Costa Rica
Dynamic effects of the Costa Rican fiscal policy

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Dynamic effects of fiscal policy: the case of a small and open economy

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The expressed ideas in this presentation are those of the authors and not necessarily represent those of the Central Bank of Costa Rica.
Contents:

1. Introduction
2. Literature review
3. Costa Rica’s fiscal context
4. Empirical methodology
5. Results
6. Conclusions
Motivation and objectives

- **Motivation:**
  - It is fundamental for the government to know the impact of its fiscal policy on the economic activity.
  - In Costa Rica, a fiscal reform was recently approved.

- **Objectives:**
  - Estimate fiscal policy effectiveness.
  - Measure possible asymmetries conditional on the economic cycle.
  - Show if the current, capital, and consumption public expenditure have different policy implications.
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Theoretical literature

- Keynesian and Neokeynesian predict an output reaction to fiscal policy via aggregate demand.
  - Myopic agents who do not take into account the government intertemporal budget constraint.
  - Price rigidities.
- While the Neoclassical, forecast a null or even negative impact (Ricardian Equivalence).
  - Rational agents, infinite temporal horizon, decision making with long-run perspectives.
  - Intertemporal disposable income would not change, thus there is no effect on consumption.
Empirical literature

- Fiscal policy effects depend on the temporal horizon considered, assumptions on the economic agent’s behavior, and the credibility about the government decisions.
- Empirically, there are three main estimation methodologies:
  - SVAR models.
  - DSGE models.
  - Narrative approach.
Empirical literature

• Blanchard and Perotti (2002) with the SVAR methodology found a positive impact from expenditure and a negative one from taxes for the United States.

• Perotti (2002), for five OECD countries and including the GDP deflator, and interest rates, found weaker effects as time passed by and both income and expenditure multipliers were negative.

• Romer and Romer (2010) used the narrative approach for the United States and found that a 1% increase in expenditure increases GDP around 1%.
Auerbach and Gorodnichenko (2012) found the fiscal policy is more effective during recessions for the United States.

Ilzetzki et al. (2013) showed more development, predetermined exchange rates, relatively closed economics, and low public debt levels increase the multipliers size.

Estevão and Samaké (2013) estimate fiscal multipliers for Central American countries. For Costa Rica, the output’s impact response due to a current expenditure shock turned to be -0.04, and the accumulated multiplier for the first year 0.76.
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Figure: Central Government Total Income and Expenditure as GDP percentage, 1991-2018

(a) Income

(b) Expenditure

Source: own elaboration.
Figure: Central Government Income Distribution, 1991-2018

(a) Total Income
(b) Tax Income

Source: own elaboration.
Figure: Central Government Expenditure Distribution, 1991-2018

(a) Total Expenditure

(b) Current Expenditure

Source: own elaboration.
Figure: Fiscal Balance and Central Government Debt as GDP percentage, 1991-2018

(a) Fiscal Balance

(b) Debt

Source: own elaboration.
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The reduced form VAR is the following

\[ X_t = A(L, q)X_{t-1} + U_t \]  

- \( X_t \equiv [G_t, T_t, Y_t]' \): logarithms of quarterly spending, taxes and GDP, all in real, per capita terms.
- \( A(L, q) \): lag polynomial with coefficients for each quarter
- \( U_t \equiv [u^g_t, u^t_t, u^Y_t]' \): vector of reduced-form VAR residuals, which in general will have nonzero cross correlations.
The dynamic fiscal policy effects are defined by the linear combination from three types of shocks, specified in the following system

\[ u_{g}^{t} = \alpha_{gy} u_{t}^{y} + \beta_{gt} e_{t}^{t} + e_{t}^{g} \]  \hspace{1cm} (2)  

\[ u_{t}^{t} = \alpha_{ty} u_{t}^{y} + \beta_{tg} e_{t}^{g} + e_{t}^{t} \]  \hspace{1cm} (3)  

\[ u_{t}^{y} = \gamma_{yt} u_{t}^{t} + \gamma_{yg} u_{t}^{g} + e_{t}^{y} \]  \hspace{1cm} (4)
Three equation SVAR

- $e_t^g$, $e_t^t$, and $e_t^y$: structural shocks for expenditure, income, and GDP respectively, uncorrelated among them.
- $u_t^g$, $u_t^t$: unexpected movements in income and expenditure.
- $\alpha_{gy} u_t^y$, $\alpha_{ty} u_t^y$: fiscal variables’ responses to unexpected movements on GDP.
- $\beta_{gt} e_t^t$, $\beta_{tg} e_t^g$: capture the expenditure and taxes’ responses to structural shocks on the other fiscal variable.
- $\gamma_{yt} u_t^t$, $\gamma_{yg} u_t^g$: GDP’s response to shocks in expenditure or income.
Three equation SVAR: Identification strategy

- Ex-ante estimation of \( \alpha_{ty} \) as:

\[
\alpha_{ty} = \sum_{i} \eta_{T_i,B_i} \eta_{B_i,y} \frac{\tilde{T}_i}{\tilde{T}}
\]

- \( \eta_{T_i,B_i} \): elasticity of type \( i \) taxes with respect to its respective tax base.
- \( \eta_{B_i,y} \): elasticity of the tax base \( i \) with respect to GDP.
- \( \frac{\tilde{T}_i}{\tilde{T}} \): proportion of tax \( i \) on the total taxes.
Three equation SVAR: Identification strategy

- Quarterly data use. It allows to assume the systematic discretionary component of $u_t^t$ and $u_t^g$ to be zero. In particular $\alpha_{gy} = 0$.
- Assumption: expenditure decisions come first, $\beta_{gt} = 0$.
- Estimates for $\beta_{tg}$, $\gamma_{yt}$, and $\gamma_{yg}$ are performed with the whole system. Equivalent to instrumental variable approach from Blanchard and Perotti (2002).
Three equation SVAR: Estimation

- Optimal lag length is four (a year).
- Unit root test are inconclusive. We use a linear trend.
- Dummy variables or seasonally adjusted series to control for seasonality.
- Dummies for structural breaks (2008 financial crisis and expansionary fiscal policy), and relevant events (closure of Banco Anglo).
Three equation SVAR: Estimation

- Terms of trade and openness degree used as controls. Costa Rica is a small open economy.
- The following null hypothesis are not rejected: No residual serial correlation, homoscedasticity and normal distribution; and model stability. Multiple robustness checks are done.
- We estimate the effect of current, capital, and consumption (flexible) government expenditure. Also, the effect on private consumption and investment.
Complementary models

- Six equations SVAR as in Perotti (2002), but augmented in one equation:
  - Includes nominal exchange rate, consumer price index, and a representative interest rate.
  - We estimate their elasticities to output as in the tax income case.
  - Use for robustness check.
  - Also includes terms of trade and openness degree.
  - Allows to recover aggregate fiscal policy transmission mechanisms. For example, expenditures effect on interest rates, and hence on output.
Complementary models

• Smooth Transition SVAR as in Auerbach and Gorodnichenko (2012), but including terms of trade and openness degree as controls:
  ▶ Only for the three equations case.
  ▶ Use the output gap to determine the regime.
  ▶ Allows to obtain different responses and its contemporaneous effects for structural shocks, both in expansions and recessions.
  ▶ Parameters are calibrated, so the economy is near 25% of the time in the recession regime.
### Table: Cumulative multipliers by quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Flexible expenditure</th>
<th>Tax income</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>0.20</td>
<td>-0.08</td>
</tr>
<tr>
<td>6</td>
<td>0.34</td>
<td>-0.14</td>
</tr>
<tr>
<td>8</td>
<td>0.46</td>
<td>-0.20</td>
</tr>
<tr>
<td>10</td>
<td>0.53</td>
<td>-0.24</td>
</tr>
<tr>
<td>14</td>
<td>0.53</td>
<td>-0.32</td>
</tr>
</tbody>
</table>

Note: A 1% increase in the fiscal variable as GDP proportion is associated with the presented GDP cumulative percentage change, by quarter. Red values are not statistically significant.

Source: own elaboration.
Figure: Cumulative GDP response

(a) To Flexible Expenditure

(b) To Tax Income

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
## Six equation SVAR results

### Table: Cumulative multipliers by quarter

<table>
<thead>
<tr>
<th>Quarter</th>
<th>Flexible expenditure</th>
<th>Tax income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.02</td>
<td>-0.02</td>
</tr>
<tr>
<td>4</td>
<td>0.15</td>
<td>-0.12</td>
</tr>
<tr>
<td>8</td>
<td>0.32</td>
<td>-0.29</td>
</tr>
<tr>
<td>12</td>
<td>0.19</td>
<td>-0.40</td>
</tr>
<tr>
<td>16</td>
<td>0.11</td>
<td>-0.41</td>
</tr>
</tbody>
</table>

Note: values in red are not statistically significant. Changes in flexible expenditure and tax income refer to 1% as GDP proportion. The multipliers are interpreted as the GDP cumulative response in percentage change, at the given quarter. Source: own elaboration.
Figure: Cumulative GDP response

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error). Discontinuous lines are confidence intervals. Source: own elaboration. Six equation SVAR model.
STVAR results

Figure: Cumulative GDP response to Flexible Expenditure

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Figure: Cumulative GDP response to Tax Income

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Three equation SVAR robustness checks

- Equivalent results when tax income or expenditure come first.
- Changes in the tax income elasticity to output do not affect the results.
- The whole system estimation is equivalent to the two step instrumental variables approach.
- Two temporal sub-samples used:
  - 1991-2005: flexible expenditure not statistically significant, tax income still significant and negative.
  - 2006-2018: expenditure still not significant, but now tax income effect is null. In this last sub-sample Costa Rica’s exchange rate became flexible.
Other results

Figure: Cumulative GDP response to Current Expenditure

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Figure: Cumulative GDP response to Capital Expenditure

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
**Figure:** Interest rate transmission channel

(a) Cumulative response of the basic passive rate to current expenditure

(b) Cumulative response of GDP to the basic passive rate

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Note: Cumulative response to a structural shock (one standard deviation of the error). Discontinuous lines are confidence intervals. Source: own elaboration. Six equations SVAR model.
Figure: Cumulative response of Private Consumption to Flexible Expenditure

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Figure: Cumulative response of Private Consumption to Tax Income

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Figure: Cumulative response of Private Investment to Flexible Expenditure

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Figure: Cumulative response of Private Investment to Tax Income

(a) Three equations SVAR

(b) Three equations STVAR

Note: GDP cumulative response to a structural shock (one standard deviation of the structural error for the SVAR 1% for the STVAR). Discontinuous lines are confidence intervals. Source: own elaboration. Three equation SVAR model.
Multipliers comparison

Figure: Cumulative Multipliers Comparison

(a) Expenditure multipliers
(b) Tax multipliers

Note: Cumulative expenditure multipliers up to one year. In red this paper multiplier. Source: own elaboration with results from several studies (Estevão and Samaké, 2013; IMF, 2018; Contreras and Battelle, 2014).
Conclusions

- Flexible expenditure effect on output is positive and statistically significant on average.
- An increase of 1% in the ratio flexible expenditure to GDP is associated with an increase of 0.2% in production one year later.
- Its effect is positive in recessions, but negative in expansions.
- Respectively, the effect on output is null for capital expenditure and negative for current expenditure, on average.
Conclusions

- There exists a crowding-out effect of current expenditure through increases in the interest rates.
- Current expenditures effect is null in recessions and negative in expansions.
- Capital expenditures effect is negative in expansions but positive in recessions.
- More expenditure flexibility, and public investment on recessions could be used as stabilization tools. But this expenditure funding requires special attention.
Conclusions

- Tax income effect is negative and statistically significant.
- An increase of 1% in the ratio tax income to GDP is associated with a reduction of 0.08% in output a year later. This effect is highly persistent through time.
- To tax shocks, the response of output is positive in expansions and negative in recessions.
  - Recessions negative effect is intuitive.
  - Increases in taxes could be less harmful during expansions.
  - The positive effect could be due to a reverse causality problem, isolated effectively in the SVAR model.
  - The “expansionary fiscal contraction" could be another explanation.
Conclusions

- Private consumption is negatively and persistently affected by taxes, even 8 years after the shock.
- Flexible expenditure effect is positive only in the first year.
- In expansions private consumption is invariant to public expenditure, but it has a positive and significant response in recessions.
- Tax income has a negative impact on private consumption both in recessions and expansions.
Conclusions

- On private investment taxes effect is negative and highly persistent, again until 8 years after the shock.
- The flexible expenditure impact is positive but not statistically significant on average.
- Conditioning on the economic cycle, private investment responses are similar to the output ones.
- Flexible expenditure has negative impact in expansions (Neoclassical Theory), but positive in recessions (Neokeynesian Theory).
- Tax income effect are, as in output, negative in recessions but positive in expansions.
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Many thanks!
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References


Costa Rican economy main characteristics

- There exists excess liquidity in Costa Rica’s financial market.
- Monetary policy interest rate pass-through last, on average, from eight to twelve months.
- Total public debt was 54% of GDP in 2018, an increase close to 100% in comparison with the beginning of the decade (28% in 2010).
- The government’s budget is highly inflexible, it is possible to decide only 5% of total expenditures.
Costa Rican economy main characteristics

- The openness degree is above 60% for all the sample period.
- Costa Rica’s labor market is not rigid, but neither completely flexible.
- The exchange rate regime began as a crawling peg (fixed type), then changed to a band system in 2006, and finally in 2015 became a managed floating exchange rate regime, where the Central Bank has discretionary power to intervene and the rate is negotiated freely.