Government Investment and the European Stability and Growth Pact

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The SGP

- A set of regulations that complement the Maastricht treaty.
- Strengthens treaty provisions, extends them.
- Approved in 1997, revised in 2005 (after enforcement was effectively abandoned).
- Limits on deficit/GDP, debt/GDP (debt/GDP effectively not enforced).
- Original version: deficit/GDP $< 3\%$, except in case of a severe recession

The SGP vs. U.S. State Constitutions

1.
   - SGP: Deficit/GDP limit independent of type of spending: interest, public consumption, public investment
   - U.S. States: Borrowing allowed for capital improvements
2.
   - SGP: Debt can be rolled over indefinitely
   - States: Bonds are not rolled over (new debt for new projects).

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   - SGP: Debt can be rolled over indefinitely
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3. (Not addressed here)
   - SGP: Multilateral agreement
   - States: self-imposed constraint

The question: Should investment be excluded?

- Many advocates of the “golden rule”
- Identified as an important shortcoming of SGP (e.g. Blanchard and Giavazzi, 2004)
- One element to take into account after 2005 reform

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- Many advocates of the "golden rule"
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- One element to take into account after 2005 reform
- We evaluate quantitative importance based on a specific source of political inefficiency (OLG)

Plan of the talk

- A simple environment in which the rule can attain first best
- Characterize equilibrium, derive some general results, build intuition
- Calibration (EU)
- Comparison with results in Bassetto with Sargent (2006)
- Looking ahead: state vs. local communities
- Discussion and Conclusion

The model - People

Model

- OLG, live up to $N+1$ periods (years)
- Prob of survival from age s to $s+1$: θ_s
- Constant pop. growth rate n
- Constant fraction of pop. by age: λ_s

The model - Goods, preferences, and technology

- 3 goods: private consumption, public consumption, public capital (depreciates at rate δ)
- Preferences:

$$\sum_{s=t}^{N+t} \beta^{s-t} \left(\prod_{j=0}^{s-t-1} \theta_j \right) [c_{s-t,s} + f(G_s) + v(\Gamma_s)]$$

- Technology:

$$C_t + G_t + \gamma_t \leq y$$

- γ_t: public investment
- y given

Pareto-optimal allocations

$$\max_{\{C_t, G_t, \Gamma_t, \gamma_t\}_{t=0}^{\infty}} \sum_{t=0}^{\infty} [\beta(1+n)]^t \{C_t + f(G_t) + v(\Gamma_t)\}$$

subject to technological constraints.

- Note: C_t is aggregate consumption, distribution is indeterminate
- First-order conditions:$\Longrightarrow$ a unique path for

$$\{G_t, \Gamma_t, C_t\}_{t=0}^{\infty}$$

The model - Government

- Govt levies lump-sum taxes T_t, purchases public goods.
- Budget constraint:

$$B_t = G_t + \gamma_t - T_t + \frac{1+r}{1+n} B_{t-1},$$

- SGP pact:

$$B_t - \frac{B_{t-1}}{1+n} \leq d + x\gamma_t$$

- Key parameters of SGP: d, x
- Note: here excluding gross investment. Will also consider excluding net investment.
- Spending and taxes chosen by majority voting, subject to SGP

The model - Competitive equilibrium

- a real allocation $\{\{\hat{c}_{s,t}\}_{s=0}^{N}, \hat{\gamma}_t, \hat{G}_t, \hat{\Gamma}_t\}_{t=0}^{\infty}$
- an asset allocation $\{\{\hat{b}_{s,t}\}_{s=0}^{N}\}_{t=0}^{\infty}$
- a tax-debt policy $\{\hat{B}_t, \hat{T}_t\}_{t=0}^{\infty}$
- a price system $\{\hat{r}_t\}_{t=0}^{\infty}(\equiv \frac{1-\beta}{\beta})$
- initial conditions
  $(\Gamma_{-1}, (1+r_{-1})B_{-1}, \{(1+r_{-1})b_{-s-1,-1}\}_{s=-N}^{-1})$

such that:

- Households optimize subject to their budget constraint

$$c_{t-s,t} + b_{t-s,t} \leq y - T_t + \frac{(1+r)}{\theta_{t-s-1}} b_{t-s-1,t-1}$$

  $+$ 0 terminal condition (N finite) or
  asset allocation bounded from below ($N = \infty$)
- Government budget constraint and SGP restriction hold
- Market for govt debt clears, investment identity holds

Remarks about competitive equilibria

- Exist
- Timing of individual consumption indeterminate.
- $$r_t = \frac{1-\beta}{\beta}$$

Describing beliefs

- History of the economy: $h^t \equiv \{G_j, \Gamma_j, T_j\}_{j=0}^{t}$

Consider mappings Ψ from histories h^t into:

- a time-t allocation

$$(\{c_s(h^t)\}_{s=0}^{N}, \gamma(h^t))$$

- a time-t debt policy $B(h^t)$
- a time-t asset allocation $\{b_s(h^t)\}_{s=0}^{N}$
- and a time-$t+1$ choice of $G(h^t)$, $\Gamma(h^t)$, and $T(h^t)$.

From Ψ to outcomes

Each mapping Ψ

- recursively generates a sequence of histories from h^j:

$$h^t = (h^{t-1}, G(h^{t-1}), \Gamma(h^{t-1}), T(h^{t-1}))$$

- induces an allocation and a tax/debt policy starting from initial conditions Γ_{j-1}, which is part of h^j, and $\{b_s(h^{j-1})\}_{s=0}^{N}$.

Equilibrium - Political-economic equilibrium

$\tilde{\Psi}$ is a P-E-E if:

- Competitive equilibrium: given any history h^t, $\tilde{\Psi}$ induces a CE
- Self-interested voting:
  given any history h^{j-1}, including the null,
  $(\tilde{G}(h^{j-1}), \tilde{\Gamma}(h^{j-1}), \tilde{T}(h^{j-1}))$ is a Condorcet winner
  if the economy follows $\tilde{\Psi}$ in the future.
- Budget balance subject to the rule: given any non-null history h^t,

$$\tilde{T}_t \geq \frac{r\tilde{B}(h^{t-1})}{1+n} + \tilde{G}_t + (1-x)\tilde{\gamma}(h^t) - d$$

$$\tilde{B}(h^t) = \tilde{G}_t + \tilde{\gamma}_t - \tilde{T}_t + \frac{1+r}{1+n}\tilde{B}(h^{t-1})$$

Markov equilibria

Assumption: $n > 0$ (stronger than needed, but satisfied).
Then:

- there exist Markov equilibria in which G and Γ are independent of the past;
- unanimous support for setting taxes at lower bound (SGP binds in every period);
- all Markov equilibria have the same values for all variables, except distribution of private consumption;
- the welfare is the same in all Markov equilibria.

Building intuition - special case

- People live up to 2 periods: $\theta_1 = 0$
- They may die after 1 period: $\theta_0 < 1$
- Population grows: $n \geq 0$

Median voter: young

Voting over G

1 Extra unit of G:

- Benefit for young: $f'(G)$
- Cost for young (taxes): 1
- No further consequences

Choice by the young: $f'(G) = 1$

- Old agree
- Same as P-O condition
- Independent of past (debt, capital,...).

Voting over Γ

1 Extra unit of Γ:

- Marginal benefit today: $+v'(\Gamma)$
- Tax increase today: $(1-x)$
- Investment undone tomorrow.
  Tax reduction: $-(1-x)\frac{1-\delta}{1+n}$
- Debt service tomorrow: $\frac{rx}{1+n} = \frac{(1-\beta)x}{\beta(1+n)}$

Choice by the young:

$$v'(\Gamma) = 1 - x + \frac{\theta_0}{1+n}\left[-\beta(1-\delta) + x(1-\beta\delta)\right]$$

P-O allocation

$$v'(\Gamma) = 1 - \beta(1-\delta)$$

- Choice independent of past (verifies the guess)
- Young and old disagree on Γ_t
- Young and P-O do not coincide in general

Back to the general case

- Marginal benefit to from additional investment:

$$v'(\Gamma_t)$$

- Increase in taxes at t: $1 - x$
- Reduction in taxes at $t+1$ from lower investment: $\frac{(1-x)(1-\delta)}{1+n}$
- Increase in debt service at $t+1$: $\frac{rx}{1+n}$
- Increase in debt service at $t+j$: $\frac{\delta rx}{(1+n)^j}$

Median voter

- Cost, as perceived by a person of age s:

$$Q_s = \sum_{j=t}^{N+t-s} \beta^{j-t} \left(\prod_{\ell=0}^{j-1} \theta_{\ell+s} \right) \Delta T_{t+s}$$

- Order people by Q_s (not age)
- The P-E-E solves

$$\arg\max_{\Gamma} v(\Gamma) - \mathrm{median}(Q_s)\Gamma$$

- Choice of G: unanimously set at P-O value

$$\arg\max_{G} f(G) - G$$

Ricardian equivalence

- If Ricardian equivalence holds, d, x do not matter.
- Deviations from Ricardian equivalence due to:
  1. Mortality (θ);
  2. Population growth (n);
  3. Mobility (θ again).

Measure of deviations from efficiency (chosen for robustness):

$$\tau = \frac{v'(\Gamma_t) - v'(\Gamma^*)}{v'(\Gamma^*)}$$

Go to graphs

Calibration

- $\beta = 0.96$;
- Depreciation rate:

$$\begin{cases} \delta = 0.06 & \text{general capital;} \\ \delta = 0.03 & \text{major infrastructure;} \end{cases}$$

Data (Baseline calibration)

Source: Eurostat.

- Pop. growth: Avg. 1995-2005
- Emigration by age: 2005 for 6 countries (Italy 2003, Belgium 1999)
- Pop. distribution and mortality by age: same year as emigration

Data (robustness check)

Source: Eurobarometer survey (publ. 2007, carried out 2005)
Question: "Do you think that in the next five years you are likely to move...?"

1. In the same city/town/village
2. To another city/town/village but in the same region
3. To another region but in the same country
4. To another country in the European Union
5. To another country outside the European Union
6. You don't think you will move
7. Don't know.

Summary data

	Pop. growth (%)	Migration rate (%) (baseline)	(Eurobar.)
AUT	0.5	0.9	0.5
FIN	0.5	0.2	1.0
GER	0.3	0.8	0.5
IRE	2.1	n/a	1.5
ITA	0.4	0.1	0.6
LUX	1.1	2.6	0.7
NL	0.5	0.5	0.9
US federal	1.2	0.1	
Median state	1.0	2.1	

Baseline results - Wedge for generic capital (%)

	SGP 1997	Golden rule
AUT	16	-24
BEL	11	-22
GER	14	-23
ITA	6	-20
LUX	35	-34
NL	13	-22
SPA	16	-25
US federal	14	-24
Median state	33	-32

Baseline results - Wedge for major infrastructure (%)

	SGP 1997	Golden rule
AUT	24	-17
BEL	16	-16
GER	21	-16
ITA	9	-14
LUX	51	-25
NL	19	-16
SPA	24	-18
US federal	20	-18
Median state	48	-24

Go to Eurobarometer numbers

Go to graphs

Debt maturity

- Bassetto with Sargent (2006): golden rule does very well
- Here: not so well

Why?

- States do not roll over debt, repay over time
- SGP allows indefinite debt rollover

Gross vs. net investment

What if we exclude net investment from deficit?

$$B_t - \frac{B_{t-1}}{1+n} \leq d + x\left(\gamma_t - \delta \frac{\Gamma_{t-1}}{1+n}\right),$$

Equivalent to setting a schedule to repay debt. Wedge in this case is

$$\tau = -\left(1 - \frac{\mathrm{median}(\theta_s)}{1+n}\right)$$

Results with net investment - Wedge for general capital (%)

	SGP 1997	Gross	Net
AUT	16	-24	-1.8
BEL	11	-22	-1.2
GER	14	-23	-1.5
ITA	6	-20	-0.7
LUX	35	-34	-3.8
NL	13	-22	-1.4
SPA	16	-25	-1.7
US federal	14	-24	-1.5
Median state	33	-32	-3.5

Results with net investment - Wedge for major infrastructure (%)

	SGP 1997	Gross	Net
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GER	21	-16	-1.5
ITA	9	-14	-0.7
LUX	51	-25	-3.8
NL	19	-16	-1.4
SPA	24	-18	-1.7
US federal	20	-18	-1.5
Median state	48	-24	-3.5

Go to graphs

Go to robustness to other preferences

What's next

- Recurrent theme in local public finance: capitalization.

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- Recurrent theme in local public finance: capitalization.
- Need some endogenous mobility
- Need demand for land

Preview

- A world with two levels of jurisdictions: states and towns
- Moving costs across states higher than across municipalities
- Fixed amount of land in each town
- (Zoning restrictions?)

Preview

- A world with two levels of jurisdictions: states and towns
- Moving costs across states higher than across municipalities
- Fixed amount of land in each town
- (Zoning restrictions?)
- Estimate structural model, get quantitative assessment of capitalization impact

Conclusions

- Europe has low mobility, growth: close to Ricardian equivalence
- If investment excluded, should be net

Eurostat vs. Eurobarometer (SGP 1997 major infr., wedge in %)

	Baseline	Eurobarometer
AUT	24	17
BEL	16	21
FRA	n/a	25
GER	21	21
IRE	n/a	49
ITA	9	20
LUX	51	28
NL	19	26
SPA	24	31

Back to baseline

Robustness to more general preferences (from Bassetto with Sargent, 2006)

Study 2-period OLG economy. Compare:

- Quasilinear preferences
- Log preferences:

$$\log c_{0,s} + \log(1 - l_{0,s}) + \phi \log(G_s) + \eta \log(\Gamma_s) +$$
$$\beta\theta_0 \Big[\log c_{1,s+1} + \log(1 - l_{1,s+1}) + \phi \log(G_{s+1}) + \eta \log(\Gamma_{s+1}) \Big]$$

Remarks

Remarks

- Equilibrium policy and allocation rules now depend on past B, Γ, K
- Dependence on K trivial with exogenous factor prices

Computational algorithm

Object to be computed:

- Allocation, as a function of state:

$$c^y, c^o, l, k, B, T$$

- Policy choice, as a function of state:

$$G, \Gamma$$

- Derivatives of allocation wrt policy, as a function of state, evaluated at the policy choice:

$$\left(\frac{\partial(c^y, c^o, l, k, B, \tau)}{\partial G}, \frac{\partial(c^y, c^o, l, k, B, T)}{\partial \Gamma}\right)$$

System of nonlinear equations, solve for fixed point as fn. of state.

Parameters: "calibration"

- A period: 30 years
- Net return on capital: 5.62% (1.0562^{30})
- Survival of young $\theta_0 = 1$ (Maximum conflict)
- $n = 100\%$ ($\approx 2.34\%$ per year)
- $\beta = \frac{1}{1+r-\delta_k}$ (Flat cons. profile)
- ϕ, η: such that SS with golden rule matches Illinois G/GDP$\approx 7\%$, γ/GDP$\approx 2\%$
- $\delta = .6$ (3% annual)

Wedge in the steady state

	Balanced budget	Golden rule
Log	3.8%	-54%
Linear	4.2%	-54.2%

Worst case: maximum conflict, high persistence

- $\beta = 0.96$
- Net return on capital: $\beta = \frac{1}{1+r-\delta_k}$ (Flat cons. profile)
- Survival of young $\theta_0 = 1$, $n = 2\%$
- ϕ, η: same as previous
- $\delta^\Gamma = 6\%$
- Resulting wedges at the steady state:

	Balanced budget	Golden rule
Log	59%	-16%
Linear	18%	-16%

High persistence, less conflict

- Same as before, except:
- Survival of young $\theta_0 = .4$.
- Resulting wedges at the steady state:

	Balanced budget	Golden rule
Log	564%	-66%
Linear	562%	-66%

Go to Conclusions

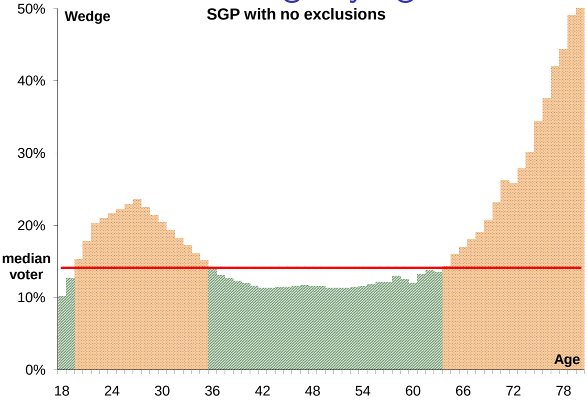
Increasing consumption profile

- Same as previous, except:
- Net return on capital: $\beta = \frac{1.12}{1+r-\delta_k}$ (Consumption rises 12%)
- Resulting wedges at the steady state:

	Balanced budget	Golden rule
Log	263%	-62%
Linear	562%	-66%

Go to Conclusions

Preferred wedge by age: SGP, no exclusions



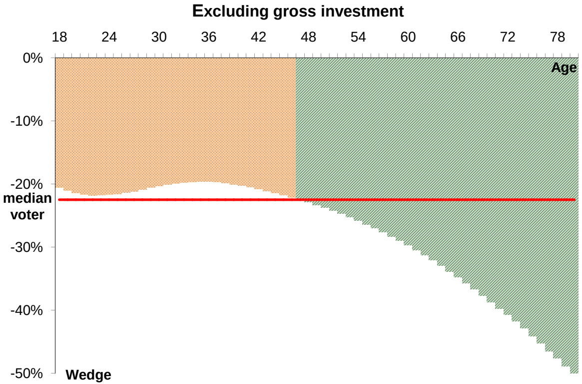
Based on Germany, baseline scenario, generic capital

Back to wedge

Back to gross investment

Back to net investment

Preferred wedge by age: excluding gross investment

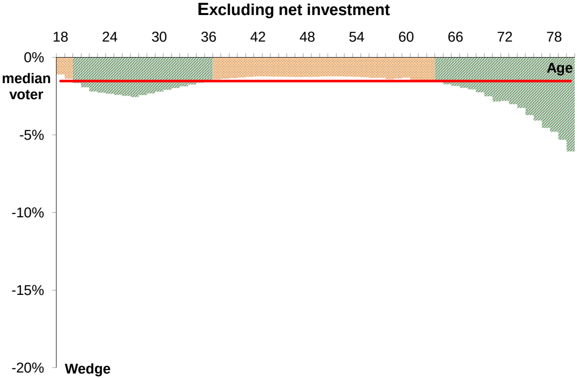


Based on Germany, baseline scenario, generic capital

▸ Back to gross investment

▸ Back to net investment

Preferred wedge by age: excluding net investment



Based on Germany, baseline scenario, generic capital

▸ Back to results