Calculating the multipliers within the Eurozone
Calculations based on Input-Output Tables
PKSG Keynes Seminar

Dr. Toralf Pusch

Halle Institute for Economic Research (IWH)

13 Nov. 2012
Calculating the multipliers within the Eurozone

Outline

Introduction

Background: empirical multiplier estimates

Input-Output based calculation of the multiplier

Some example calculations (DE, FR)
   - Textbook multiplier and general government spending multiplier
   - The spending multiplier of government consumption
   - The multiplier of government spending on construction
   - The multiplier of government spending on welfare

Comparison of multipliers for EU member states
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Some of my inspirations for this contribution:

- Input-Output researchers at my institute (Ludwig and Brautzsch 2008), reacting to the Bazaar Economy debate in Germany (launched by Sinn)
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- Two rather recent contributions considering the fiscal spending multipliers by Polish (Laski et al. 2010) and US (Palley 2009) researchers
- A general comeback of fiscal policy after the World Financial Crisis
Introduction 2

The development of Input-Output analysis

- The technique was developed by Wassily Leontief in the 1940s
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- Today Input-Output analysis is applied by researchers around the world, especially in Asia and the Netherlands.
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- Related to planning efforts during the US during World War 2
- Questions at that time: how are the effects of demobilization and decreases of war spending after the end of the war?
- This was also involving usage of the first large-scale commercial electro-mechanical computer of IBM.
- Today Input-Output analysis is applied by researchers around the world, especially in Asia and the Netherlands.
- Examples: Analysis of sectoral policies (e.g. R&D), tax policy, regional policy issues
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Comparison of multipliers for EU member states
Literature review: fiscal multipliers

- old: Samuelson (1948), Hansen (1953)
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- recent: New Keynesian studies (theoretical, empirical)
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Literature review: fiscal multipliers

**Literature review**

- old: Samuelson (1948), Hansen (1953)
- recent: New Keynesian studies (theoretical, empirical)
- recent: Post Keynesian studies (theoretical)
- 1st problem of many studies: linear approximation of fiscal spending multipliers (the same in booms as in downturns) which is unrealistic for a number of reasons
Literature review: fiscal multipliers

Literature review

- old: Samuelson (1948), Hansen (1953)
- recent: New Keynesian studies (theoretical, empirical)
- recent: Post Keynesain studies (theoretical)
- 1st problem of many studies: linear approximation of fiscal spending multipliers (the same in booms as in downturns) which is unrealistic for a number of reasons
- 2nd problem of many studies: macro data, only implicitly is the production structure reflected
Calculating the multipliers within the Eurozone

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Comparison of multipliers for EU member states
Textbook multiplier

Goes back to Samuelson (1948)

\[
\frac{dY}{dG} = \frac{1}{1 - c + m}
\]
Calculating the multipliers within the Eurozone

Input-Output method

Textbook multiplier

Goes back to Samuelson (1948)

\[
\frac{dY}{dG} = \frac{1}{1 - c + m}
\]

Assumptions:

- based on familiar accounting identity:
  \[Y = C + I + G + X - M\]
- marginal consumption and import quota: \(c, m\)
Calculating the multipliers within the Eurozone

Input-Output method

Input-Output tables

Domestic Input-Output table =

\[
\begin{bmatrix}
a_{1,1} & \ldots & a_{1,n} & D_1 \\
\ldots & \ldots & \ldots & \ldots \\
a_{n,1} & \ldots & a_{n,n} & D_n \\
OC_1 & \ldots & OC_n & 0
\end{bmatrix}
\]
Input-Output tables

Domestic Input-Output table =

\[
\begin{pmatrix}
a_{1,1} & \ldots & a_{1,n} & D_1 \\
\vdots & \ddots & \vdots & \vdots \\
a_{n,1} & \ldots & a_{n,n} & D_n \\
OC_1 & \ldots & OC_n & 0
\end{pmatrix}
\]

- nominal values
- vertical \( a_{i,j} \): absorbing sector (Inputs...)
- horizontal \( a_{i,j} \): delivering sector (Outputs...)
- \( a_{i,j} \) input of good i for production of good j
- \( D_i \): final demand of good i (Outputs)
- \( OC_j \): other costs for production of good j (incl. value added)
Calculating the multipliers within the Eurozone

Input-Output method

Input-Output tables

Domestic Input-Output table =

\[
\begin{bmatrix}
 a_{1,1} & \ldots & a_{1,n} & D_1 \\
\vdots & \ddots & \vdots & \vdots \\
 a_{n,1} & \ldots & a_{n,n} & D_n \\
 OC_1 & \ldots & OC_n & 0
\end{bmatrix}
\]

- nominal values
- vertical \( a_{i,j} \): absorbing sector (Inputs...)
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- \( a_{i,j} \) input of good \( i \) for production of good \( j \)
- \( D_i \): final demand of good \( i \) (Outputs)
- \( OC_j \): other costs for production of good \( j \) (incl. value added)

Import matrix \( M \): entries \( m_{i,j} \), final demand, no other costs
Input-output multiplier: Domestic Absorption

1st step: Domestic absorption $DA = C + I + G$
Input-output multiplier: Domestic Absorption

1st step: Domestic absorption \( DA = C + I + G \)

Calculation of \( M_X \), \( M_{DA} \) and \( \Delta_{DA} \):

\[
x = y_x - A \cdot y_x,
\]

\[
y_x = (\text{Id} - A)^{-1} \cdot x,
\]

\[
\mu = A_M \cdot y_x,
\]

\[
M_X = \sum_{i=1}^{n} \mu_i,
\]

\[
M_{DA} = M - M_X
\]

\[
\Delta_{DA} = \frac{1 - m_{DA}}{1 - c (1 - m_{DA})}
\]
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Multiplier calculations

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Multiplier calculations

Textbook multiplier and general government spending multiplier

Textbook and DA multipliers

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th></th>
<th>France</th>
<th></th>
</tr>
</thead>
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<tr>
<td></td>
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<td>DA concept</td>
<td>Textbook</td>
<td>DA concept</td>
</tr>
<tr>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<td>0.17</td>
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<td>0.17</td>
</tr>
<tr>
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<td>0.18</td>
</tr>
<tr>
<td></td>
<td>2005</td>
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<td>1.32</td>
<td>0.19</td>
</tr>
<tr>
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<tr>
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<td>13%</td>
<td>9%</td>
<td>5%</td>
<td>4%</td>
</tr>
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Table: Import quotas and multipliers for Germany and France;
Source: Eurostat, own calculations
# Government consumption multipliers

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<tr>
<th>Year</th>
<th>c</th>
<th>( m_{PC} )</th>
<th>mul</th>
<th>Year</th>
<th>c</th>
<th>( m_{PC} )</th>
<th>mul</th>
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<td>0.08</td>
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<td>0.08</td>
<td>1.74</td>
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<td>0.57</td>
<td>0.08</td>
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<td>0.08</td>
<td>1.76</td>
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<td>0.08</td>
<td>1.72</td>
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<tr>
<td>2004</td>
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<td>2004</td>
<td>0.57</td>
<td>0.08</td>
<td>1.71</td>
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<tr>
<td>2005</td>
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<td>0.08</td>
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<td>0.09</td>
<td>1.69</td>
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<td>2006</td>
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<td>1.67</td>
<td>2006</td>
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<tr>
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<td>0.09</td>
<td>1.64</td>
<td>2007</td>
<td>0.57</td>
<td>0.09</td>
<td>1.67</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>7%</td>
<td></td>
<td></td>
<td></td>
<td>3%</td>
</tr>
</tbody>
</table>

**Table:** Private consumption quotas, import quotas and public consumption multipliers for Germany and France
Calculating the multipliers within the Eurozone

Multiplier calculations

The multiplier of government spending on construction

Construction spending multipliers

<table>
<thead>
<tr>
<th>Year</th>
<th>Germany</th>
<th>France</th>
</tr>
</thead>
<tbody>
<tr>
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<td>2001</td>
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</tr>
<tr>
<td>2002</td>
<td>0.06</td>
<td>1.79</td>
</tr>
<tr>
<td>2003</td>
<td>0.06</td>
<td>1.79</td>
</tr>
<tr>
<td>2004</td>
<td>0.06</td>
<td>1.78</td>
</tr>
<tr>
<td>2005</td>
<td>0.06</td>
<td>1.76</td>
</tr>
<tr>
<td>2006</td>
<td>0.06</td>
<td>1.72</td>
</tr>
<tr>
<td>2007</td>
<td>0.06</td>
<td>1.69</td>
</tr>
<tr>
<td>max. decrease</td>
<td>6%</td>
<td>3%</td>
</tr>
</tbody>
</table>

Table: Import quotas and multipliers of construction for Germany and France
Calculating the multipliers within the Eurozone

- Multiplier calculations
- The multiplier of government spending on welfare

## Welfare spending multipliers

<table>
<thead>
<tr>
<th></th>
<th>Germany</th>
<th></th>
<th>France</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
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<td>$m_{ Cp}$</td>
<td>$mult$</td>
<td>$m_{ Cp}$</td>
<td>$mult$</td>
</tr>
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<td>1.51</td>
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<td>0.18</td>
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<tr>
<td>2004</td>
<td>0.18</td>
<td>1.51</td>
<td>0.19</td>
<td>1.48</td>
</tr>
<tr>
<td>2005</td>
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<td>1.47</td>
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</tr>
<tr>
<td>2006</td>
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<tr>
<td>2007</td>
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<td>1.41</td>
<td>0.20</td>
<td>1.42</td>
</tr>
<tr>
<td>max. decrease</td>
<td>8%</td>
<td>5%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Table:** Import quotas and multipliers of welfare spending for Germany and France
Calculating the multipliers within the Eurozone
EU fiscal spending multipliers

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Comparison of multipliers for EU member states
Calculating the multipliers within the Eurozone

EU fiscal spending multipliers

Different spending multipliers for EU member states

<table>
<thead>
<tr>
<th></th>
<th>Textbook</th>
<th>DA concept</th>
<th>PC concept</th>
<th>Construction</th>
<th>Welfare</th>
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<td>mult</td>
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<td>BE</td>
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<td>0.81</td>
<td>0.28</td>
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<td>CZ</td>
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<tr>
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<td>0.70</td>
<td>0.81</td>
<td>0.30</td>
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</tr>
</tbody>
</table>

Table: Consumption quotas, import quotas and multipliers in 2005
Calculating the multipliers within the Eurozone

EU fiscal spending multipliers

Different spending multipliers for EU member states

<table>
<thead>
<tr>
<th></th>
<th>cp</th>
<th>Textbook</th>
<th>DA concept</th>
<th>PC concept</th>
<th>Construction</th>
<th>Welfare</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>m</td>
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<td>mult</td>
<td>m&lt;sub&gt;PC&lt;/sub&gt;</td>
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<tr>
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<td>1.49</td>
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<tr>
<td>PT</td>
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<td>0.33</td>
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<td>0.15</td>
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</tbody>
</table>

**Table:** Consumption quotas, import quotas and multipliers in 2005
Thank you for comments, discussion and for the invitation.