Fiscal Spillovers and Monetary Policy Transmission in the Euro Area

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Motivation

The key to understanding the current challenges in the euro area is the specific construction of Economic and Monetary Union. The coexistence of an achieved monetary union - the single currency, the single monetary policy and the Eurosystem with the ECB at its helm- and of a largely decentralized economic pillar. Indeed, Member States are responsible for their fiscal and economic policies, but are called to treat them as a matter of common concern.

(Jean-Claude Trichet (28th of June, 2011), in "Revitalising the European Dream: A Corporate View")

Motivating Questions

- This common concern refers to the fact that fiscal policy has external effects on other countries
- Where do those effects of a single country's fiscal policy lie and how big are they?
- In what way does it depend on the common monetary policy?
- How different is monetary transmission across countries and how ...
- Would it change with different fiscal policy specifications?

My Approach

- Fully structural (DSGE) complementing the mostly purely empirical work in this area so far
- Each country is estimated with bayesian methods separately as an open economy model and then all countries are tied together via trade weights (GVAR methodology)
- In total, this corresponds to a multi-country (or: multi-regions) new-keynesian model for the Euro Area
- new approach in estimating a structural multi-country model
- The structure allows policy analysis and counterfactual (eg. decomposition of channels)

Related Papers

1. Global VAR (GVAR)
    - Pesaran, Scott, Weiner (2003), estimate the first GVAR in reduced form
    - Dees, Pesaran, Smith, Smith (2010) (DPSS), use structural equations
    - Hebous, Zimmermann (2010) determine fiscal spillovers in reduced form
2. Currency Union (all of them are two country economies)
    - Wolman, Duarte (2010) analyze fiscal policy and regional inflation
    - Stähler, Thomas (2011) look at fiscal policy in a currency union
    - Forni,Pisani (2010) examine fiscal consolidation between Spain and Euro area
3. Fiscal and Monetary policy in the Euro area
    - Gali, Monacelli (2008) analyze optimal policy
    - Cwik, Wieland (2009) use Taylor's multi-country model for some Euro countries

Results to take away

- Monetary policy has a heterogeneous effect both on output and on inflation, debt accumulation is also different across countries
- Monetary Transmission would become more homogeneous if all countries followed the same fiscal policy rules
- The only structural model that is able to analyze the size and sign of fiscal spillovers:
    1. the Interest rate channel decreases fiscal spillovers
    2. the trade channel increases fiscal spillovers
- Stabilization Policy dictates for the central bank to target inflation as aggressively as possible and for the fiscal branch to react heavily to deviations of debt from its steady state

Outline of Talk and Procedure

1. Model description
2. Data and data transformation
3. Calibration and Estimation
4. Solving the model
5. Results

Overview

- Medium-sized open economy DSGE model
- two micro founded sectors: households with habit formation and firms
- Firms have monopolistic power: Calvo pricing and indexing to lagged inflation
- no capital included
- fiscal authority is allowed to run deficits and behaves according to rules
- common monetary policy authority that sets the common short run interest rate
- perfect risk sharing between agents in the currency union

Households

The period utility function looks like this:

$$U(C,L) \equiv \frac{(C_{i,t} - h_i C_{i,t-1})^{1-\sigma_i}}{1-\sigma_i} - \frac{L_{i,t}^{1+\phi_i}}{1+\phi_i}$$

The lifetime utility function is maximized under the budget constraint:

$$\int_0^1 P_{i,t}(j) C_{i,t}(j)(1+\tau_{i,t}^C) + R_t B_{i,t} \leq B_{t-1,i} + (1-\tau_{i,t}^L) W_{i,t} L_{i,t} + Pr_{i,t}$$

with respect to $C_{i,t}$,$L_{i,t}$ and $B_{i,t}$

Firms

The Production Function looks like this:

$$Y_{i,t}(j) = A_{i,t} L_{i,t}(j)$$

Retailers include the nominal friction in the model by maximizing over the price (Calvo + indexation) Profits of firm j (in nominal terms) are then equal to

$$\Pi_{i,t}(j) = (P_{i,t}(j) - MC_{i,t}) \left(\frac{P_{i,t}(j)}{P_{i,t}} \right) Y_{i,t}(j)$$

The overall aggregate demand equation looks like this:

$$Y_{i,t}(j) = C_{i,t}^{H}(j) + \sum_{k=2}^{11} C_{k,t}^{*}(j) + G_{i,t}(j)$$

Government

Fiscal Sector (Log-linearized tax rates and gov. expenditure rules):

$$\begin{aligned}
\tau_{i,t}^{C} &= \rho_{\tau^C}\tau_{i,t-1}^{C} + \rho_{\tau^C,y}\tilde{y}_{i,t} + \rho_{\tau^C,b}\tilde{b}_{i,t-1} + \epsilon_t^{\tau^C} \\
\tau_{i,t}^{L} &= \rho_{\tau^L}\tau_{i,t-1}^{L} + \rho_{\tau^L,y}\tilde{y}_{i,t} + \rho_{\tau^L,b}\tilde{b}_{i,t-1} + \epsilon_t^{\tau^L} \\
\tilde{g}_{i,t} &= \rho_g\tilde{g}_{i,t-1} - \rho_{g,y}\tilde{y}_{i,t} - \rho_{g,b}\tilde{b}_{i,t-1} + \epsilon_t^{G}
\end{aligned}$$

The Budget constraint of the government is:

$$B_{i,t} = \frac{B_{i,t-1}R_{t-1}}{\pi_{i,t}} + G_{i,t} - T_{i,t}$$

Euro Area wide central bank Interest Rate rule in log-linearized form:

$$\tilde{r}_t = \rho_r\tilde{r}_{t-1} + \rho_\pi(\omega_i\tilde{\pi}_{i,t} + (1-\omega_i)\tilde{\tilde{\pi}}_{i,t}^{*}) + \rho_y(\omega_i\tilde{y}_{i,t} + (1-\omega_i)\tilde{\tilde{y}}_{i,t}^{*}) + \epsilon_{t,R}$$

Foreign Economy

- along the lines of Adolfson (2005) and Forni, Pisani (2010) I add a reduced form VAR(1) with consumption, output and inflation for the foreign country
- in addition to that the lagged interest rate is included as an explanatory variable
  $\Rightarrow$ otherwise each single country-model would not be determinate, compare Leeper (1994) "passive" monetary and "passive" fiscal policy
- later the foreign sector will be fully endogenized (see reduced form GVAR)

Variables used

1. Endogenous Variables
   - real Output
   - real Government Expenditure
   - Inflation
   - real Debt
   - Labor tax rate
   - Consumption tax rate
2. Weakly exogenous variables
   - Common short run interest rate
   - Oil Price
3. For the Trade weights: Imports and exports between the respective countries

Description

Origin:

- The endogenous variables for all countries stem from the OECD quarterly data set
- The weakly exogenous variables are taken from the AWM dataset
- Trade data come from eurostat

Frequency and Time Range:

- Quarterly Data
- Ranging from $1999Q1$ to $2009Q4$ (for trade data: yearly data from 1999 to 2009)

Countries covered:

- Austria, Belgium, Germany, Finland, France, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain

Detrending with GVECM

- Perform GVECM with the endogenous variables and the two weakly exogenous variables (interest rate and oil price)
- Calculate infinite forecasts (these values are the steady state values) and deduct those from the actual observations (controlling for intercept and trend, if necessary)
- this procedure was put forward by DPSS (2009) and is shown to be equivalent to a multivariate Beveridge-Nelson Decomposition
- the deviations from steady state values are then taken for the estimation (no measurement equations needed any more)

Calibrated Parameters

Calibrated Parameters for two countries: Germany and Spain

Description	Parameter	GE	ES
impatience	β	0.99	0.99
openness	$1-\lambda$	0.124	0.159
openness *	$1-\lambda^*$	0.083	0.023
Labor tax ss	τ_L^{SS}	0.1091	0.0892
Cons. tax ss	τ_C^{SS}	0.1276	0.1378
Gov. over GDP ss	$\frac{G^{ss}}{Y^{ss}}$	0.188	0.185
GDP over debt ss	$\frac{Y^{ss}}{B^{ss}}$	1.500	2.00
Lagged IR	ρ_r	0.8514	0.8514
Coeff. on inflation	ρ_π	1.5432	1.5432
Coeff. on output	ρ_y	0.0957	0.0957
GDP weight	ω	0.289	0.123

Estimation

- Each country DSGE model is estimated separately
- Priors and prior distributions are the same for every country
- For the priors and their shapes I rely heavily on Lubik, Schorfheide (2006) and Smets, Wouters (2003)
- The coefficients of the Taylor Rule are also estimated in a Euro Area wide estimation of the model beforehand
- Three Metropolis-Hastings Chains with 250000 replications each, convergence according to Brooks-Gelman Diagnostics

Some Estimation Results

Solution I

1. After having estimated the parameters one can bring the model in the following form:

$$A_{i,0}x_{i,t} = A_{i,1}x_{i,t-1} + A_{i,2}E_t(x_{i,t+1}) + A_{i,3}x^*_{i,t} + A_{i,4}x^*_{i,t-1} + G_i w_{i,t}$$

   with $w_{i,t} = \gamma_i w_{i,t-1} + \epsilon_{i,t}$

2. By the GVAR methodology I stack the country matrices one below the other by constructing the trade weighting matrices for all countries W_i and the vector $z_{i,t} = (x_{it}^{'}, x_{it}^{*'})'$:

$$A_{i,z0}z_{i,t} = A_{i,z1}z_{i,t-1} + A_{i,z2}E_t(z_{i,t+1}) + G_i w_{i,t}$$

   with $A_{i,z0} = (A_{i,0}, -A_{i,3})$, $A_{i,z1} = (A_{i,1}, A_{i,4})$ and $A_{i,z2} = (A_{i2}, 0(dim(A_{i,4})))$

Solution II

3. Now I can relate the single country variables to the full set of all endogenous variables $z_{i,t} = W_i x_t$. It is then possible to stack the 11 countries below each other and get the global solution after inverting:

$$x_t = Ax_{t-1} + BE_t(x_{t+1}) + \Gamma u_t$$

4. In order to obtain a global solution and be able to perform a dynamic analysis the following form is required

$$x_t = \Phi x_{t-1} + H\epsilon_t$$

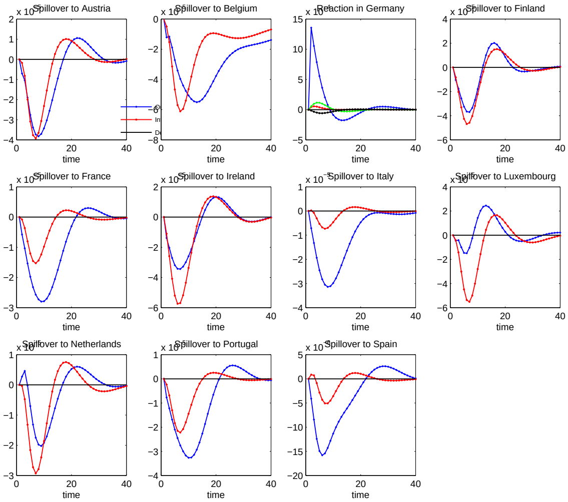
5. This is obtained via the Binder, Pesaran (1995,1997) method

Example GVAR

Order of results

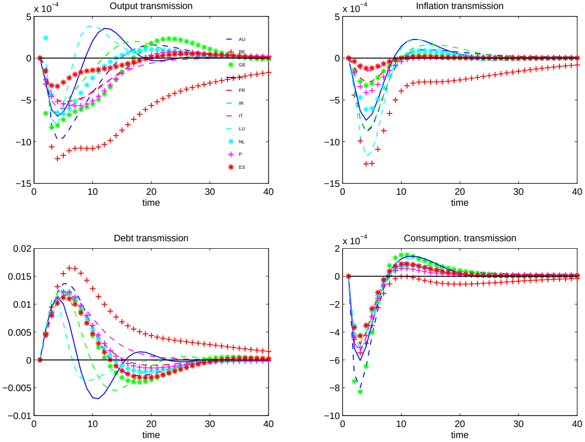
- Fiscal Spillovers after a
  - Government Shock
  - Consumption Tax shock
  - Labor tax shock
- Decomposition of Interest Rate and Trade channels
- Monetary Policy
  - baseline results
  - counterfactuals with different fiscal specification
- Stabilization Policy of MP to a fiscal shock
- Stabilization Policy of FP to a monetary shock

Germany's government spending increase



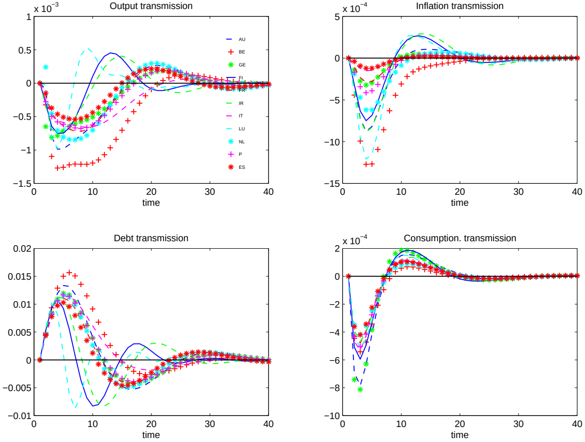
The interest rate channel dominates the trade channel as is intuitive and therefore most fiscal spillovers (both output and inflation) of all other member countries are negative. The multiplier is positive, however.

Baseline Case



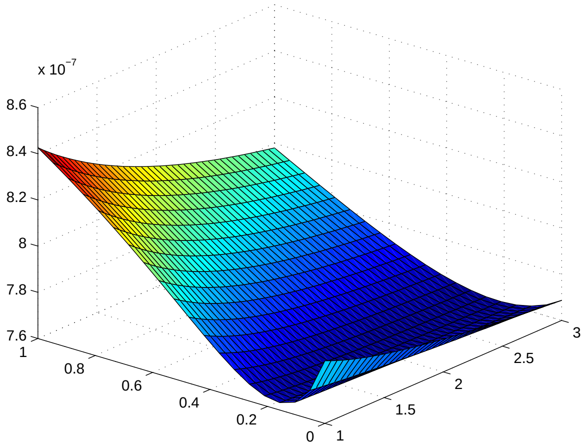
Monetary Policy is heterogeneous in terms of output and inflation transmission. The reaction is sizeable and quite persistent.

Counterfactual Exercise



The reaction of inflation did not change at all, output changes for a few countries by a bit(and will change more upon the next estimation

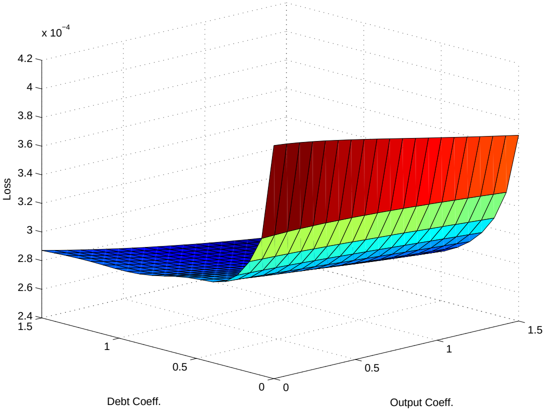
Monetary Reaction to Fiscal Policy Shock I



Loss Function: $L = 0.8\pi^2 + 0.2y^2$

The optimal reaction to stabilize euro area wide inflation and output (after a gov. exp. shock in Germany) is for the central bank to react to output with a coefficient of approximately 0.2 and to inflation as aggressively as possible.

Fiscal Reaction to Monetary Policy Shock



Loss Function: $L = 0.5y^2 + 0.5b^2$

The optimal response is to target debt and output both very aggressively to stabilize the economy after a expansionary shock to the interest rate rule.

Conclusion

- This paper adds to the existing literature along two lines:
  1. fiscal monetary interaction in a currency union
  2. setting up and estimating a new multi-country model
- Fiscal spillovers are mostly dominated by the interest rate channel
- Monetary policy transmission heavily depends on homogeneity of country-specific fiscal rules
- Instrument with which one can analyze many more macroeconomic questions in a currency union

Further Research

- Business Cycle convergence in the Euro Area over time
- how well do the country models match the actual data (DSGE-GVAR)
- Regions of (In-)Determinacy in the Fiscal-Monetary Interactions within the global model
- Extending the model with capital, net worth and borrowing constraints
- Incomplete/Complete Markets and other frictions

Estimation Results

Estimated Parameters for two countries: Germany and Spain

Description	Parameter	Prior	Prior Shape	Prior Std. Dev.	GE	ES
habit	h	0.3000	normal	0.1	0.3801	0.3676
Calvo parameter	θ	0.7500	normal	0.05	0.9071	0.9166
inflation indexation	ϖ	0.7500	normal	0.1	0.7536	0.5994
CES utility consumption	σ	3.0000	normal	0.5	2.8704	2.5832
CES utiliy labor	ϕ	2.0000	normal	0.5	2.8628	2.6656
AR param. gov. exp. rule	ρ_g	0.8	uniform	0.15	0.9114	0.855
coeff. on Y in gov. exp. rule	$\rho_{g,y}$	0.25	normal	0.05	0.1688	0.2017
coeff. on B in gov. exp. rule	$\rho_{g,b}$	0.1	normal	0.02	0.2316	0.2414
AR parameter cons. tax rule	ρ_{τ^C}	0.8	uniform	0.15	0.6636	0.8352
coeff. on Y cons. tax rule	$\rho_{\tau^C,y}$	0.25	normal	0.05	0.1611	0.1733
coeff. on B cons. tax rule	$\rho_{\tau^{\circ}C,b}$	0.1	normal	0.02	0.1838	0.1364
AR parameter labor tax rule	ρ_{τ^L}	0.8	uniform	0.15	0.8067	0.6802
coeff. on Y labor tax rule	$\rho_{\tau^L,y}$	0.25	normal	0.05	0.1588	0.2012
coeff. on B labor tax rule	$\rho_{\tau^L,b}$	0.1	normal	0.02	0.1821	0.1323

Back to Estimation

Simple three country example I

$$x_{1t} = \Phi_1 x_{1,t-1} + \Lambda_{10} x^*_{1t} + \Lambda 11 x^*_{1,t-1} + u_{1t}$$

$$x_{2t} = \Phi_2 x_{2,t-1} + \Lambda_{20} x^*_{2t} + \Lambda 21 x^*_{2,t-1} + u_{2t}$$

$$x_{3t} = \Phi_3 x_{3,t-1} + \Lambda_{30} x^*_{3t} + \Lambda 31 x^*_{3,t-1} + u_{3t}$$

For Country 1 this means in detail:

$$\begin{pmatrix} y_{1t} \\ \pi_{1t} \end{pmatrix} = \begin{pmatrix} \phi_{1,11} & \phi_{1,12} \\ \phi_{1,21} & \phi_{1,22} \end{pmatrix} \begin{pmatrix} y_{1,t-1} \\ \pi_{1,t-1} \end{pmatrix} + \begin{pmatrix} \lambda_{11,11} & \lambda_{11,12} \\ \lambda_{11,21} & \lambda_{11,22} \end{pmatrix} \begin{pmatrix} y^*_{1t} \\ \pi^*_{1t} \end{pmatrix} + \begin{pmatrix} \lambda_{12,11} & \lambda_{12,12} \\ \lambda_{12,21} & \lambda_{12,22} \end{pmatrix} \begin{pmatrix} y^*_{1,t-1} \\ \pi^*_{1,t-1} \end{pmatrix} + \begin{pmatrix} u_{y,1t} \\ u_{\pi,1t} \end{pmatrix}$$

$$\begin{pmatrix} 1 & 0 & -\lambda_{11,11} & -\lambda_{11,12} \\ 0 & 1 & -\lambda_{11,21} & -\lambda_{11,22} \end{pmatrix} \begin{pmatrix} y_{1t} \\ \pi_{1t} \\ y^*_{1t} \\ \pi^*_{1t} \end{pmatrix} = \begin{pmatrix} \phi_{1,11} & \phi_{1,12} & \lambda_{12,11} & \lambda_{12,12} \\ \phi_{1,21} & \phi_{1,22} & \lambda_{12,21} & \lambda_{12,22} \end{pmatrix} \begin{pmatrix} y_{1,t-1} \\ \pi_{1,t-1} \\ y^*_{1,t-1} \\ \pi^*_{1,t-1} \end{pmatrix} + \begin{pmatrix} u_{y,1t} \\ u_{\pi,1t} \end{pmatrix}$$

which given $z_{1,t} = W_1 \cdot x_t$ is:

$$A_1 z_{1t} = B_1 z_{1,t-1} + u_{1t}$$

Simple three country example II

The VARX* of country 1 is then finally:

$$\begin{pmatrix} 1 & 0 & -\lambda_{11,11} & -\lambda_{11,12} \\ 0 & 1 & -\lambda_{11,21} & -\lambda_{11,22} \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & w_{12} & 0 & w_{13} & 0 \\ 0 & 0 & 0 & w_{12} & 0 & w_{13} \end{pmatrix} \begin{pmatrix} y_{1t} \\ \pi_{1t} \\ y_{2t} \\ \pi_{2t} \\ y_{3t} \\ \pi_{3t} \end{pmatrix} =$$

$$\begin{pmatrix} \phi_{1,11} & \phi_{1,12} & \lambda_{12,11} & -\lambda_{12,12} \\ \phi_{1,21} & \phi_{1,22} & \lambda_{12,21} & \lambda_{12,22} \end{pmatrix} \begin{pmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ 0 & 1 & 0 & 0 & 0 & 0 \\ 0 & 0 & w_{12} & 0 & w_{13} & 0 \\ 0 & 0 & 0 & w_{12} & 0 & w_{13} \end{pmatrix} \begin{pmatrix} y_{1,t-1} \\ \pi_{1,t-1} \\ y_{2,t-1} \\ \pi_{2,t-1} \\ y_{3,t-1} \\ \pi_{3,t-1} \end{pmatrix} + \begin{pmatrix} u_{y,1t} \\ u_{\pi,1t} \end{pmatrix}$$ or in

more compact form:

$$A_1 W_1 x_t = B_1 W_1 x_{t-1} + u_{1t}$$

The final global solution is then:

$$\begin{pmatrix} A_1 W_1 \\ A_2 W_2 \\ A_3 W_3 \end{pmatrix} x_t = \begin{pmatrix} B_1 W_1 \\ B_2 W_2 \\ B_3 W_3 \end{pmatrix} x_{t-1} + \begin{pmatrix} u_{1t} \\ u_{2t} \\ u_{3t} \end{pmatrix}$$

Simple three country example III

or:

$$Gx_t = Hx_{t-1} + u_t$$

The reduced form global solution is at the end:

$$x_t = Fx_{t-1} + \epsilon_t$$

with: $F = G^{-1}H$ and $\epsilon_t = G^{-1}u_t$

Back to Solution