Financial Development, Institutional Quality and Maximizing-Growth Trade-Off in Government Finance

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Exogenous growth ($\gamma = 0$)

Endogenous growth ($\gamma = \text{const} > 0$)

Empirical evidence

controversial: Barro (1995) negative, Sarrel (1996) threshold at 8%
Adam and Bevan (2005) global econometric study (monetary and fiscal)

neutral/negative
Jones and Manuelli (1993)
Palivos and Yip (1995)

inverted U-shape relation between $\tau$ and $\gamma$
Barro (1990)

neutral - Fischer (1979)
negative - Stockman (1981)
depends on the type of public spending ($g, g^c, g^w$) and the nature of their financing ($\tau, T$)
Baxter and King (1993)

PURPOSE:
LONG RUN EFFECTS OF FISCAL AND MONETARY POLICY

THIS PAPER – PROVIDES THE THEORETICAL ENVIRONMENT FOR STUDYING:
- LONG TERM EFFECTS OF FISCAL AND MONETARY POLICY (endogenous growth)
- WHILE CONTROLLING FOR SEVERAL STRUCTURAL PARAMETERS
MODEL: Extension of Minea & Villieu (2009, JofM)

1/ THE REPRESENTATIVE AGENT (producer & consumer)
- production function with productive public spending \( y = Ak^\alpha g^{1-\alpha} \), \( 0 < \alpha < 1 \)
- maximizes present value of intertemporal utility:
\[
U = \int_0^\infty u(c_t) \exp(-\rho t) dt,
\]
\[
\text{with } u(c_t) = \begin{cases} 
\frac{S}{S-1} \left( \frac{c_t}{S} - 1 \right), & \text{for } S \neq 1, S > 0 \\
\log(c_t), & \text{for } S = 1
\end{cases}
\]

2/ INTRODUCING MONEY
- on the DEMAND side: \( \Phi(y_t, m_t) = \psi y_t \), where \( \psi = \frac{\phi_0}{\mu} \left( \frac{y_t}{m_t} \right)^\mu \), with \( \psi \in (0,1) \)
  - the existence of transaction costs (an isoelastic functional form) on all spending
  - for \( \mu \to \infty \), we find a simple “cash-in-advance” (CIA) technology \( m_t = c_t + i_t + g_t \)
- on the SUPPLY side: \( M_t = D_t + L_t \) (deposits \( D_t \) + “cash” or “high-powered” money \( L_t \))
  - standard multiplier: \( (1/h > 1) \), therefore \( M_t = L_t / h \)
  - constant money growth policies: \( \dot{M}_t / M_t = \dot{L}_t / L_t = \omega \Rightarrow \text{real seigniorage } \omega L_t / P_t = h \omega m_t \)
3/ THE GOVERNMENT BUDGET CONSTRAINT

- productive public spending (public investment) $g_t$
- financed through output taxes $\tau_t$, money (seigniorage) $m_t$ and deficit $\dot{b}_t$ (in which case he will have to pay interest – the debt burden – on the issued debt $r_t b_t$)
- the Government budget constraint is:

$$\dot{b}_t = r_t b_t + g_t - \eta \tau f(k_t, g_t) - h\omega m_t$$

- $(1-h)$ stands for “seigniorage flight” from the monetary authorities (to the banking sector)
- symmetrically, $(1-\eta)$ stands for “tax flight” from the public sector

- we suppose that deficit converges to a (positive) constant in the long-run: $d \equiv (\dot{b} / y)^* = \gamma \theta$
  - according to stylized facts, the deficit to GDP long-run ratio is around 2.5% in OECD

![Graph showing the budget constraint](source: OECD)
4/ EQUILIBRIUM

- the representative agent maximizes discounted intertemporal utility under a budget constraint:

\[
\dot{k} + \dot{b} + \dot{m} = r_b + (1 - \tau) y - \Phi(c, z, g, m) - c - \delta k - \pi m + x
\]

- we find the long-run real interest rate:

\[
r^* = \frac{(1 - \tau) f_k}{1 + \phi(R^*)^{1+\mu}} - \delta = \frac{\alpha \beta (1 - \tau) \left( g/y \right)^*}{1 + \phi(R^*)^{1+\mu}} - \delta, \text{ with } \beta \equiv A^{1/\alpha}
\]

- \(\phi(R^*)^{1+\mu} = R^*(m/y)^*\) stands for transaction costs (they equal zero if \(\phi = \phi_0 = 0\))

- we define the long-run endogenous growth rate as \(\gamma^* = \dot{c}/c = \dot{k}/k = \dot{m}/m = \dot{g}/g = \dot{b}/b\)

\[
\gamma^* = \frac{\alpha \beta (1 - \tau) \left[ \eta + \phi \omega (\omega + \rho)^{-1} \right]^{1-\alpha}}{1 + \phi (\omega + \rho)^{1+\mu}} - \rho - \delta
\]

- for \(S = 1\), steady-state growth is:

\[
\gamma^* = \frac{\alpha \beta (1 - \tau) \left[ \eta + \phi \omega (\omega + \rho)^{-1} \right]^{1-\alpha}}{1 + \phi (\omega + \rho)^{1+\mu}} - \rho - \delta
\]
5.1. THE NO-MONEY CASE \((\phi = 0)\) – Proposition 1

(a) Any increase in the debt-to-GDP ratio \((\theta)\) reduces the long-run rate of economic growth. The highest long-run rate of economic growth, namely the Barro solution, corresponds to a balanced-budget rule, with zero public debt in the long-run.

Proof: based on the no-Ponzi game (solvability) constraint of the Government.

(b) There is an inverted-U relation between the tax rate \((\tau)\) and the long-run growth rate. With positive public debt \((\theta > 0)\), the long-run growth-maximizing tax rate is higher than the solution of Barro, namely the elasticity of output with respect to public capital in the production function.

Proof: based on the positive/negative effect of distortionary taxes in the presence of productive public spending (see the seminal contribution of Barro, 1990).

5.2. INTRODUCING MONEY – Proposition 2

(a) Any increase in the debt ratio \((\theta)\) reduces the long-run rate of economic growth.

(b) There is again an inverted-U relation between the tax rate \((\tau)\) and the long-run growth rate. The tax rate that maximizes long-run economic growth is an increasing function of the debt ratio \((\theta)\) and a decreasing function of the money growth rate \((\omega)\).

(c) There is an inverted-U relation between the money growth rate \((\omega)\) and the long-run rate of economic growth. The money growth rate that maximizes long-run economic growth is an increasing function of the debt ratio \((\theta)\) and a decreasing function of tax rate \((\tau)\).

Proof: see the expression of long-run growth above.
5.3. FISCAL AND MONETARY POLICIES GROWTH TRADE-OFF

- GOAL: growth maximizing *simultaneous* fiscal and monetary policies

- using FOCs of the long-run growth rate with respect to each instrument we find

\[ \hat{\tau} = \hat{\tau}(\omega, \theta, \ldots) \] \[ \text{and} \quad \hat{\omega} = \hat{\omega}(\tau, \theta, \ldots). \]

*Figure 1 – Reaction functions for growth-maximizing income-tax rate and money growth rate*
Figure 2 – Economic growth as a function of $\tau$ and $\omega$

Figure 3 – Contour lines of economic growth as a function of $\tau$ and $\omega$

Unless otherwise indicated, we use simulation values: $\rho = \delta = \phi_0 = 0.05$, $S = \mu = 1$, $\alpha = 0.75$, $\beta = 0.5$, $h = 0.4$, $\eta = 0.7$ and $\theta = 0$. 

\[\text{Figure 2} - \text{Economic growth as a function of } \tau \text{ and } \omega\]

\[\text{Figure 3} - \text{Contour lines of economic growth as a function of } \tau \text{ and } \omega\]
Figure 4 – Contour lines of economic growth (sensitivity analysis)
Impact of a change in the debt ratio

Figure 5 – Growth-maximizing couples \((\tau^*, \omega^*)\) as a function of the public debt ratio

- both optimal values of instruments are lower in the long-run
- steady-state economic growth is (of course) lower
- optimal inflation is higher in the long-run (our results confirms an important strand of empirical literature)
6. SOME EMPIRICAL EVIDENCE

- 75 developing and developed countries (average taxes, money growth and public debt to GDP)
- financial development = “private money by deposit money banks to GDP” (IFS and GFS)
- Kaufman. et al. (2007) governance indicators (the World Bank)

*Figure 6 – Financial development, institutional quality, taxes and money growth*
- we perform some transformations:

\[ h \equiv \left( \tilde{h}^{\max} - \tilde{h} \right) / \left( \tilde{h}^{\max} - \tilde{h}^{\min} \right) \quad \text{and} \quad \eta \equiv \left( \tilde{\eta} - \tilde{\eta}^{\min} \right) / \left( \tilde{\eta}^{\max} - \tilde{\eta}^{\min} \right) \]

Figure 7 – The distribution of countries with respect to \( h \) and \( \eta \)
- the estimation of a structural equation:

\[
\mathbf{\gamma}^* = \frac{\alpha \beta (1 - \tau) \left[ \eta \tau + h \phi \omega (\omega + \rho)^{-1} - \theta \right]^{\frac{1-\alpha}{\alpha}}}{1 + \phi (\omega + \rho)^{\frac{\mu}{1+\mu}}} - \rho - \delta
\]

- using logs we find:

\[
\log(\gamma + \delta + \rho) = \log \alpha \beta + \log(1 - \tau) + \frac{1-\alpha}{\alpha} \log X - \log \left( 1 + \phi (\omega + \rho)^{\frac{\mu}{1+\mu}} \right) + \frac{1-\alpha}{\alpha} \log(1 - \rho \theta X^{-1})
\]

with \( X \equiv \eta \tau + h \phi \omega (\omega + \rho)^{-1} \)

- since \( \rho, \phi \to 0 \), the equation we try to estimate is:

\[
\log(\gamma + \delta + \rho) = \beta_0 + \beta_1 \log(1 - \tau) + \beta_2 \log X + \beta_3 \left( (\omega + \rho)^{\frac{\mu}{1+\mu}} \right) + \beta_4 (\theta / X)
\]

- we consider that \( \delta, \rho, \phi \equiv \phi_0^{-(1+\mu)} , \mu \) are identical for all countries

- consequently, each country is distinguished by:

  fiscal \((\tau, \theta)\), monetary \((\omega)\) and structural \((h, \eta)\) variables
Table 1 – Results of the estimations of the structural equation (11)

<table>
<thead>
<tr>
<th>Coef. Values</th>
<th>β₀</th>
<th>β₁</th>
<th>β₃</th>
<th>β₄</th>
<th>Adj. R²</th>
<th>F Fisher</th>
</tr>
</thead>
<tbody>
<tr>
<td>Coef. Values</td>
<td>-1.605***</td>
<td>0.593***</td>
<td>0.086*</td>
<td>-0.174***</td>
<td>-0.020**</td>
<td>0.2720</td>
</tr>
<tr>
<td>(0.141)</td>
<td>(0.185)</td>
<td>(0.049)</td>
<td>(0.035)</td>
<td>(0.009)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Exp. Sign - + + - -

Parameters are the same as in our simulations: \( \mu = 1 \) and \( \rho = \delta = \phi_0 = 0.05 \) (see Figures 2 - 3).

Heteroscedasticity White-corrected standard errors are in round brackets, p-values in square brackets. ***, ** and * denote 1%, 5% and 10% significance respectively.

Remark:
- the negative effect of public debt \( \beta_4 < 0 \)
- the negative effect of transaction costs \( \beta_3 < 0 \)
- the existence of an estimated interior growth-maximizing financing solution:

*Figure 8 – Estimated iso-growth curves in the plan (\( \tau, \omega \))
The existence of an optimal (growth-maximizing) interior solution confirms:
- the presence of joint inverted-U curves between taxes, money and long-run growth

A higher public debt to GDP ratio (compare left-hand figure to right-hand figure):
- lowers optimal long-run economic growth
- but raises optimal taxes and money growth rate (as in our model)
Finally, for each country $i$, characterized by a country-specific vector $(h_i, \eta_i, \theta_i)$, we may construct a country-specific iso-growth locus:

*Figure 9 – Country estimation of iso-growth curves in the plan $(\tau, \omega)$*
Comments concerning the construction of the chart:

- Fig.9 may be seen as the estimated equivalent of Fig.4
- we propose two countries for each case (taxes-only, interior and seigniorage-only)
- for example, for the US: \( h = 0.45 \), \( \eta = 0.94 \) and \( \theta = 0.43 \) (1975-1998 averages); we plug these values in the estimated equation and draw the iso-growth locus
- using taxes and seigniorage averages (\( \tau^{obs} = 0.18 \) and \( \omega^{obs} = 0.06 \)), we locate the US economy on the iso-growth chart (in brackets the observed growth rate \( \gamma^{obs} = 3.49\% \))

Remark that:
- the actual position of the US economy is not very far away from its optimal-estimated position, AND
- the observed average growth rate (3.49\%) is not very different from the growth-rate associated to its position on the iso-growth chart (3.91\%)
- if the US would move to an optima-estimated financing system (taxes-only and no-seigniorage), its growth rate would increase to the optimal-estimated growth rate (4.28\%)

However, for some countries results are not that straightforward, and some explanations may be:
- Government may misestimate growth effects of taxes/seigniorage (for example because they misestimate the share of productive public spending or their elasticity to output)
- we do not sufficiently account for heterogeneity across countries (i.e. public consumption)
- other goals (welfare, the size of the public sector, economic growth volatility,…)
CONCLUSION

Goal:
- we build a growth model and study the financing role of fiscal and monetary policies, while accounting for several structural parameters (financial development, the quality of institutions)

Results:
- thresholds on fiscal and monetary policies
- structural parameters are a key factor in assessing the government financing method
- a positive link between public debt, optimal taxes and optima seigniorage

A short empirical section seems not to reject our theoretical findings

Future research:
- the welfare analysis (difficult, because of transitional dynamics)
- endogenous financial development and institutional quality indicators

The main question in these developments:
- how to deal at best with the complexity/tractability arbitrage of our model…