Advanced Macroeconomics II

Fiscal Policy

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Part of these slides are based on Jordi Galì slides for Macroeconomia Avanzada II.
Outline

- Fiscal Policy in the Real business cycle model
- Debt Dynamics
- The effects of fiscal shocks
- Fiscal evidence on countries debt and debt consolidation
Public Expenditure: provision of public goods and services.
Redistributive issues
- expenditure for goods and services.
- transfer: redistributive (unemployment subsidies, pensions)
- subsidies: firms subsidies
- interests on public debt

Taxes: Finance the provision of public goods and services. Redistributive and incentive issues
- consumption taxes
- capital income taxes
- profits taxes
- labor income taxes

The difference between public expenditure and taxes is the deficit, financed through the emission of public debt

Fiscal policy decision \(\rightarrow\) Affects the level of the economic activity.
\(\rightarrow\) Fiscal policy is exogenous: independent from fluctuations
\(\rightarrow\) Fiscal policy is used as an instrument of business cycle stabilization
Fiscal Policy in the RBC model

GOVERNMENT BUDGET CONSTRAINT: with a balanced budget

- The Government runs a balanced budget
- Example I: with only lump-sum taxes
  \[ G_t = T_t \]
- Example II: with lump-sum taxes and labor income taxed
  \[ G_t = T_t + \tau_n w_t N_t \]
- \( G_t \) can be represented by an AR(1) process
  \[ \ln \left( \frac{G_t}{G} \right) = \rho_g \ln \left( \frac{G_{t-1}}{G} \right) + \varepsilon_{g,t} \]
- If \( G \) does not enter into the utility function, i.e. \( U(C_t, G_t, N_t) \) or alternatively it does not enter into firms’ production function, i.e. \( Y = AF(N, K, G) \) \( \Rightarrow \) it is a pure waste for the economy. In this case government expenditure is nonproductive.
IRFS to a government spending shock in the basic RBC

Result: government spending implies a large crowding-out effect on private consumption
IRFS to a government spending shock in the basic RBC

- The RBC model predicts a decline in private consumption in response to a rise in government spending. (crowding out effect on consumption)

- With infinitely-lived Ricardian households, an increase in (nonproductive) government spending purchases (financed by current or future lump-sum taxes), lowers the present value of after-tax income, and thus generates a negative wealth effect on consumption (Aiyagari et al., 1990; Baxter and King, 1993; Christiano and Eichenbaum, 1992).

- The quantity of labor supplied at any given wage increases.

- **Equilibrium:** lower consumption, lower real wage, higher employment (increase in hours) and higher output.

- The increase in employment leads, if sufficiently persistent, to a rise in the expected return to capital, and may trigger a rise in investment. Otherwise investment decrease.
Fiscal Policy in the RBC model

GOVERNMENT BUDGET CONSTRAINT: general form

- Government budget constraint in period $t$:

$$G_t + (1 + r_{t-1})B_{t-1}^g = \tau^n_t w_t N_t + T_t + B_t^g$$

- Household budget constraint of the RBC model modifies as follows:

$$C_t + B_t = (1 - \tau^n_t) w_t N_t + (1 + r_{t-1})B_{t-1} + D_t - T_t$$

Definitions:

- $G_t$: public expenditure
- $B_t^G$: stock of Government Bond - Public Debt (one period, risk free)
- $r_t$: interest rate on public debt.
- $\tau^n_t$: labor income tax
- $T_t$: lump-sum tax (no distortionary).
Fiscal Policy in the RBC model

- The equation for the labor supply becomes:
  \[ \frac{U_{n,t}}{U_{c,t}} + (1 - \tau^n_t) w_t U_{c,t} = 0 \]

- For \( U(C_t, N_t) = C_t^{1-\sigma} - \nu N_t^{1+\varphi} \), in log-deviation from the steady state
  \[ \hat{w}_t = \sigma \hat{c}_t + \varphi \hat{n}_t - \frac{\tau^n_t}{1 - \tau^n_t} \hat{\tau}_t^n \]

- where \( \tau^n \) is the steady state of the labor income tax.

- The production function
  \[ Y_t = A_t N_t^{1-\alpha} \]

- in log-deviation
  \[ \hat{y}_t = a_t + (1 - \alpha) \hat{n}_t \]
Equilibrium

- Goods market
  \[ Y_t = C_t + G_t \]

- in log-deviations
  \[ \hat{y}_t = (1 - s_g)\hat{c}_t + s_g\hat{g}_t. \]
  where \( s_g \equiv G/Y \).

- Labor market
  \[ \sigma\hat{c}_t + \varphi\hat{n}_t - \frac{\tau^n}{1 - \tau^n}\hat{\tau}_t^n = \hat{a}_t - \alpha\hat{n}_t \]

- Bonds market
  \[ \hat{b}_t = \hat{b}_t^g \]
  \[ \hat{r}_t = \sigma E_t\{\Delta\hat{c}_{t+1}\} \]

- Technology
  \[ \hat{y}_t = \hat{a}_t + (1 - \alpha)\hat{n}_t \]
Equilibrium output

From the labor market, equilibrium after some algebra,

\[
\frac{\sigma (1 - \alpha) + (1 + \varphi) (1 - s_g)}{(1 - s_g) (1 - \alpha)} \hat{y}_t = \hat{a}_t \left( \frac{(1 - \alpha) + 1 + \varphi}{1 - \alpha} \right) \\
+ \sigma \frac{s_g}{1 - s_g} \hat{g}_t - \frac{\tau^n}{1 - \tau^n} \hat{\tau}_t^n
\]

solving for \( \hat{y}_t \)

\[
\hat{y}_t = \frac{(1 - s_g) (1 + \varphi)}{\sigma (1 - \alpha) + (1 + \varphi) (1 - s_g)} \hat{a}_t \\
+ \frac{(1 - \alpha) \sigma s_g}{\sigma (1 - \alpha) + (1 + \varphi) (1 - s_g)} \hat{g}_t + \\
- \left( \frac{(1 - s_g) (1 - \alpha)}{\sigma (1 - \alpha) + (1 + \varphi) (1 - s_g)} \right) \frac{\tau^n}{1 - \tau^n} \hat{\tau}_t^n
\]
Equilibrium of hours, consumption and real wage

Substituting the equilibrium output into the production function we find \( \hat{n}_t = n(\hat{g}_t, \hat{\tau}_t^n, \hat{a}_t) \).

Substituting \( \hat{y}_t \) into the aggregate resource constraint we find \( \hat{c}_t = c(\hat{g}_t, \hat{\tau}_t^n, \hat{a}_t) \).

Finally substituting \( \hat{n}_t \) and \( \hat{c}_t \) into the labor supply we find \( \hat{w}_t = w(\hat{g}_t, \hat{\tau}_t^n, \hat{a}_t) \).

Find \( \hat{c}_t = c(\hat{g}_t, \hat{\tau}_t^n, \hat{a}_t) \), \( \hat{n}_t = n(\hat{g}_t, \hat{\tau}_t^n, \hat{a}_t) \) and \( \hat{w}_t = w(\hat{g}_t, \hat{\tau}_t^n, \hat{a}_t) \) by your own.

Finally we also know that

\[
\hat{r}_t = \sigma E_t \{ \Delta c_{t+1} \} \]
Discussion

- Effects of different fiscal shocks \((\tau^n_t, g_t)\)
- Ricardian Equivalence Ricardiana
- Fiscal rules and Stabilization policies
- Structural Deficit: a big European Problem
Empirical evidence on the effects of fiscal shocks

- **Identification problem**: simultaneity.

- Discretionary changes in taxes are likely to affect GDP contemporaneously, but aggregate fluctuations will also contemporaneously affect commonly used tax measures (such as tax revenues).

- Consider the following

\[ \Delta y_t = \alpha_0 + b \Delta \tau_t + u_t \]

- Any measure \( \tau_t \) which is a function of factors also contemporaneously affecting output, cannot be used to consistently identify the effects of tax changes. The chosen tax measure would be contemporaneously correlated with the error term \( u_t \), violating the standard requirement for consistent estimation of the coefficients.

- Blanchard and Perotti (2002). Try to identify only the "structural" shocks to revenues: uncorrelated with contemporaneous shocks.
Empirical evidence on the effects of fiscal shocks

- The Macroeconomic Effects of Tax Changes: Romer & Romer (AER 2010)
  - narrative approach
  - exogenous tax changes:
    - legislated changes (not automatic)
    - tax changes introduced for:
      - need to reduce the public deficit inherited
      - aim to achieve a long-term debt target
Empirical evidence on the effects of fiscal shocks - Romer and Romer 2010 AER

- Equations estimated:

\[ \Delta y_t = \alpha + \sum_{k=0}^{K} \beta_k \Delta T_{t-k} + u_t \]

- and

\[ \Delta y_t = \alpha + \sum_{k=0}^{K} \beta_k \Delta T_{t-k}^a + \sum_{k=0}^{K} \gamma_k \Delta T_{t-k}^i + u_t \]
Empirical evidence on the effects of fiscal shocks - Romer and Romer 2010 AER

Panel A. All exogenous tax changes
Empirical evidence on the effects of fiscal shocks - Romer and Romer 2010 AER

**Figure 4. Estimated Impact of an Exogenous Tax Increase of 1 Percent of GDP on GDP**

*Single equation, no controls*
Figure 12. Estimated Impact of an Exogenous Tax Increase of 1 percent of GDP on GDP, Including Tax Changes Dated at Both Time of Implementation and Time of Passage (Single equation, controlling for lagged GDP growth)
Debt Dynamics

- Understanding the Effects of Government Spending on Consumption: Galí, López-Salido y Vallés (JEEA 2007)
  - A model with both standard Ricardian and liquidity constrained households (consume all their disposable income)
  - Public expenditure (purchases of good and services)

\[
g_t = \sum_{k=1}^{K} \phi'_k x_{t-k} + \varepsilon_t^g
\]

- Macroeconomic Effects:

\[
z_t = \sum_{k=0}^{K} \beta_k \varepsilon_{t-k}^g + u_t
\]
The Effects of Government Spending Shocks - Galì, Lopez-Salido and Vallet JEEA 2007

**Figure 1.** The dynamic effects of a government spending shock.
Note: Estimated impulse responses to a government spending shock in the large VAR. Sample Period 1954:I–2003:IV.
The Effects of Fiscal Consolidation

  - 15 Countries, 1980-2009
  - 173 countries-year fiscal consolidation measures (aim: deficit reduction)
  - Equations estimated:

\[ z_t = \alpha + \sum_{k=0}^{K} \beta_k f_{t-k} + u_t \]

- \( z_t \) : GDP, unemployment
Figure 3.2. Impact of a 1 Percent of GDP Fiscal Consolidation on GDP and Unemployment

Fiscal consolidation is normally contractionary. A fiscal consolidation equal to 1 percent of GDP typically reduces real GDP by about 0.5 percent and raises the unemployment rate by about 0.3 percentage point.

Source: IMF staff calculations.
Note: t = 1 denotes the year of consolidation. Dotted lines equal one standard error bands.
The Effects of Fiscal Consolidation - IMF WEO October 2010

![Graph showing the effects of fiscal consolidation on GDP and unemployment rate](image)

Font: IMF WEO, October 2010
Fiscal consolidation based on cuts to government transfers is less contractionary than that based on cuts to government consumption or government investment. But the differences between the three spending types are within the margin of error.

Source: IMF staff calculations.
Note: The three lines indicate consolidation in which most of the spending cuts fell on government transfers, government consumption, and public investment, respectively. \( t = 1 \) denotes the year of consolidation.
The Effects of Fiscal Consolidation - IMF WEO October 2010

- Factors that usually soften the short-term impact of fiscal consolidation.
  
  - Central banks cut interest rates and the currency falls in value. This helps cushion the impact on consumption and investment, and boosts exports.
  - Fiscal consolidation is less costly when markets are more concerned about fiscal sustainability.
  - Consolidations based on spending cuts are less painful than those based on tax hikes. This is largely because Central banks cut interest rates more after spending cuts.
The Effects of Fiscal Consolidation - IMF WEO October 2010

- **FISCAL CONSOLIDATION IN THE LONG RUN**: fiscal consolidation has a positive impact on output. In particular, lower debt tends to reduce real interest rates and debt service costs, which allows for future tax cuts. By boosting private investment, this increases output in the long term.

- The authors’ simulations suggest that the contraction in output may be more than twice as large as their baseline estimate when central banks cannot cut interest rates, and when the adjustment is synchronized across all countries. Nevertheless, for economies considered at high risk of sovereign default, short-term negative effects are likely to be smaller.
Debt Dynamics

\[ B_t^g = (1 + r_{t-1})B_{t-1}^g + G_t - \tau_t^n W_t N_t - T_t \]

- Definition of Deficit:
  \[ DEF_t \equiv B_t^g - B_{t-1}^g = r_{t-1}B_{t-1}^g + G_t - \tau_t^n W_t N_t - T_t \]

- Definition of Primary Deficit:
  \[ DEF_t^p \equiv G_t - \tau_t^n W_t N_t - T_t \]
  \[ DEF_t^p \equiv G_t - T_t \]

- or

  \[ DEF_t^* \equiv r_{t-1}B_{t-1}^g + G(Y_t^*) - T(Y_t^*) \]
  \[ DEF_t^{p,*} \equiv G(Y_t^*) - T(Y_t^*) \]
Debt Dynamics
Definitions

\[
\begin{align*}
    b_t^g & \equiv \frac{B_t^g}{Y_t}, \\
    \text{def}_t & \equiv \frac{\text{DEF}_t}{Y_t}, \\
    \text{def}_t^p & \equiv \frac{\text{DEF}_t^p}{Y_t}, \\
    \text{def}_t^* & \equiv \frac{\text{DEF}_t^*}{Y_t^*}, \\
    \text{def}_t^{p,*} & \equiv \frac{\text{DEF}_t^{p,*}}{Y_t^*}, \\
    g_t & \equiv \frac{Y_t - Y_{t-1}}{Y_{t-1}}
\end{align*}
\]

Deficit and discretionary fiscal policy

\[
def_t = r_{t-1} b_{t-1}^g + \text{def}_t^{p,*} + \text{cyclical comp.}
\]
Debt Dynamics I

- Considering the deficit:

\[ B_t^g = B_{t-1}^g + DEF_t \]

- or, as a share of output

\[ b_t^g = \frac{1}{1 + g_{t-1}} \cdot b_{t-1}^g + def_t \]

- thus

\[ \Delta b_t^g = -\frac{g_{t-1}}{1 + g_{t-1}} \cdot b_{t-1}^g + def_t \]
Debt Dynamics I

- Stationarity condition:

\[ \Delta b_t^g = -\frac{g}{1 + g} b_{t-1}^g + \text{def} \]

if \( g > 0 \)

- In the steady state:

\[ b^g = \frac{1 + g}{g} \text{def} \]

- show the phase diagram
Debt Dynamics I: Phase Diagram with $g > 0$
Debt Dynamics II

- Considering the primary deficit:

\[ B_t^g = (1 + r_{t-1})B_{t-1}^g + DEF_t^p \]

- as a share of output

\[ b_t^g = \left( \frac{1 + r_{t-1}}{1 + g_{t-1}} \right) b_{t-1}^g + def_t^p \]

- thus

\[ \Delta b_t^g = \left( \frac{r_{t-1} - g_{t-1}}{1 + g_{t-1}} \right) b_{t-1}^g + def_t^p \]
Stationarity condition

\[ \Delta b_t^g = \left( \frac{r - g}{1 + g} \right) b_{t-1}^g + \text{def}^p \]

if:

\[ r < g \]

Steady State:

\[ b^g = \frac{1 + g}{g - r} \text{def}^p \]
Dynamics of Primary Debt: \( r < g \)

\[
\Delta b_t^g = \left( \frac{r - g}{1 + g} \right) b_{t-1}^g + def^p
\]
Dynamics of Primary Debt: $r < g$

\[ \Delta b_t^g \]

\[ def^{p_1} \]

\[ def^{p_0} \]

\[ \left( \frac{r - g}{1 + g} \right) b_{t-1}^g + def^p \]
Dynamics of Primary Debt: \( r > g \)

\[
\Delta b_t^g = \left( \frac{r - g}{1 + g} \right) b_{t-1}^g + \text{def}^p
\]
Dynamics of Primary Debt: $r \left( b_{t-1}^g \right)$

\[
\Delta b_t^g = \left( \frac{r(b_{t-1}^g) - g}{1 + g} \right) b_{t-1}^g + \text{def}^p
\]
Alternatives to an adjustment of the primary deficit

- Higher growth
- Default or debt restructuring (or inflation)
- "Financial Repression"
- Sale of public assets (40% of GDP in advanced economies)

Empirical Evidence
# Government Balance: Fiscal Monitor 2014

### Statistical Table 1. Advanced Economies: General Government Overall Balance (Percent of GDP)

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Font: Fiscal Monitor, April 2014
2. Fiscal Balance (percent of GDP)

- Advanced economies
- Emerging market and developing economies
- World
Figure 1.2. Fiscal Trends in Advanced Economies

1. Headline and Cyclically Adjusted Balances

- Cyclically adjusted balance (percent of potential GDP)
- Headline balance (percent of GDP)

2. Annual Cyclically Adjusted Primary Balance Change (percent of potential GDP)

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## Statistical Table 4. Advanced Economies: General Government Gross Debt (Percent of GDP)

| Year | Australia | Austria | Belgium | Canada | Cyprus | Czech Republic | Denmark | Estonia | Finland | France | Germany | Greece | Hong Kong SAR | Iceland | Ireland | Israel | Italy | Japan | Korea | Latvia | Netherlands | New Zealand | Norway | Portugal | Singapore | Slovak Republic | Spain | Sweden | Switzerland | United Kingdom | United States | Average | Euro area | G7 | G20 advanced |
|------|-----------|---------|---------|--------|--------|---------------|---------|---------|---------|--------|---------|--------|--------------|---------|----------|--------|-------|-------|--------|--------|----------|---------|--------|--------|----------|-------------|-------|--------|------------|----------|-----------|-----------|-----------|
| 2006 | 10.0      | 9.7     | 11.7    | 16.7   | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2007 | 9.7     | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |
| 2008 | 10.0   | 9.7     | 11.7    | 16.7    | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2009 | 9.7   | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |
| 2010 | 10.0   | 9.7   | 11.7   | 16.7   | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2011 | 9.7   | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |
| 2012 | 10.0   | 9.7   | 11.7   | 16.7   | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2013 | 9.7   | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |
| 2014 | 10.0   | 9.7   | 11.7   | 16.7   | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2015 | 9.7   | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |
| 2016 | 10.0   | 9.7   | 11.7   | 16.7   | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2017 | 9.7   | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |
| 2018 | 10.0   | 9.7   | 11.7   | 16.7   | 20.5   | 24.3          | 27.2    | 28.8    | 30.8    | 31.8   | 31.6    | 31.4   | 31.4         | 31.1    | 31.4     | 31.4   | 31.4  | 31.4  | 31.4   |
| 2019 | 9.7   | 10.1   | 12.1   | 17.1   | 20.8   | 24.6          | 27.5    | 29.2    | 31.3    | 32.3   | 32.1    | 31.8   | 31.8         | 31.5    | 31.8     | 31.8   | 31.8  | 31.8  | 31.8   |

Notes: See the original source for detailed notes and data sources.
### Table 1.5. Selected Advanced Economies: Gross Financing Needs, 2014–16 (Percent of GDP)

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