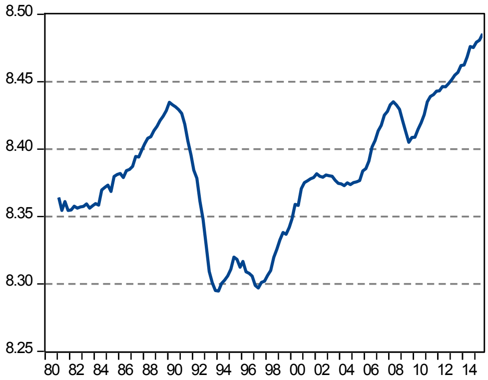



**Figure 48 Real interest rate**

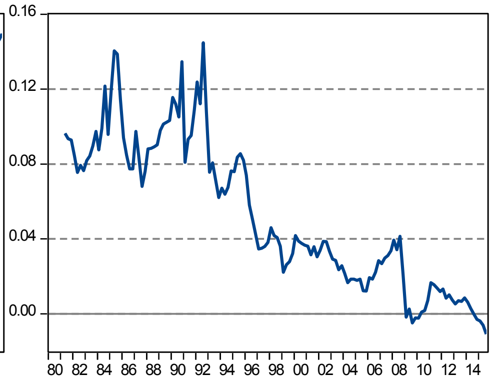



**Figure 49 OECD output gap**

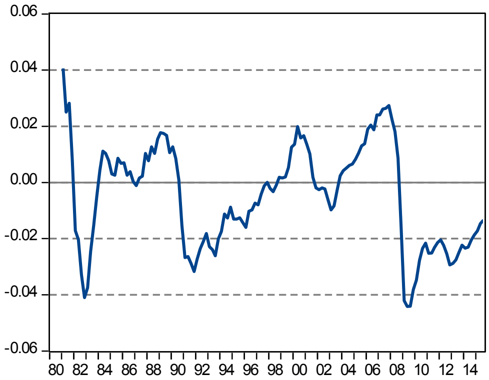



**Figure 50 OECD output gap (NIER)**

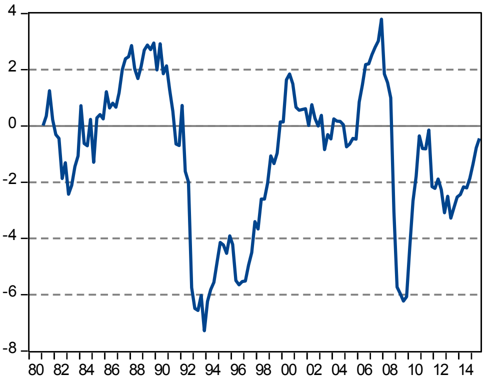
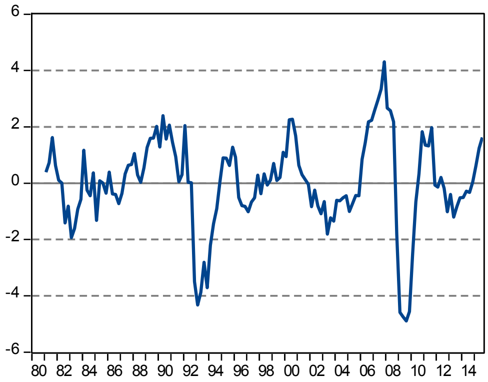



**Figure 51 OECD output gap (HP)**



# Appendix B. Estimated shocks

**Figure 52 and 53 Quarterly (left) and yearly shocks (right) to government consumption**[42]

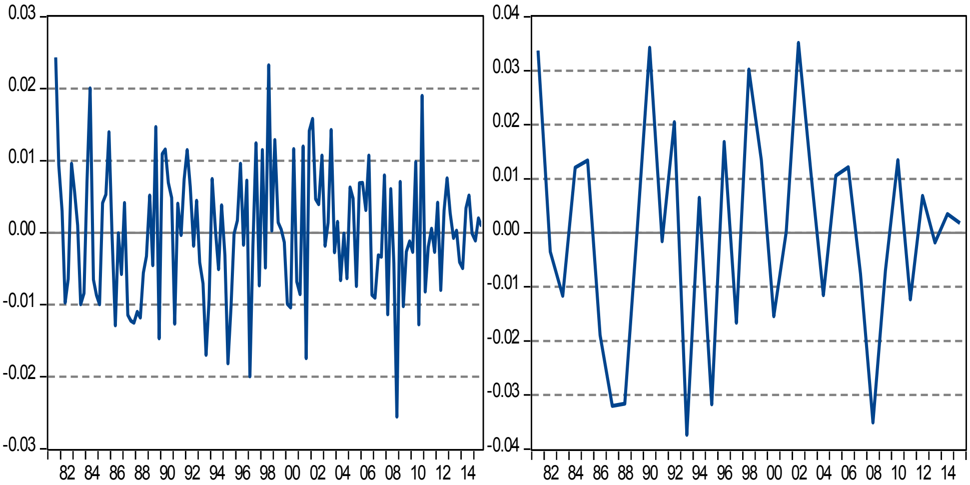



**Figure 54 and 55 Quarterly (left) and yearly shocks (right) to government investments**

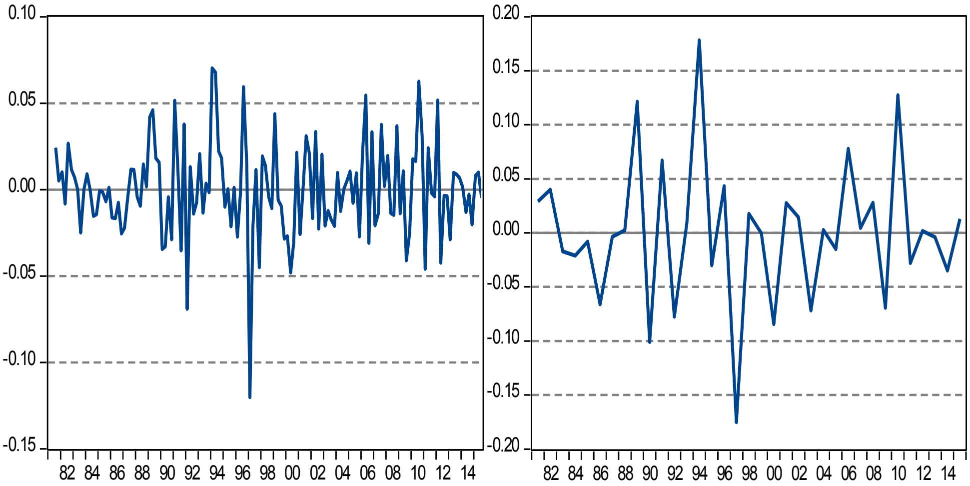
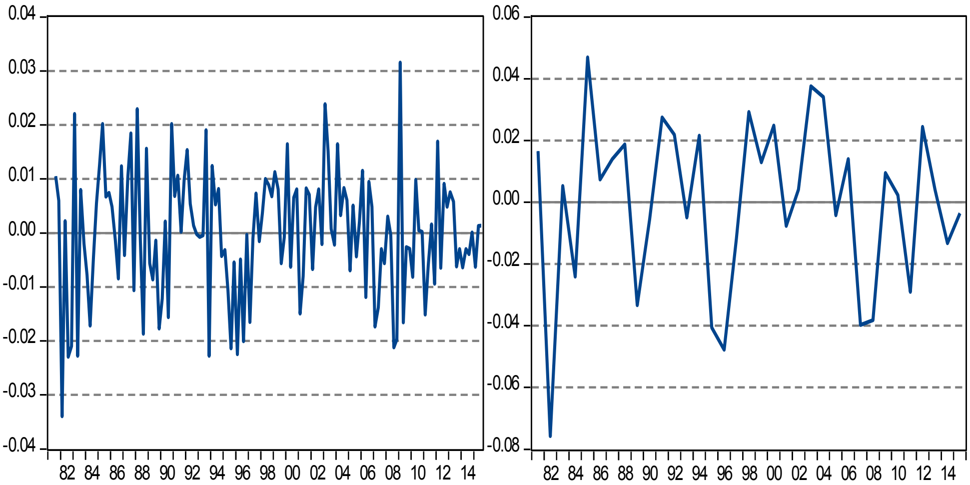



**Figure 56 and 57 Quarterly (left) and yearly shocks (right) to transfers**




[42] The yearly shocks have been calculated as the (yearly) sum of the quarterly shocks.

**Figure 58 and 59 Quarterly (left) and yearly shocks (right) to direct taxes**

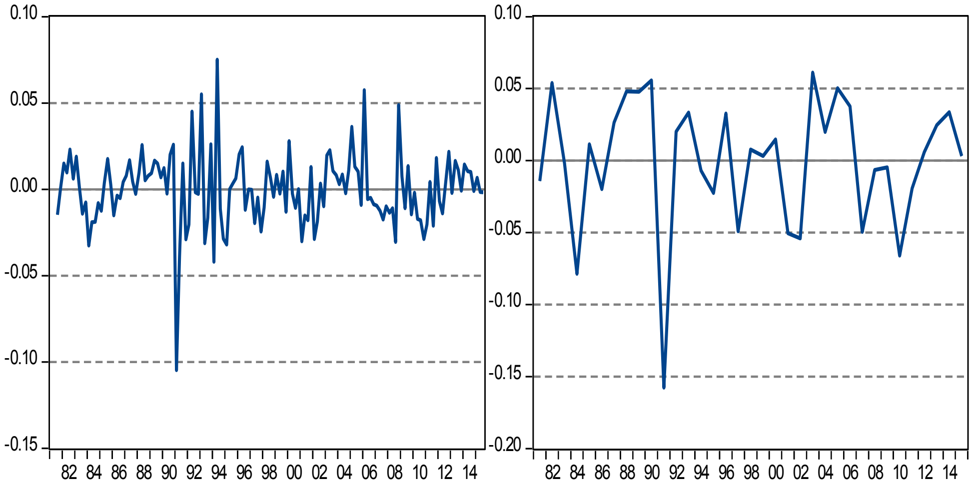



**Figure 60 and 61 Quarterly (left) and yearly shocks (right) to indirect taxes**

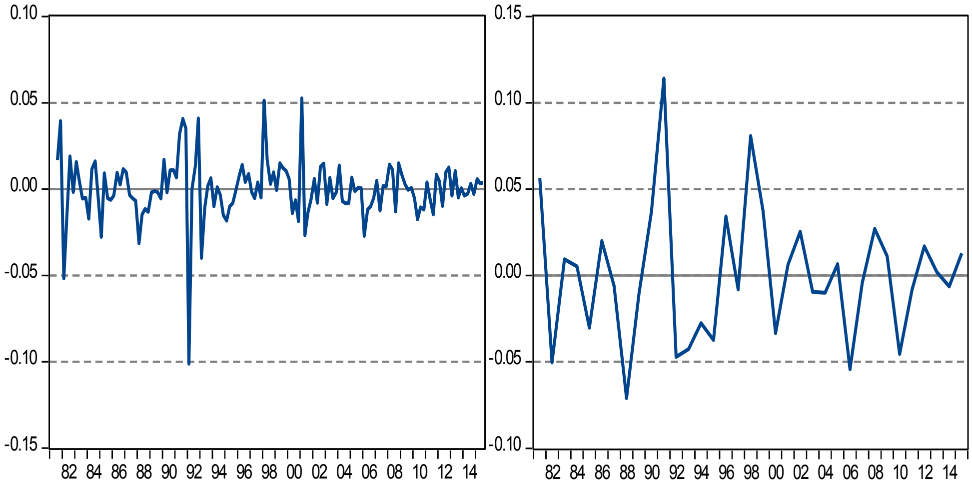


**Figure 62 and 63 quarterly (Left) and yearly (right) Cyclically adjusted budget balance (Diff, NIER)**[43]

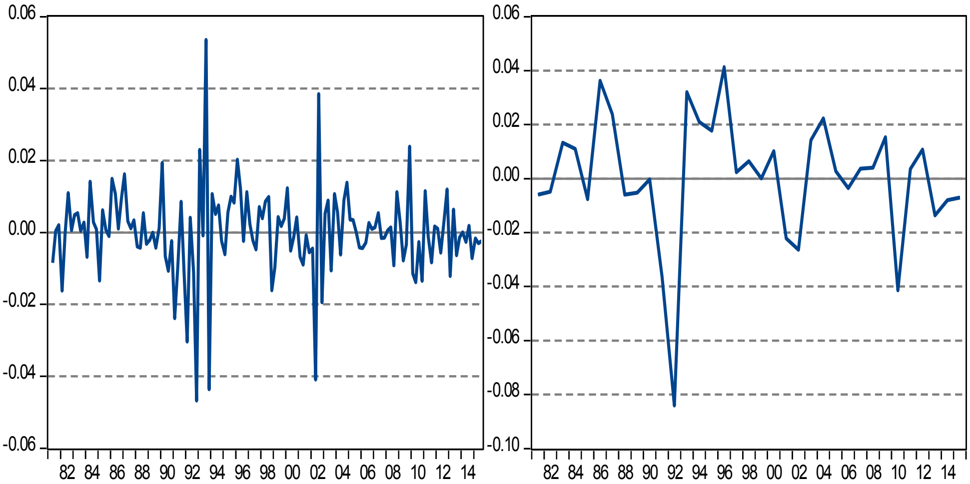
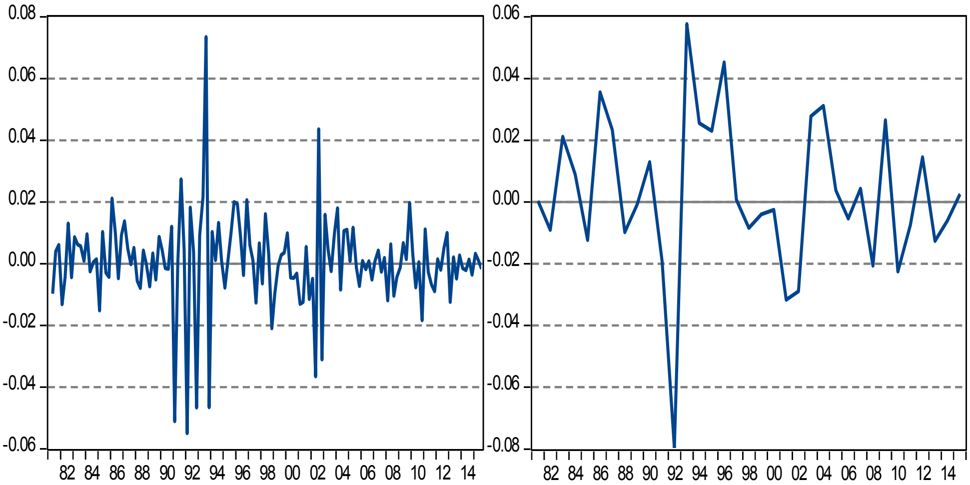



**Figure 64 and 65 quarterly (Left) and yearly (right) Cyclically adjusted budget balance (Diff, Blanchard 1993)**




[43] The yearly shocks have been calculated as the (yearly) sum of the quarterly shocks.

# Appendix C. Local Projection regressions[44]

In the case of shocks to government consumption (G) and direct taxes to households (T), the following LP-regression is estimated (here the linear effects of G shocks on GDP (Y) is exemplified, using the logarithmic specification):[45,46]

$$\begin{aligned}\ln Y_t = \alpha_1 &+ \beta_1 shock^G_{t-h} + \beta_2 shock^G_{t-h-1} \\ &+ \gamma_1 \ln Y_{t-h-1} + \gamma_2 \ln G_{t-h-1} + \gamma_3 \ln T_{t-h-1} \\ &+ \gamma_4 \ln R_{t-h-1} + \mu_1\, trend_{t-h}\ ,\end{aligned}$$

Where *h*=0,1,… and R is the real interest rate. The corresponding non-linear regression is given by:

$$\begin{aligned}\ln Y_t = I_{t-h-1}\big[&\alpha_1 + \beta_1 shock^G_{t-h} + \beta_2 shock^G_{t-h-1} \\ &+ \gamma_1 \ln Y_{t-h-1} + \gamma_2 \ln G_{t-h-1} + \gamma_3 \ln T_{t-h-1} \\ &+ \gamma_4 \ln R_{t-h-1} + \mu_1\, trend_{t-h}\big] \\ &+ (1 - I_{t-h-1})\big[\alpha'_1 + \beta'_1 shock^G_{t-h} + \beta'_2 shock^G_{t-h-1} \\ &+ \gamma'_1 \ln Y_{t-h-1} + \gamma'_2 \ln G_{t-h-1} + \gamma'_3 \ln T_{t-h-1} \\ &+ \gamma'_4 \ln R_{t-h-1} + \mu'_1\, trend_{t-h}\big]\end{aligned}$$

In the case of shocks to government investments (IG), transfers to households (TRH) and indirect taxes on consumption (IT), the following LP-regression is estimated (here the linear effects of IG shocks on GDP (Y) is exemplified, using the logarithmic specification):

$$\begin{aligned}\ln Y_t = \alpha_1 &+ \beta_1 shock^{IG}_{t-h} + \beta_2 shock^{IG}_{t-h-1} \\ &+ \gamma_1 \ln Y_{t-h-1} + \gamma_2 \ln G_{t-h-1} + \gamma_3 \ln T_{t-h-1} \\ &+ \gamma_4 \ln IG_{t-h-1} + \gamma_5 \ln R_{t-h-1} + \mu_1\, trend_{t-h}\end{aligned}$$

For shocks to the cyclically adjusted budget balance (CAB), the following LP-regression is estimated:[47]

$$\begin{aligned}Y^*_t = \alpha_1 &+ \beta_1 \Delta CAB_{t-h} + \beta_2 \Delta CAB_{t-h-1} \\ &+ \gamma_1\, Y^*_{t-h-1} + \gamma_2\, G^*_{t-h-1} \\ &+ \gamma_3 T^*_{t-h-1} + \gamma_4 \ln R_{t-h-1} + \mu_1\, trend_{t-h}\end{aligned}$$

---

[44] Newey-West (1987) standard errors have been used to correct for serial correlation in both the structural VAR models and Local Projection regressions. Two lags for the logarithmed variables minimize the Hannan-Quinn (1979) criterion and have been used in all estimated VAR models in order to identify the structural shocks.

[45] Two lags are used in all regressions for the longer sample, 1980–2015.

[46] A contemporaneous OECD gap has also been added to all regressions, see Section 4.2.

[47] As noted in Section 2.3, all variables but CAB has been transformed using transformation (8).

# Appendix D. Estimated impulse response functions

## SVAR

### GDP EFFECTS

**Figure 66 and 67 GDP effects on SVAR shocks to government consumption**

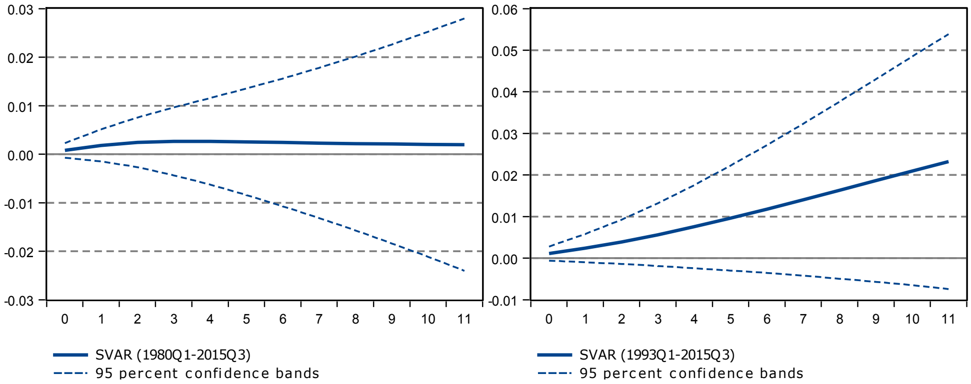



**Figure 68 and 69 GDP effects on SVAR shocks to government investments**

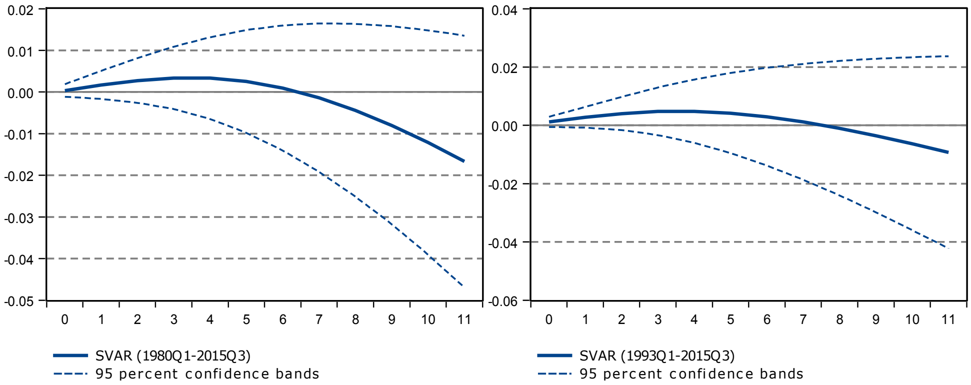



**Figure 70 and 71 GDP effects on SVAR shocks to transfers**

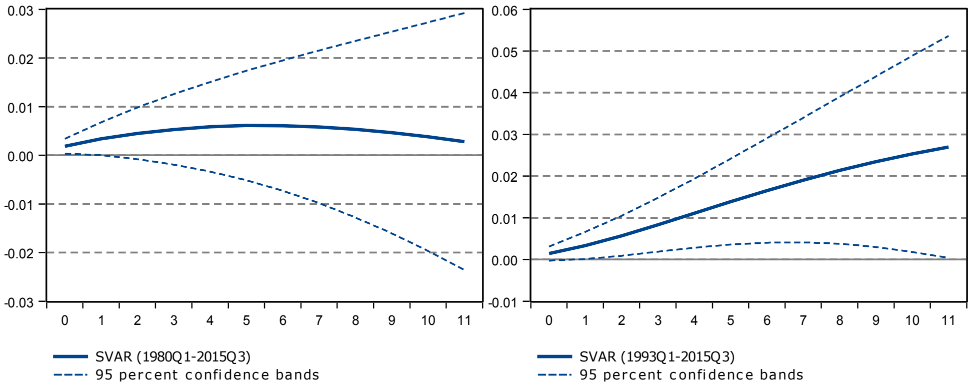


**Figure 72 and 73 GDP effects on SVAR shocks to direct taxes**

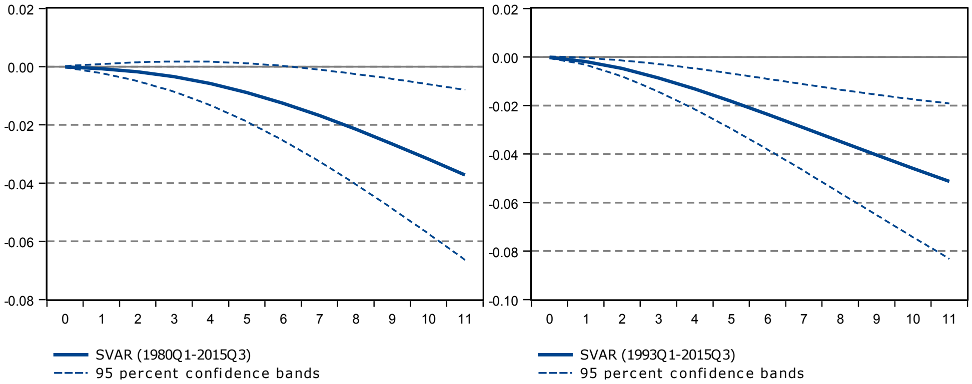
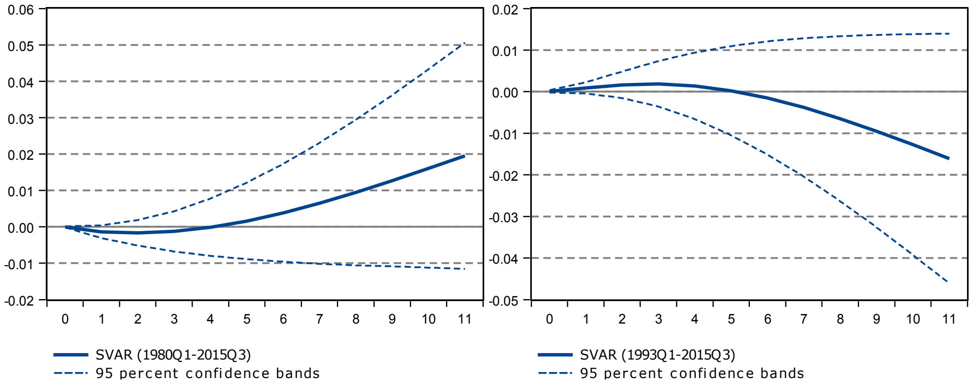
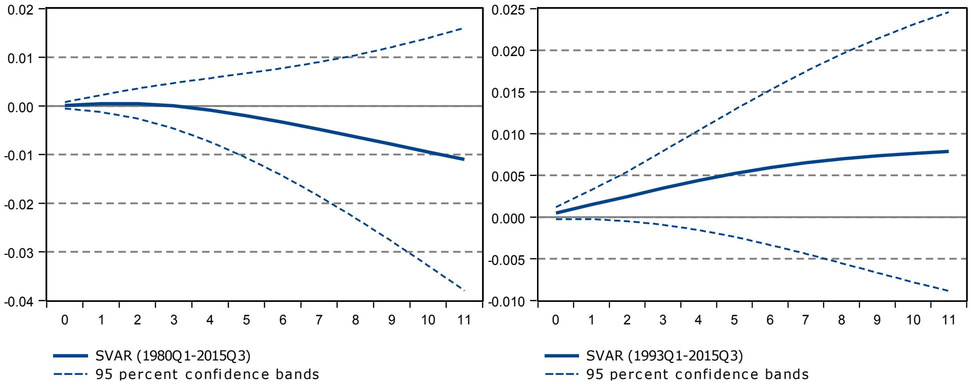



**Figure 74 and 75 GDP effects on SVAR shocks to indirect taxes**

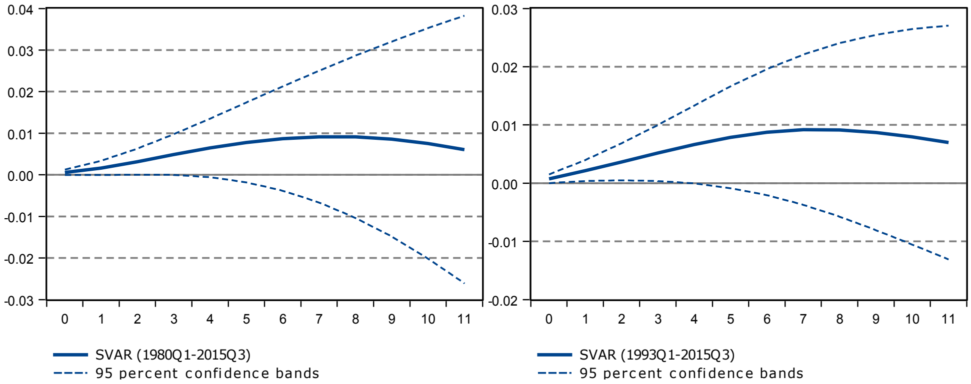


## EMPLOYMENT EFFECTS

### Figure 76 and 77 Employment effects on SVAR shocks to government consumption




### Figure 78 and 79 Employment effects on SVAR shocks to government investments




### Figure 80 and 81 Employment effects on SVAR shocks to transfers

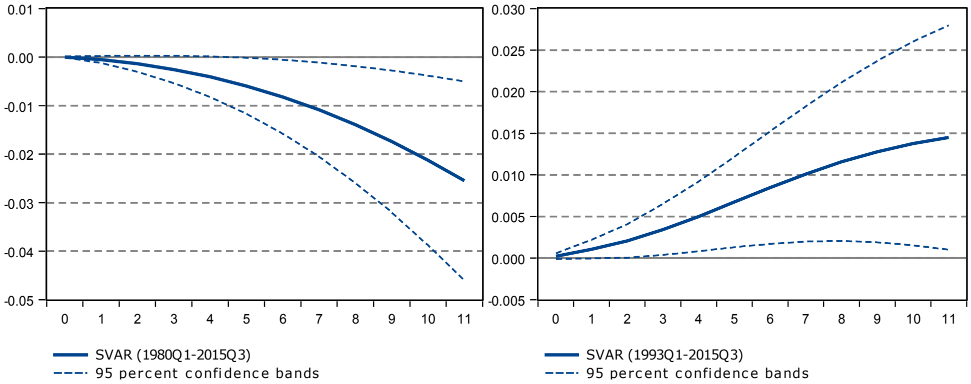


**Figure 82 and 83 Employment effects on SVAR shocks to direct taxes**

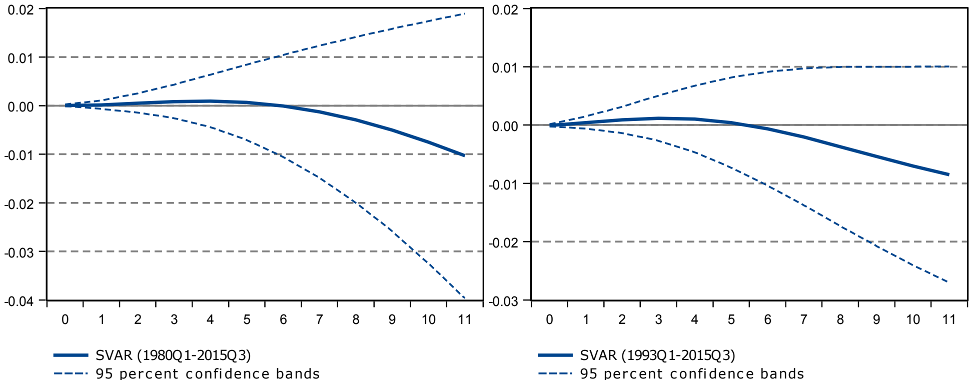
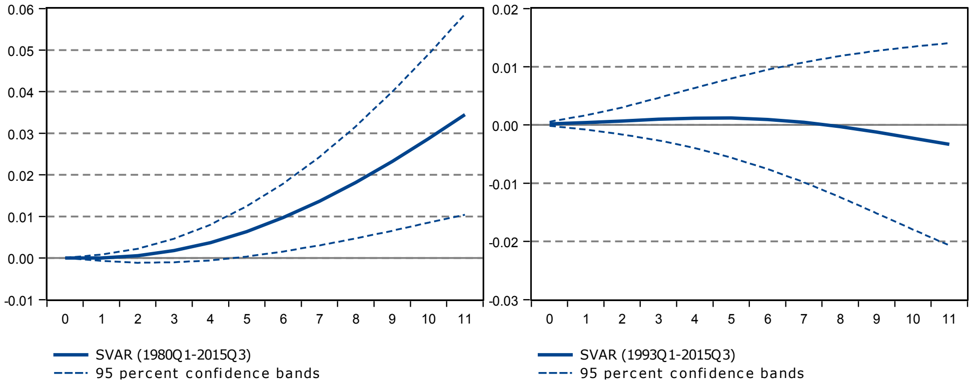



**Figure 84 and 85 Employment effects on SVAR shocks to indirect taxes**



# Linear Local Projections

**IRFS USING THE (LINEAR) LP METHOD.GDP**

**Figure 86 and 87 Shocks to government consumption, effects on GDP (LP method)**

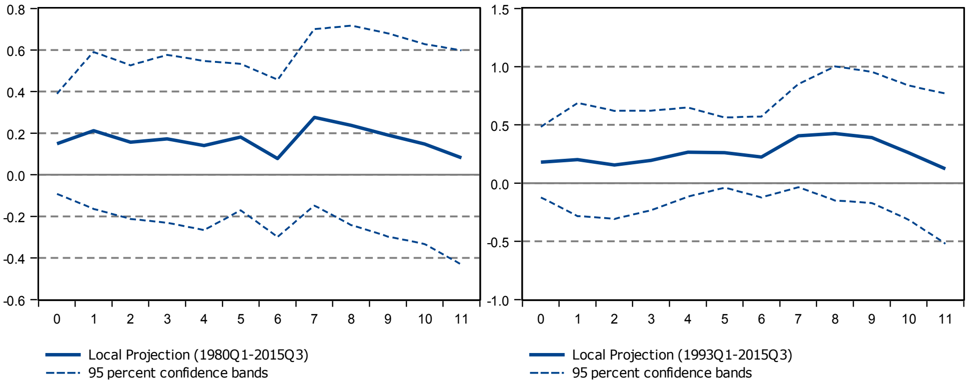



**Figure 88 and 89 Shocks to government investments, effects on GDP (LP method)**

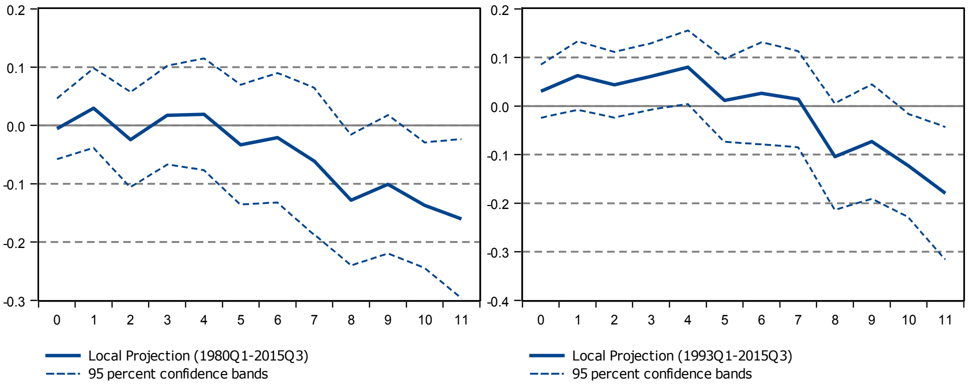



**Figure 90 and 91 Shocks to transfers, effects on GDP (LP method)**

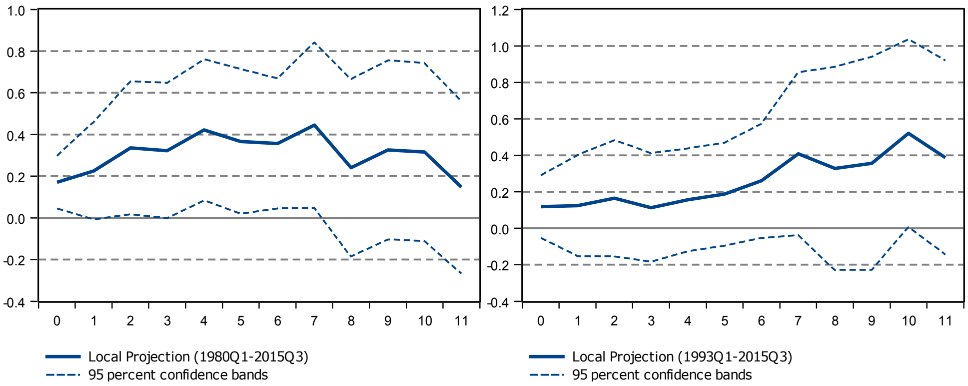


**Figure 92 and 93 Shocks to direct taxes, effects on GDP (LP method)**

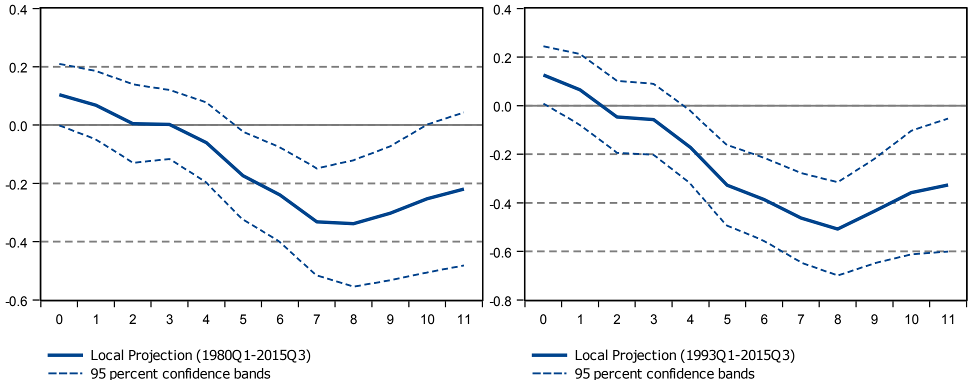
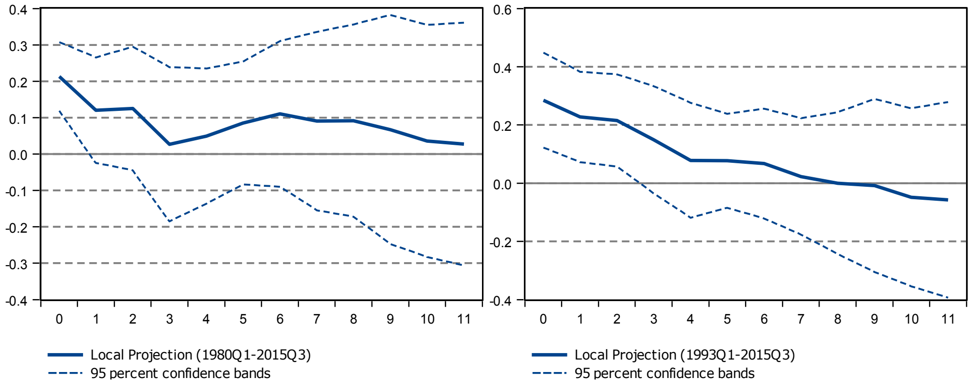



**Figure 94 and 95 Shocks to indirect taxes, effects on GDP (LP method)**



**IRFS USING THE (LINEAR) LP METHOD. EMPLOYMENT**

**Figure 96 and 97 Shocks to government consumption, effects on employment (LP method)**

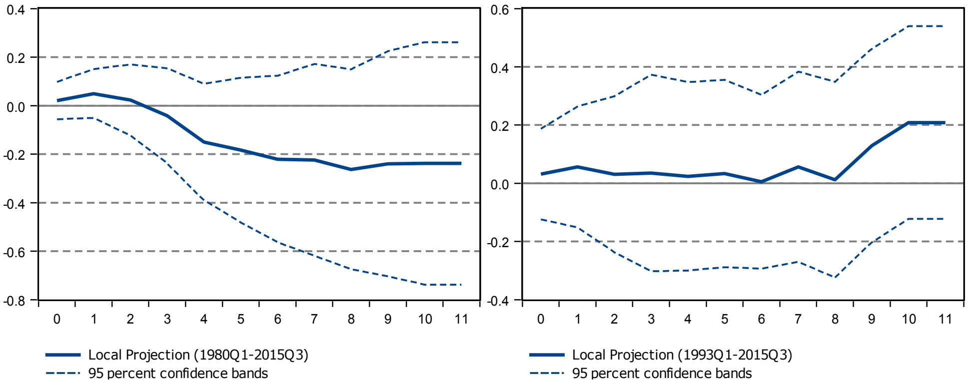



**Figure 98 and 99 Shocks to government investments, effects on employment (LP method)**

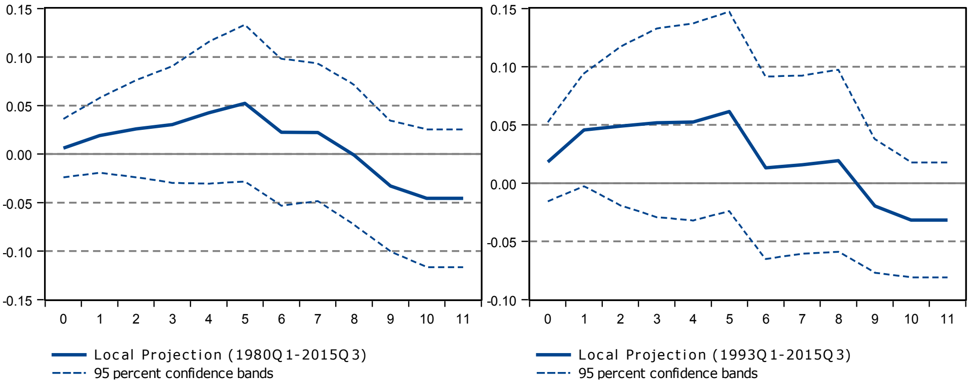



**Figure 100 and 101 Shocks to transfers, effects on employment (LP method)**

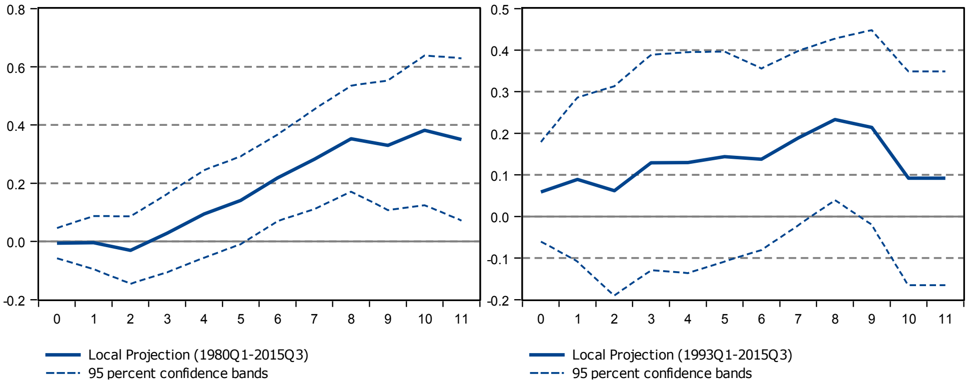


**Figure 102 and 103 Shocks to direct taxes, effects on employment (LP method)**

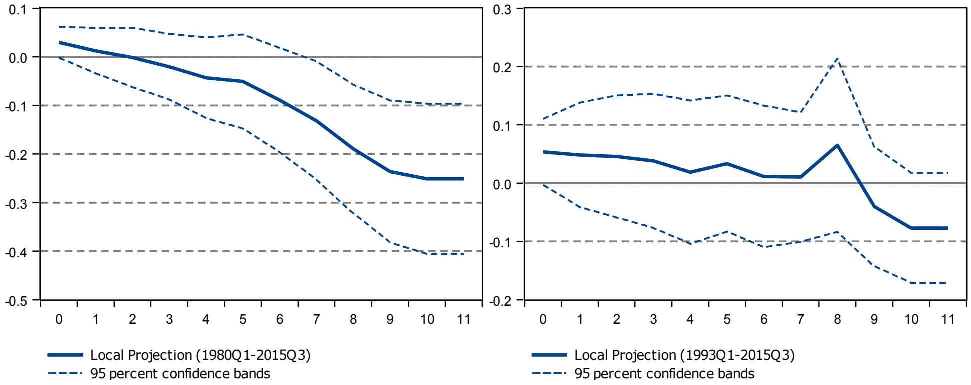
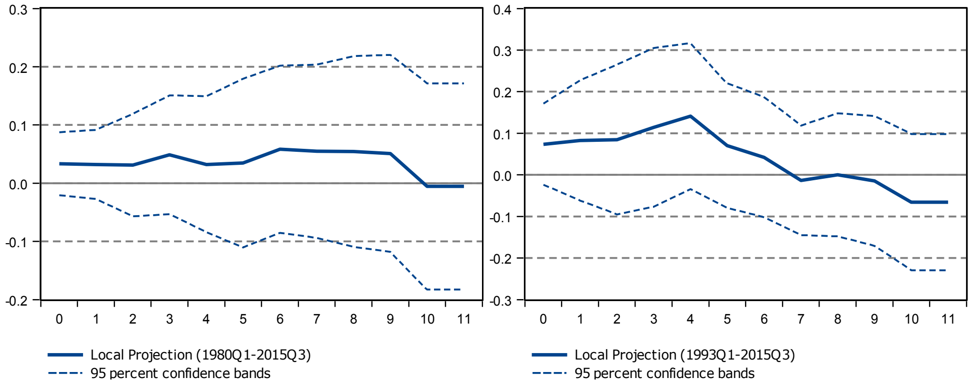
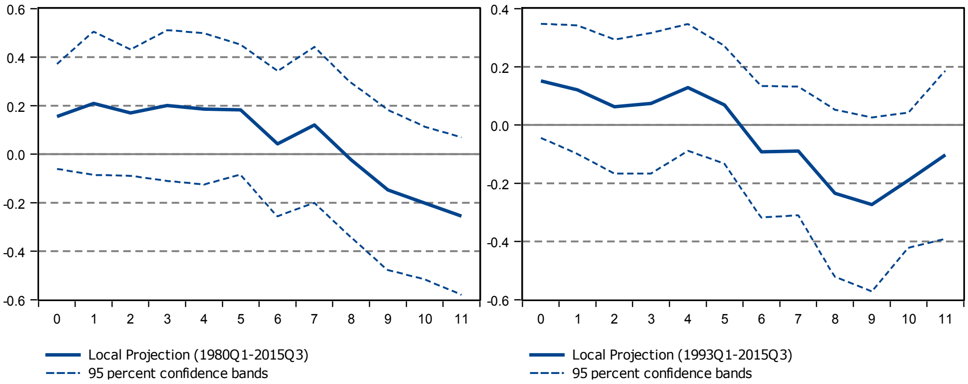



**Figure 104 and 105 Shocks to indirect taxes, effects on employment (LP method)**

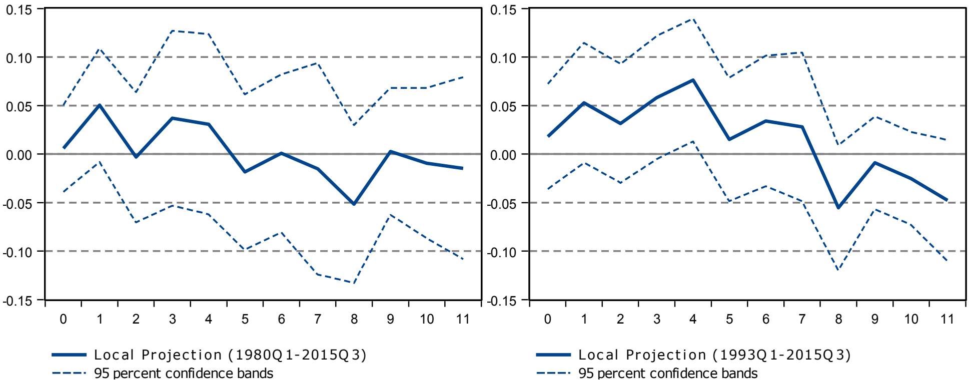


## IRFS USING THE (LINEAR) LP METHOD. GDP. INCLUDING THE OECD GAP

### Figure 106 and 107 Shocks to government consumption, effects on GDP (LP method)




### Figure 108 and 109 Shocks to government investments, effects on GDP (LP method)




### Figure 110 and 111 Shocks to transfers, effects on GDP (LP method)

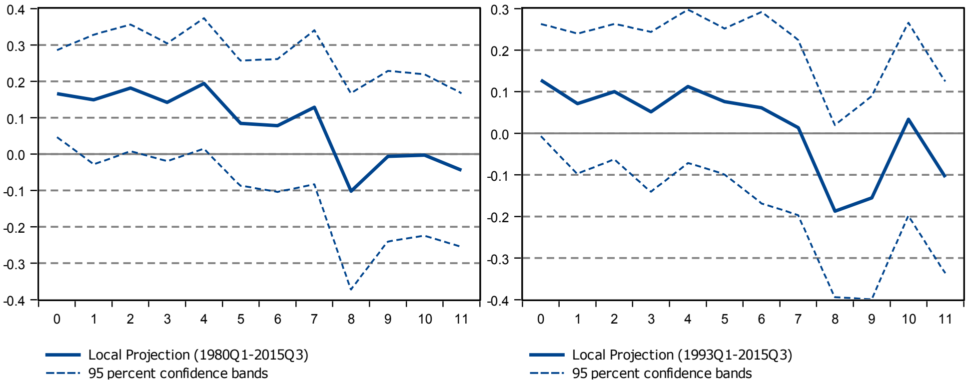


**Figure 112 and 113 Shocks to direct taxes, effects on GDP (LP method)**

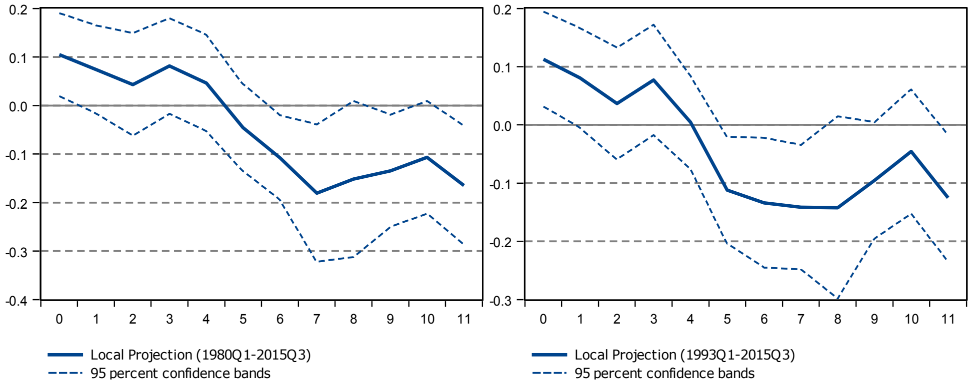
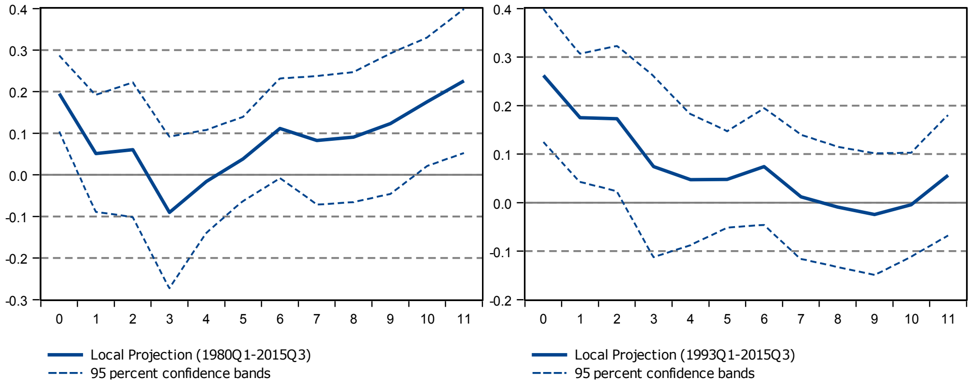



**Figure 114 and 115 Shocks to indirect taxes, effects on GDP (LP method)**



## IRFS USING THE (LINEAR) LP METHOD. EMPLOYMENT. INCLUDING THE OECD GAP

**Figure 116 and 117 Shocks to government consumption, effects on employment (LP method)**

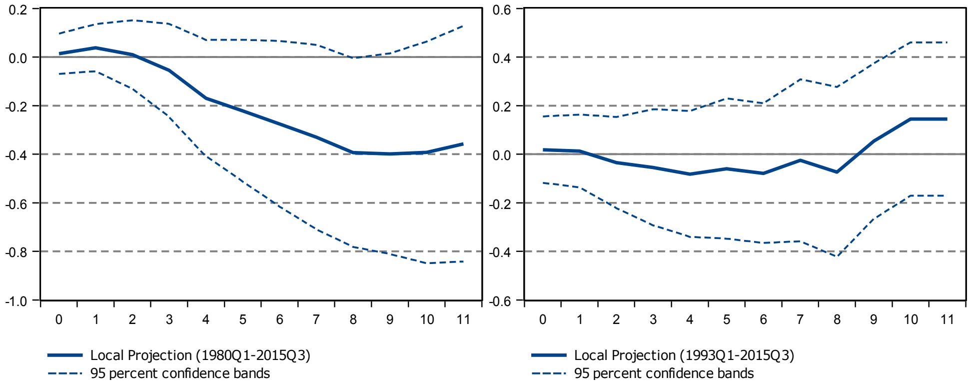



**Figure 118 and 119 Shocks to government investments, effects on employment (LP method)**

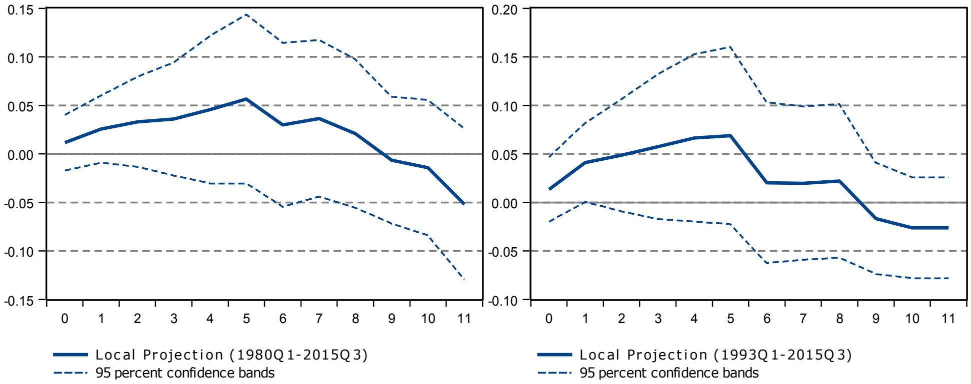



**Figure 120 and 121 Shocks to transfers, effects on employment (LP method)**

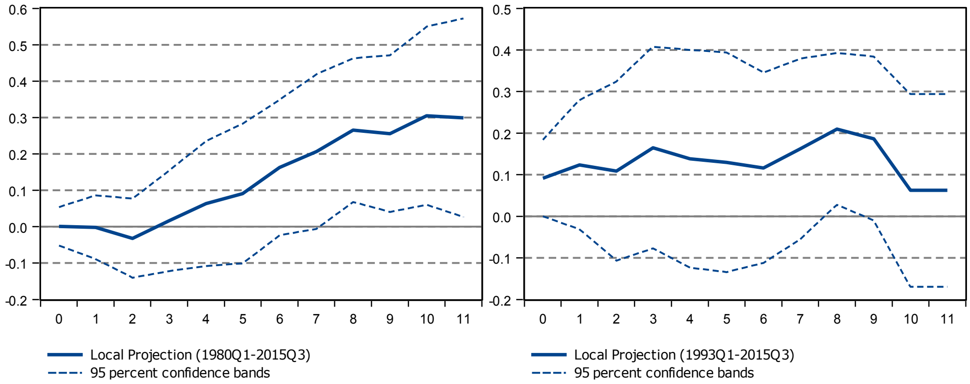


**Figure 122 and 123 Shocks to direct taxes, effects on employment (LP method)**

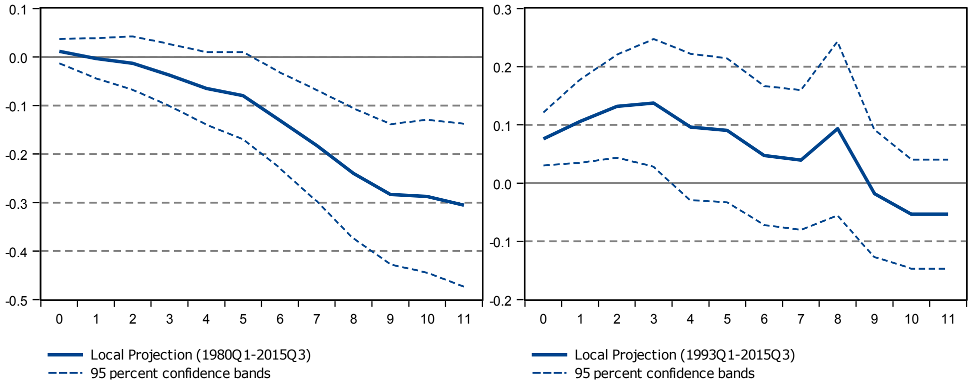
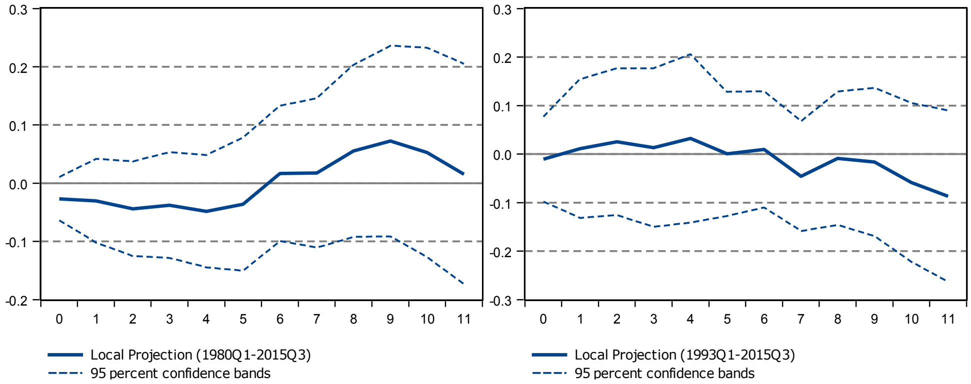


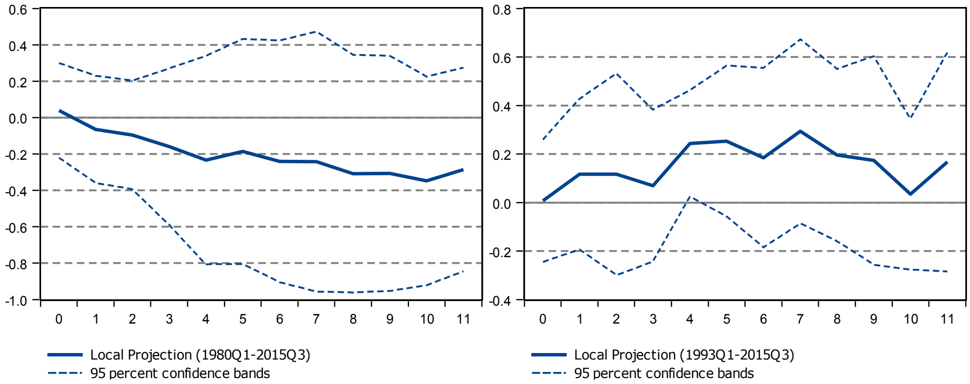

**Figure 124 and 125 Shocks to indirect taxes, effects on employment (LP method)**



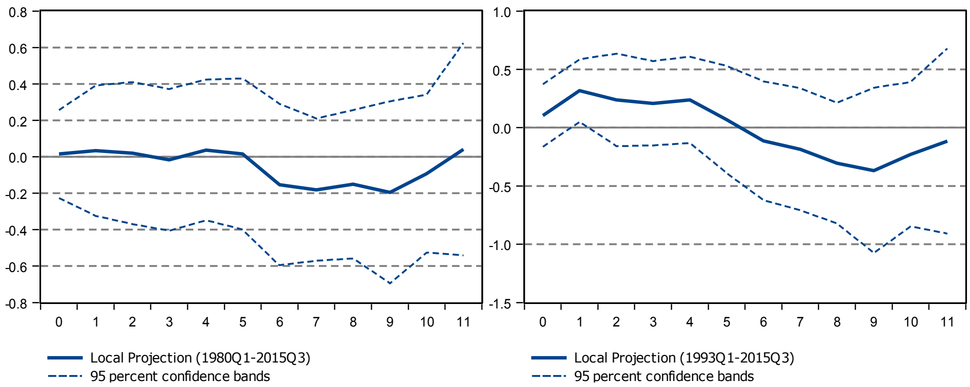
# Nonlinear Local Projections

## GDP EFFECTS OF G-SHOCKS (LP). NEGATIVE CHANGE AND LEVEL OF OUTPUT GAP

### Figure 126 and 127 IRFs in periods of slump (NIER)




### Figure 128 and 129 IRFs in periods of slump (HP)




## GDP EFFECTS OF IG-SHOCKS (LP)

### Figure 130 and 131 IRFs in periods of slump (NIER)

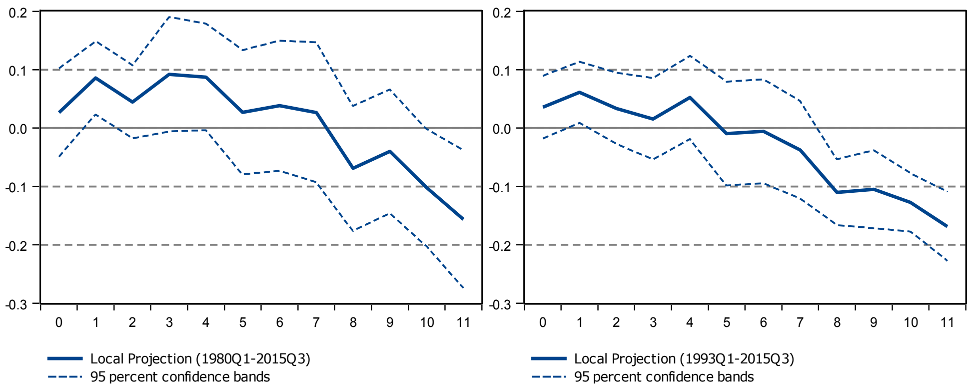
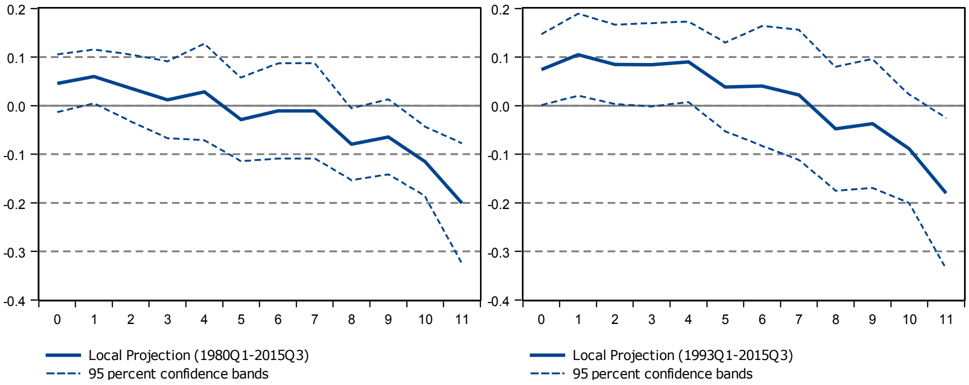


**Figure 132 and 133 IRFs in periods of slump (HP)**




**GDP EFFECTS OF TR-SHOCKS (LP)**

**Figure 134 and 135 IRFs in periods of slump (NIER)**

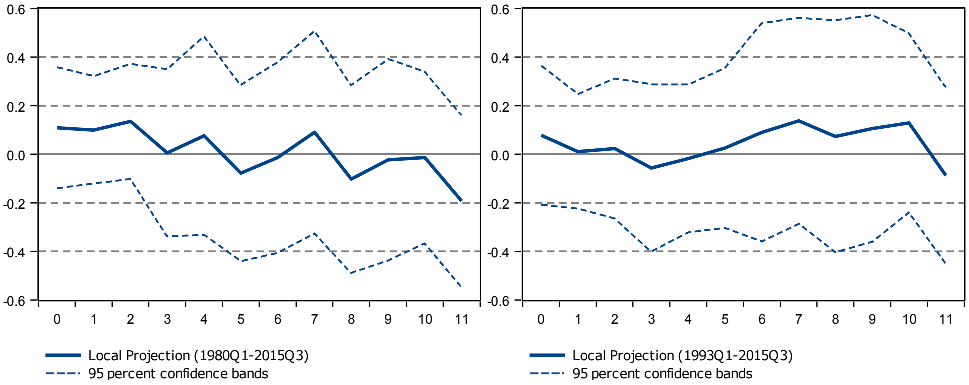
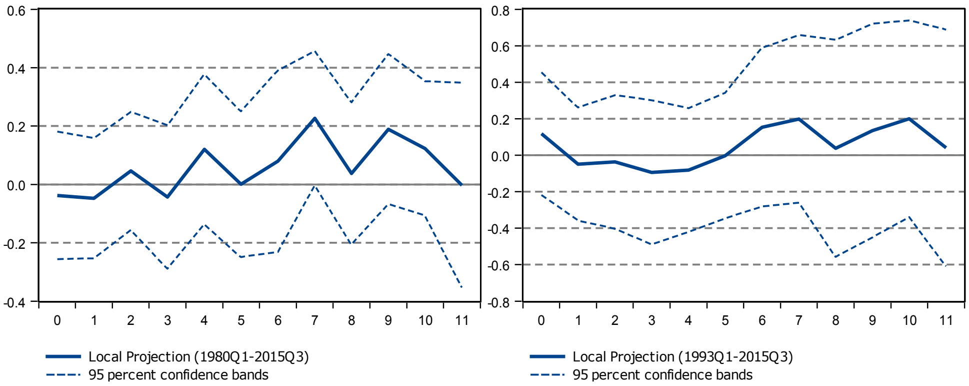
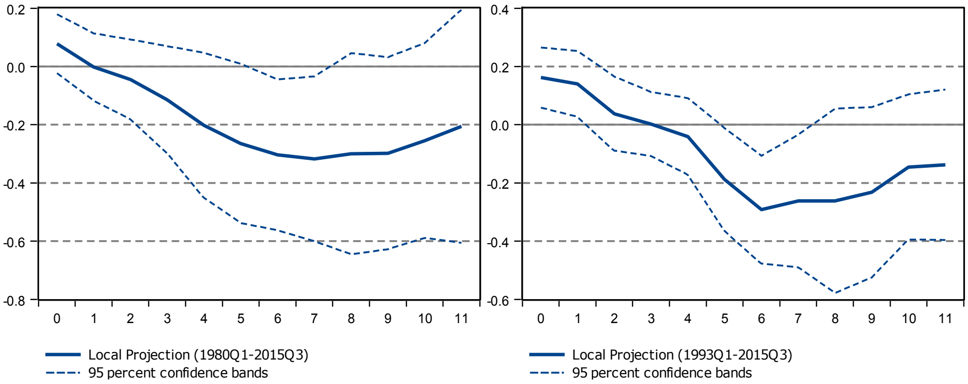



**Figure 136 and 137 IRFs in periods of slump (HP)**

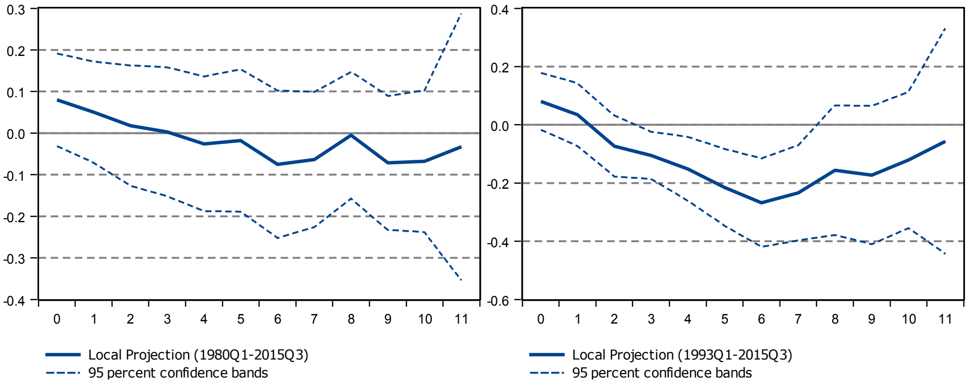


## GDP EFFECTS OF T-SHOCKS (LP)

### Figure 138 and 139 IRFs in periods of slump (NIER)

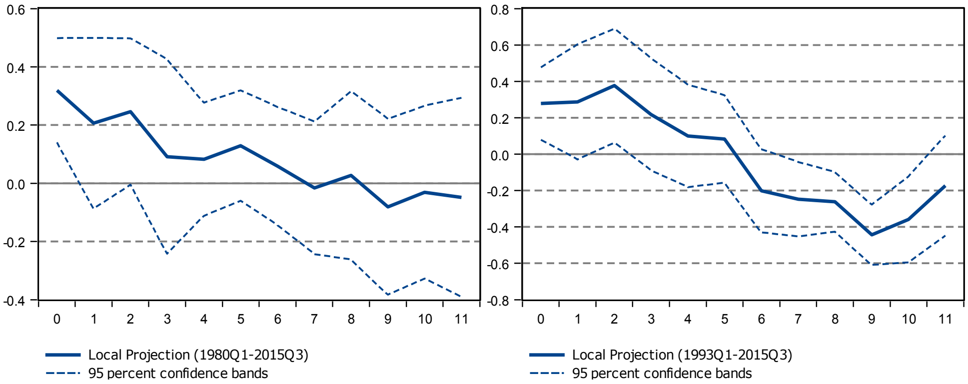



### Figure 140 and 141 IRFs in periods of slump (HP)

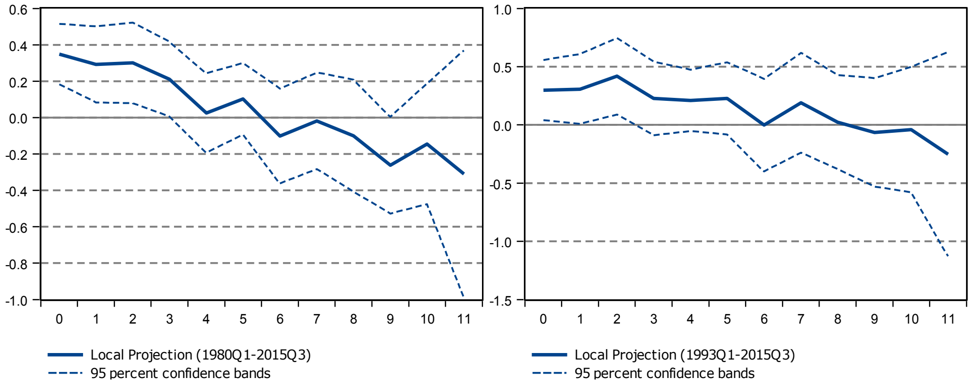



## GDP EFFECTS OF IT-SHOCKS (LP)

### Figure 142 and 143 IRFs in periods of slump (NIER)

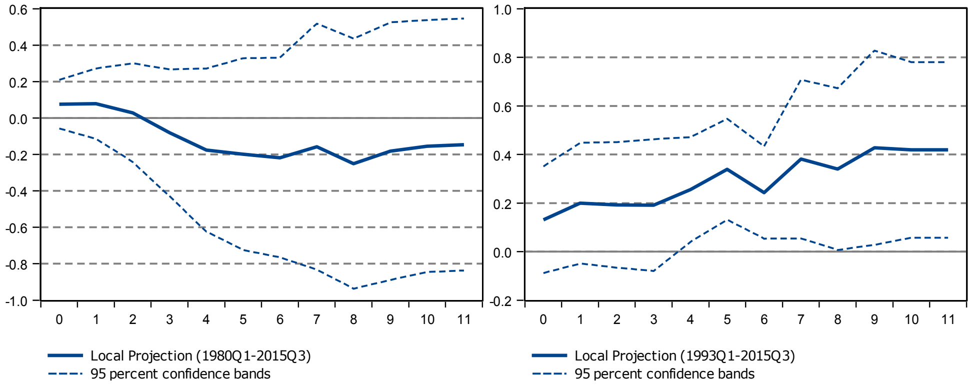


### Figure 144 and 145 IRFs in periods of slump (HP)

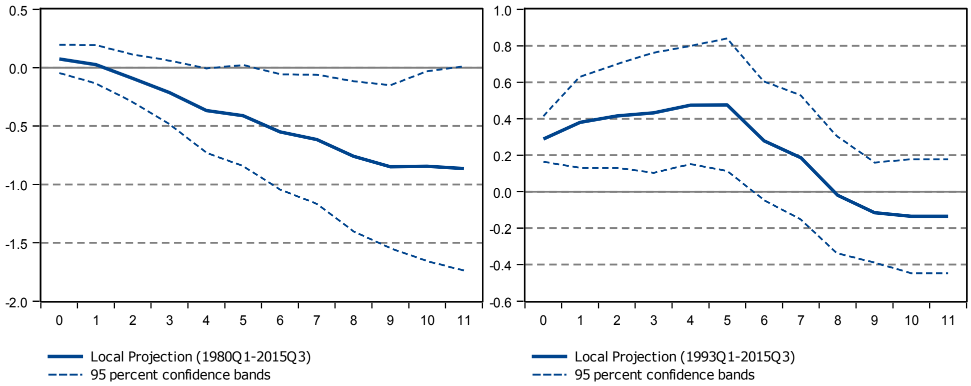



## EMPLOYMENT EFFECTS OF G-SHOCKS (LP)

### Figure 146 and 147 IRFs in periods of slump (NIER)

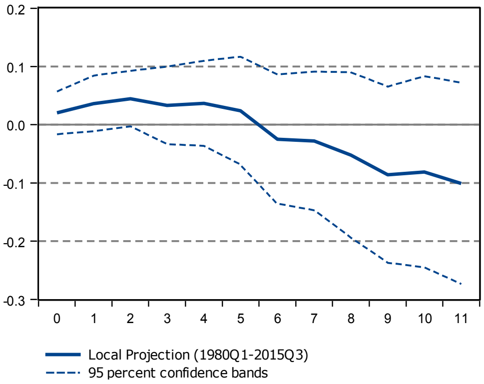


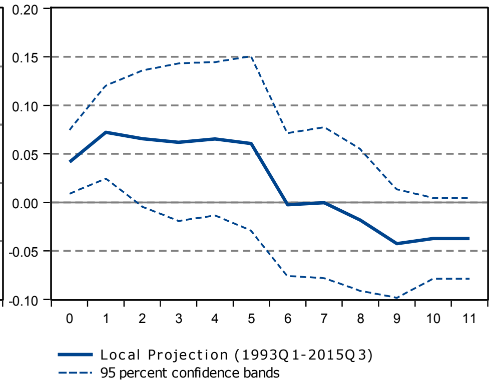

### Figure 148 and 149 IRFs in periods of slump (HP)



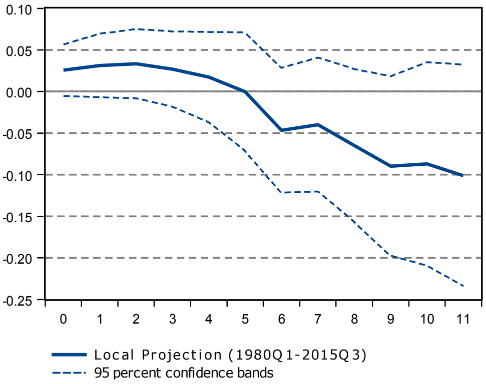
## EMPLOYMENT EFFECTS OF IG-SHOCKS (LP)

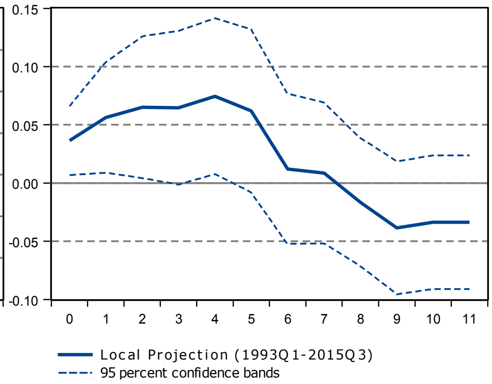
### Figure 150 and 151 IRFs in periods of slump (NIER)



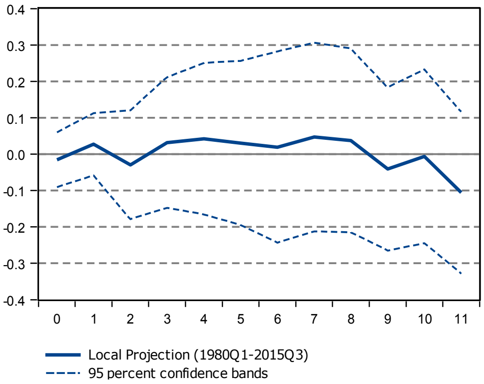

### Figure 152 and 153 IRFs in periods of slump (HP)

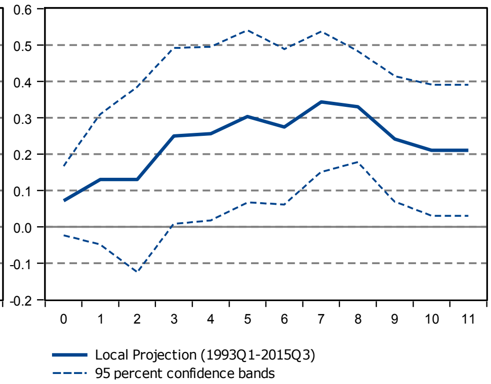


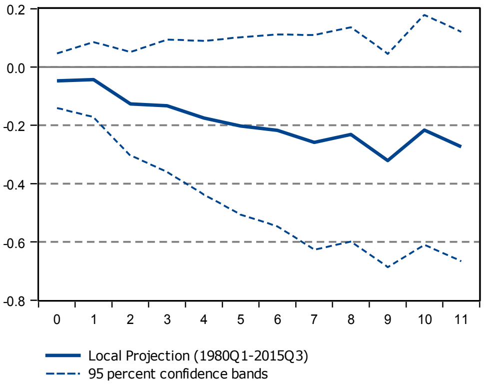

## EMPLOYMENT EFFECTS OF TR-SHOCKS (LP)

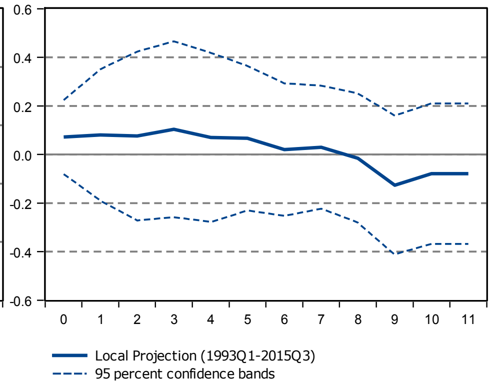
### Figure 154 and 155 IRFs in periods of slump (NIER)



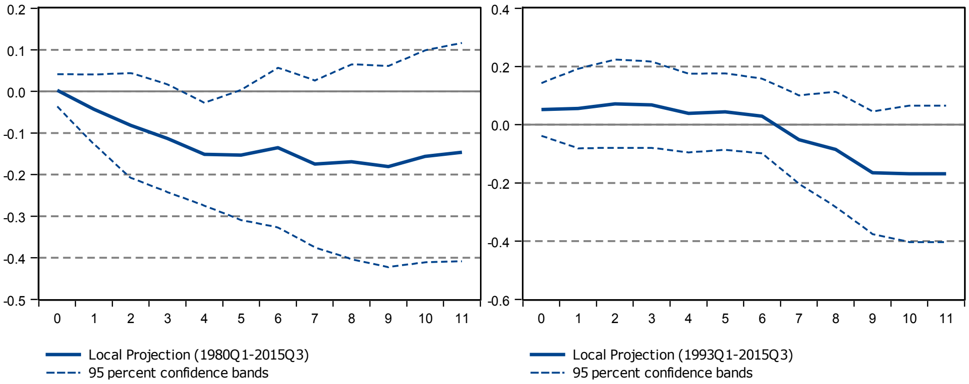

### Figure 156 and 157 IRFs in periods of slump (HP)



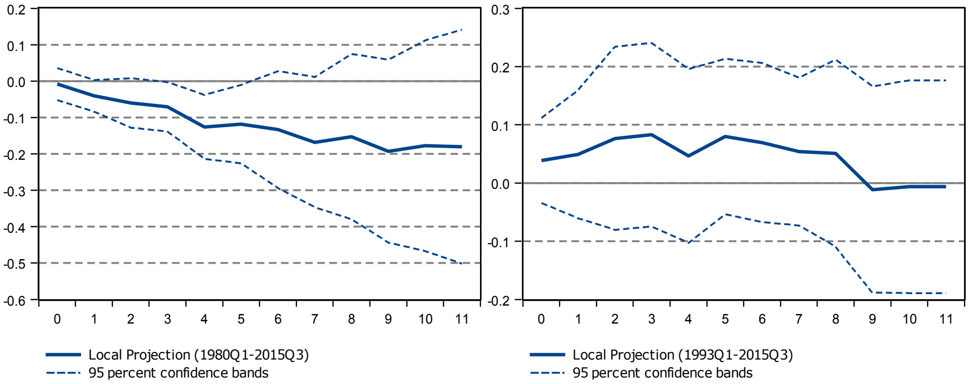



## EMPLOYMENT EFFECTS OF T-SHOCKS (LP)

### Figure 158 and 159 IRFs in periods of slump (NIER)




### Figure 160 and 161 IRFs in periods of slump (HP)



**EMPLOYMENT EFFECTS OF IT-SHOCKS (LP)**

**Figure 162 and 163 IRFs in periods of slump (NIER)**

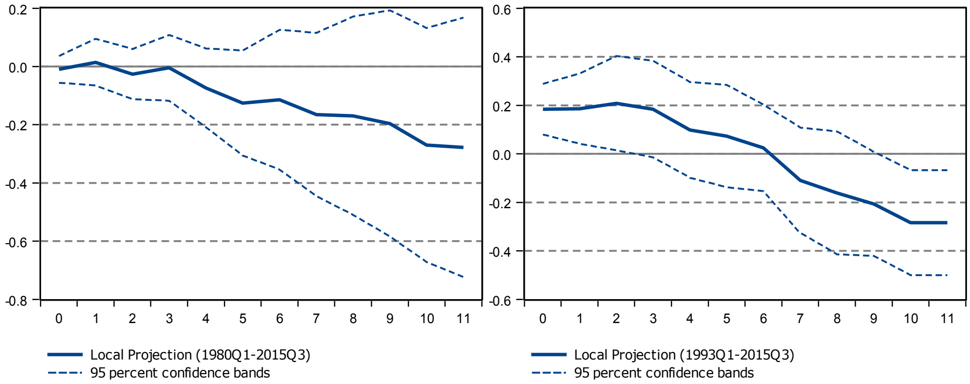
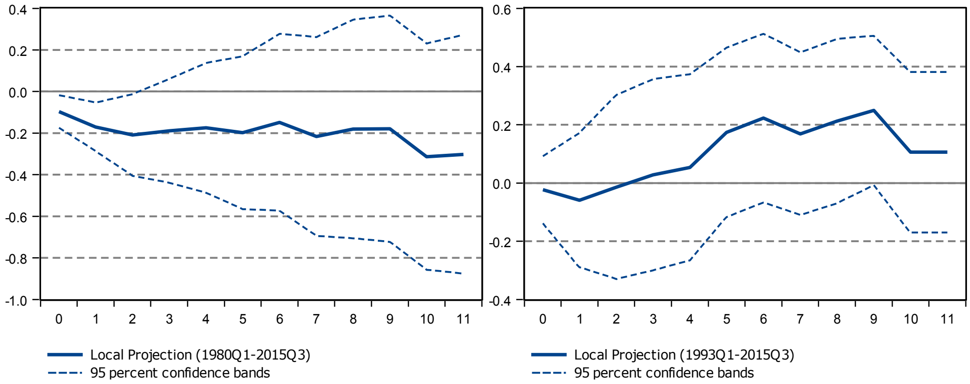



**Figure 164 and 165 IRFs in periods of slump (HP)**



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