Fiscal Policy

Fiscal policy focuses on the connection between elements of government policy (spending, taxation and debt) and the overall economy.

Some big issues:

1. Proximate sources of changes in debt-output ratio?

2. Effect of spending shocks (e.g. wars)?
3. Effect of deficit finance, spending held equal?

4. Effect of starting a pay-as-you-go social security system or privatizing social security?

5. Optimal taxation for financing a war?
Government Budget Constraint

\[ B_{t+1} = B_t + D_t \]

\[ B_{t+1} = B_t + [G_t - T_t + r_t B_t] \]

\( B_t \) - government debt

\( D_t \) - government deficit

\( (G_t, T_t) \) - government spending and (net) taxes
Two Empirical Questions:

How does the debt-GDP ratio change over time?

What narrowly accounts for the big changes in the debt-GDP ratio?
US Debt-GDP Ratio

Year

1750 1800 1850 1900 1950 2000 2050
A Decomposition:

\[ B_{t+1} = B_t + D_t \]

\[ \frac{B_{t+1}}{Y_{t+1}} = \frac{B_t}{Y_{t+1}} + \frac{D_t}{Y_{t+1}} \]

\[ \frac{B_{t+1}}{Y_{t+1}} - \frac{B_t}{Y_t} = \frac{B_t}{Y_{t+1}} - \frac{B_t}{Y_t} + \frac{D_t}{Y_{t+1}} \]

\[ \frac{B_{t+1}}{Y_{t+1}} - \frac{B_t}{Y_t} = \frac{D_t}{Y_{t+1}} - \frac{B_t}{Y_{t+1}} \left( \frac{Y_{t+1}}{Y_t} - Y_t \right) \]
A Decomposition:

\[
\frac{B_{t+1}}{Y_{t+1}} - \frac{B_t}{Y_t} = \frac{D_t}{Y_{t+1}} - \frac{B_t}{Y_{t+1}} \left( \frac{Y_{t+1} - Y_t}{Y_t} \right)
\]

\[
\frac{B_{t+1}}{Y_{t+1}} - \frac{B_t}{Y_t} = \frac{G_t - T_t}{Y_{t+1}} + \frac{B_tr_t}{Y_{t+1}} - \frac{B_t}{Y_{t+1}} \left( \frac{Y_{t+1} - Y_t}{Y_t} \right)
\]

Thus, changes in the debt-output ratio can be decomposed into (1) a primary deficit term, (2) an interest term and (3) an output growth term. The next slide examines the sum of the last two terms (interest and growth terms).
Decomposing the Change in the US Debt-Output Ratio
A Decomposition:

\[ \frac{B_{t+1}}{Y_{t+1}} - \frac{B_t}{Y_t} = \frac{G_t - T_t}{Y_{t+1}} + \frac{B_tr_t}{Y_{t+1}} - \frac{B_t}{Y_{t+1}} \left( \frac{Y_{t+1} - Y_t}{Y_t} \right) \]

The sum of the interest rate and growth term has often been NEGATIVE since 1950. Thus, the real interest rate on US govt debt is often smaller than output growth. There is some basis for positive $B/Y$ ratios to be stable over time without running primary surpluses. This is an uncomfortable point for neoclassical growth theorists.
Present-Value Budget:

It would be useful to convert the sequence of budget constraints into a single present-value budget constraint. This was done in consumer theory. One difficulty is that it is natural to view a government as living forever. Thus, there is no LAST period for such a government.
Issue: NO LAST PERIOD:

If a government faced a “last period” and was responsible, then it would be natural to require that it pay back all debt and not contract additional debt in the last period. This would then imply a present-value budget constraint. We will deal with the no last period issue by assuming a useful condition on how debt can behave far into the future.
Some Algebra (Use $R_t \equiv 1 + r_t$):

\[ B_t = \frac{T_t - G_t}{R_t} + \frac{B_{t+1}}{R_t} \]

\[ B_t = \frac{T_t - G_t}{R_t} + \frac{T_{t+1} - G_{t+1}}{R_t R_{t+1}} + \frac{B_{t+2}}{R_t R_{t+1}} \]

\[ B_t = \frac{T_t - G_t}{R_t} + \frac{T_{t+1} - G_{t+1}}{R_t R_{t+1}} + \frac{T_{t+2} - G_{t+2}}{R_t R_{t+1} R_{t+2}} + \frac{B_{t+3}}{R_t R_{t+1} R_{t+2}} \]

Assume: the term $\frac{B_{t+n}}{R_t R_{t+1} \cdots R_{t+n-1}}$ goes to zero as $n$ gets large.
\[ B_t = \frac{T_t - G_t}{R_t} + \frac{T_{t+1} - G_{t+1}}{R_t R_{t+1}} + \frac{T_{t+2} - G_{t+2}}{R_t R_{t+1} R_{t+2}} + \frac{B_{t+3}}{R_t R_{t+1} R_{t+2}} \]

Implication is the Present-Value Budget Constraint:

\[ B_t R_t + G_t + \frac{G_{t+1}}{R_{t+1}} + \frac{G_{t+2}}{R_{t+1} R_{t+2}} + \cdots = T_t + \frac{T_{t+1}}{R_{t+1}} + \frac{T_{t+2}}{R_{t+1} R_{t+2}} + \cdots \]

**LHS:** present value of spending + value of current debt plus interest

**RHS:** present value of taxes
Some Interpretations:

1. What does the Assumption mean: (i) mathematically it says that the debt must grow at a rate less than the interest rate far into the future or (ii) intuitively it rules out rolling over the debt forever.

2. What does the Present-Value Budget imply:

(i) taxes must pay for spending and initial debt
(ii) implicit assumption: government debt is default-free

(iii) historically most countries (but not the US!!) have defaulted on internal or external debt. See Reinhart and Rogoff “This Time is Different: Eight Centuries of Financial Folly”.

(iv) The theory we develop focuses on governments with “responsible policies”. Argentina and Greece are not covered by this theory.
Life-Cycle Model w/ Government:

1. Consider the Life-Cycle Model ... but with

2. Government: \((G_t, T_{yt}, T_{ot}, B_t)\) w/ \(T_t = N[T_{yt} + T_{ot}]\)

3. Government obeys the present-value budget

4. Assume: \(U(c_y, c_o) = \log(c_0)\) ... thus \(\alpha = 0\)
Life-Cycle Model: Mechanics

No Govt: \( K_{t+1} = N a_{t+1} = N(1 - \beta)A_k^\beta \)

Govt which spends, taxes and borrows:

\[ Na_{t+1} = K_{t+1} + B_{t+1} \]

\[ K_{t+1} = Na_{t+1} - B_{t+1} = N[(1 - \beta)A_k^\beta - T_yt] - B_{t+1} \]

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)A_k^\beta - T_yt] - b_{t+1} \]
\[ k_{\text{new}} = (1 - \beta) k_{t}^B \]

\[ k_{\text{new}} = (1 - \beta) A k_{t}^B - P_{y_t}^{-1} b_{t+1} \]
Example: A “Temporary” War

1. start at steady state w/ \( G_0 = B_0 = 0 \)

2. war lasts one period: \( G_1 > 0 \)

3. Finance: \( NT_{y1} = NT_{o1} = G_1/2 \)

4. Future: \( G_t = B_t = T_{yt} = T_{ot} = 0 \) for \( t = 2, 3, \ldots \)
Example: A “Temporary” War

We can analyze this example using the assumption that agents only care about consumption in old age (i.e. $\alpha = 0$) or for any value of $\alpha$. In fact, this example was analyzed in homework 5! Other examples will lead to “complications” unless we focus on $\alpha = 0$. 
Example: A “Temporary” War

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)Ak_t^\beta - Tyt] - b_{t+1} \]

At \( t=1 \) the law of motion shifts down as young agents are poorer as a result of the tax. At \( t=2,3,... \) the law of motion shifts back up to its original position. Thus, we have a one period fall in \( k \) and then a slow return to the original steady state. [same result as for \( \alpha \neq 0 \)] Output also falls and then returns to the original steady state.
“Temporary” War Multipliers

We talked about Multipliers in the Business-Cycle Lecture. Multipliers measure the impact on output produced by a policy change. Here the policy change is the govt spending change: \( \text{Multiplier}(n) = \frac{\Delta Y_t + n}{\Delta G_t} \).

This multiplier is NEGATIVE for \( n \geq 1 \) in the Temporary War example. This contrasts with the POSITIVE (balanced and unbalanced budget) govt spending multipliers that come from the Simple Keynesian model.
“Temporary” War Multipliers

This multiplier is NEGATIVE for $n \geq 1$ in the Temporary War example. The only way to get a positive government spending multiplier in the life-cycle model is via an increase in $(K_t, L_t, A_t)$ as $Y_t = A_t F(K_t, L_t)$. Labor is always unchanged in the model. Capital falls because young agents are poorer as a result of the war tax. Open Issue: Endogenous labor choice leads to a positive multiplier?
The Cold War: Three Plans

start at steady state w/ $G_0 = B_0 = 0$

war lasts forever: $G_t = G = Ng > 0$ for all $t \geq 1$

Plan 1 (Tax Old): $(T_{yt}, T_{ot}) = (0, g)$ all $t \geq 1$

Plan 2 (Tax Young): $(T_{yt}, T_{ot}) = (g, 0)$ all $t \geq 1$

Plan 3 (Deficit Finance):
\[(Ty_1, To_1) = (0, 0) \text{ and } (Ty_t, To_t) = (0, g(1 + r_t)) \text{ for } t \geq 2\]
The Cold War: Do All Plans Satisfy the Govt Budget?

Plan 1: Intuition - yes as it runs a balanced budget each period $G_t = Ng = NT_{ot}$

Plan 2: Intuition - yes as it runs a balanced budget each period $G_t = Ng = NT_{yt}$

Plan 3: Not initially obvious, but yes as debt does not explode.
Plan 1: Analysis

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)A_k^\beta - T_yt] - b_{t+1} \]

\[ k_{t+1} = [(1 - \beta)A_k^\beta - 0] - 0 - \text{law of motion} \]

Because the law of motion does not move, then GDP, capital and investment do not move. Since government spending increases some other component of GDP must decrease. Consumption of the old falls by the full amount of the war expenditure in each period.

\[ C_t \downarrow + I_t + G_t \uparrow = Y_t = F(K_t, N) \]
Plan 2: Analysis

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)Ak_t^\beta - Ty_t] - b_{t+1} \]

\[ k_{t+1} = [(1 - \beta)Ak_t^\beta - g] - 0 \ - \text{law of motion} \]

Law of motion shifts down. Thus, over time capital and output fall. Consumption of agents born far in the future in Plan 2 must be lower than under Plan 1. This holds if the economy was initially below the Golden Rule steady state.

\[ C_t \downarrow + I_t \downarrow + G_t \uparrow = Y_t \downarrow = F(K_t \downarrow, N) \]
Plan 3: Analysis

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)Ak_t^\beta - Ty_t] - b_{t+1} \]

\[ k_{t+1} = [(1 - \beta)Ak_t^\beta - 0] - g \ - \text{law of motion} \]

Law of motion shifts down. It shifts down by EXACTLY the amount of the downward shift in Plan 2. Thus, the aggregate consequences (for GDP, investment, consumption, factor prices) are exactly the same as in Plan 2. Welfare for each agent born in each time period is also exactly the same as in Plan 2. The only difference with Plan 2 is that in Plan 3 govt debt is positive.
Ricardian Equivalence

The equivalence between Plan 2 and Plan 3 is an illustration of a general principle called Ricardian Equivalence. Within an economic model with lump-sum taxation, two plans that finance the same government expenditure will be equivalent provided the present value of taxation on each household is the same across the two plans. This result holds FOR ANY utility functions for the agents!
Understanding why Plan 2 and Plan 3 are equivalent

Plan 2: \[ PVTax = T_{y,t} + \frac{T_{o,t+1}}{1+r} = g + 0 = g \]

Plan 3: \[ PVTax = T_{y,t} + \frac{T_{o,t+1}}{1+r} = 0 + \frac{g(1+r)}{1+r} = g \]

The timing of taxes differs in Plan 2 and 3 but the present value for any agent is the same in Plan 2 and 3. A graph of this situation is useful!
Budget Set

\([C_0, C_y]\)
Plan 2 and 3: Further Remarks

Sometimes it is claimed that deficit finance ”crowds out” investment and reduces capital whereas balanced-budget finance does not. Plan 2 is consistent with balanced-budgets. Plan 3 is consistent with deficit finance. Thus, the example serves to highlight that this claim is not true in general. In the life-cycle model what does ”crowd out” capital is shifting the burden of paying for spending to future generations. Compare Plan 1 to either Plan 2 or 3!
Ricardian Equivalence:

We have an article written by Robert Barro on Ricardian Equivalence. He is a strong proponent both of the idea that Ricardian Equivalence is a useful polar theoretical result and of the claim that many government policies that finance the same spending stream may display a near equivalence.

We will try to follow his argument.
Ricardian Equivalence: Definition

Two government tax policies that finance the same government expenditures will be said to display Ricardian Equivalence (RE) provided that the consumption allocation to all agents in the model is the same for the two policies.
Theory: When Might Two Policies Display Ricardian Equivalence?

Answer: When budget sets across the two policies are the same for all agents in the economy.

When might that hold?

1. Present value of taxes are the same for all agents but timing of taxes changes. (example: equivalence of Plan 2 and 3 in ”Cold War” example)
2. Altruistic bonds that hold across generations of the same family. This might lead family dynasties to offset any shifting of tax burdens across generations. Family dynasties may vary the generosity of bequests (inter vivos or at death) in response to changes in present-value tax burdens arising from changes in govt policy.

The life-cycle model abstracts from such altruistic bonds.
Deviations from Ricardian Equivalence

1. Non-lump-sum taxes

2. Borrowing limits

3. Uninsured risks and taxation as insurance provision
Deviations from Ricardian Equivalence: Borrowing Limits

Suppose a consumer cannot borrow at all. Suppose the consumer chooses to be at the corner of the budget constraint under tax Plan 1. Consider tax Plan 2 that has the same present value but has lower current taxes. This will expand the consumers budget constraint and will lead an agent who was on the corner under Plan 1 to change his/her consumption.

Upshot: Ricardian equivalence does not exactly hold.
Deviations from Ricardian Equivalence: Non-lump-sum taxes

Income taxes are not lump sum in the US. They depend on income and tax rates defined for different income brackets. No simple theoretical result will apply when the schedule of tax rates and brackets is, say, reduced in one year but increased in future years. This will, in theory, typically also impact the choice of time allocated to work as the "marginal tax" rates that apply in the first year may fall and the marginal tax rates in future years may increase. Thus, budget sets will typically be altered.

Upshot: It is an empirical question how important such effects may be for changes in taxes across time that are not associated with government spending changes.
A Shred of Evidence

Barro mentions the case of Israel in the 1980’s. In 1984 Israel experienced a large increase in the budget deficit. This was associated with a (temporary) fall in real taxes collected due to a sharp rise in inflation. Barro highlights the behavior of public and private savings rates over time.
Definitions

\[ Y = C + I + G \]

\[ I = [Y - C - Tax] + [Tax - G] \]

\[ [Y - C - Tax] = \text{Private Savings} \]

\[ [Tax - G] = \text{Public Savings} \]

National Savings = Private Savings + Public Savings
### Israel: 1983-87

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<tr>
<th>Year</th>
<th>National Savings</th>
<th>Private Savings</th>
<th>Public Savings</th>
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<tr>
<td>1983</td>
<td>13</td>
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<td>1985</td>
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</tr>
<tr>
<td>1987</td>
<td>12</td>
<td>14</td>
<td>-2</td>
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</table>
Temporary Tax Cut: Analysis

The US govt some years ago (under GW Bush) sent $500 checks to many tax-paying families. One might view this episode as coming close to the theoretical ideal of a temporary tax cut. The reason is that there was no clear discussion of how this action was related to corresponding spending cuts. Thus, one might think that nearly equal tax increases might come within a few years.
Regardless of whether or not one views this episode in this way, there is the theoretical issue of how an idealized temporary tax cut, without any change in govt spending, might impact the economy.
Temporary Tax Cut: Assumptions

1. Consider the Life-Cycle Model in steady state. Government spending is constant across all periods.

2. Government: \( G_0 = Ng = NTy_0 + NT_{o0} \) and \( Ty_0 = T_{o0} = g/2 \)

3. At \( t = 1 \) the govt collects no taxes.

4. At \( t = 2, 3, ... \) then \( Ty_t = T_{ot} = g/2 + gr_t/2 \)
Thus, for $t = 2, 3, \ldots$ the government collects enough tax to pay for spending and to pay the interest on the debt. The debt is positive because the government runs a deficit in period 1.
Temporary Tax Cut: Conclusions

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)A k_t^\beta - T_y] - b_{t+1} \]

\[ k_{t+1} = [(1 - \beta)A k_t^\beta - g/2] - 0 \text{ - at } t = 0 \]

\[ k_{t+1} = [(1 - \beta)A k_t^\beta - 0] - g \text{ - at } t = 1 \]

\[ k_{t+1} = [(1 - \beta)A k_t^\beta - g/2 - gr_t/2] - g \text{ - at } t = 2, 3, \ldots \]
Law of motion keeps shifting downward. Tax cut is not expansionary. It is a trick to shift the burden of paying for spending onto future generations within this simple model.
Fiscal Multipliers:

The model produces a tax-cut output multiplier \( \frac{\Delta Y_{t+n}}{\Delta T_t} \). This multiplier is NEGATIVE for \( n \geq 1 \).

If some believe that tax cuts can be expansionary, then what is the mechanism for this? Do proponents rely on (i) real world taxes are not lump-sum or (ii) future labor hours increase in response to a tax cut on the grounds that leisure is a normal good and future generations are poorer?
Social Security: Theory

Most governments run a mandatory tax-transfer system whereby working-age individuals are taxed to fund transfer payments to older individuals. Such systems are often labeled social security systems. We will analyze within the Life-Cycle model a pure pay-as-you-go social security system:

\[(T_{yt}, T_{ot}) = (s, -s) \text{ all } t \geq 1\]
Social Security: Analysis

\[ k_{t+1} = a_{t+1} - b_{t+1} = [(1 - \beta)A_k^\beta - T_yt] - b_{t+1} \]

\[ k_{t+1} = [(1 - \beta)A_k^\beta - s] - 0 \text{ - law of motion} \]

Thus, starting a pay-as-you-go system in the model results in a downward shift of the law of motion. The initial old generation clearly benefits. Other generations clearly do not benefit as long as the initial steady state is below the Golden-Rule level.
\[ k_{\text{new}} = (1 - \beta) \Delta k_t^\beta \]

\[ k_{\text{new}} = (1 - \beta) A k_t^3 - 5 \]
Social Security: Analysis  If the economy is initially in a steady state below the Golden Rule, then neither social security nor anything else produces a Pareto improvement in this model. Recall the Proposition from Chapter 5! This proposition argue that, with positive interest rates, allocations produced by competitive markets in the life-cycle model are Pareto efficient. The model now has taxes and transfers added, but with these being lump-sum this will not change the upshot of the Proposition.
Social Security: Analysis

Calculate Present Value of Tax in Social Security

\[ PVTax = Tyt + \frac{T_{ot} + 1}{1+r} = s - \frac{s}{1+r} = \frac{sr}{1+r} > 0 \text{ when } r > 0 \]

Upshot: Social security is equivalent to either (i) a present-value tax or (ii) the government forcing agents into a low return investment.
Social Security: Would this analysis change if we allow population growth?

\[(T_{yt}, T_{ot}) = (s, -s(1 + n)) \text{ all } t \geq 1\]

\[k_{t+1} = \frac{a_{t+1} - b_{t+1}}{1 + n} = \frac{[(1 - \beta)A_k^\beta - T_{yt}] - b_{t+1}}{1 + n}\]

\[k_{t+1} = \frac{[(1 - \beta)A_k^\beta - s] - 0}{1 + n} \text{ - law of motion}\]
Social Security: Would this analysis change if we allow population growth?

\[ PV Tax = T_{yt} + \frac{T_{ot}}{1+r} = s - \frac{s(1+n)}{1+r} = \frac{s(r-n)}{1+r} > 0 \]

No: provided real return to capital exceeds population growth (i.e. when \( r > n \)).
Why do Social Security systems exist when the model says they do not lead to Pareto improvements?

Three possibilities:

1. (Insurance) Insurance for individual earnings or macro shocks absent in the real world markets. Social security provides insurance. Model abstracts from all risks.

2. (Nanny State) Some consumers would systematically under-save w/o forced “savings” via govt old-age pension programs.

3. (Politics) Model is ok, but we need to think about politics.
James Mirrlees (1995) states:

“From the point of view of insurance, there seem to me to be two compelling theoretical arguments for having the State rather than the market provide a wide range of insurance, for old-age pensions, disability and sickness, unemployment and low income: the first is that the market handles adverse selection badly. The second is that, even if adverse selection were not important, people should take out insurance at an age when they are incapable of doing so rationally, namely zero.”

Mirrlees won the Nobel Prize in economics for his work on optimal taxation under ”adverse selection” and ”moral hazard”
Larry Summers (1986) states:

“The point can be made more strongly. America’s largest social program, social security, is premised to no small degree on the view that individuals are not rational in preparing for old age and need to be coerced to do so. The existence of TIAA-CREF as a custodian of the retirement funds of many of us in this room is due to a conviction that college professors cannot be trusted to save enough for their own or their spouses old age. If important, these behavior patterns are likely to dwarf liquidity constraints in explaining consumption and saving. Indeed, liquidity constraints arise in no small part from rules that are explicitly designed to prevent the profligate from getting too far over their heads.”

Summers is famous for theorizing about the possible reasons for why there are few women PhD’s in science.
Social Security (Medicare) Facts:


2. Major Expansions:

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<th>Benefit</th>
<th>Earnings Tax Rate</th>
<th>Starting Year</th>
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<td>OASI</td>
<td>10.6</td>
<td>1935 and 1939</td>
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<td>DI</td>
<td>1.8</td>
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<td>HI (Medicare)</td>
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<td>1965</td>
</tr>
<tr>
<td>Medicare Part D</td>
<td>0</td>
<td>2003</td>
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</table>
Social Security Facts:

3. Earnings Cap 106,000 in 2009

4. Since the mid 1950’s social security is effectively a mandatory program for the vast majority of US workers (85 percent or so).

5. Old Age Benefit formula- paid monthly based on

- 35 highest indexed earnings years produces AIME

- progressive formula based on an individual’s AIME

- benefits paid as a real annuity linked to CPI

- spousal benefit: benefit equals the greater of old-age benefit based on own earnings history or half of spouse’s benefit
Percent of Workforce Covered by OASI

Fraction of Paid Workers
Average earnings and benefit payments are both expressed as a multiple of average economy wide earnings.

US Benefit Function:

1. Some argue that the shape of the benefit function may provide valuable insurance. Its shape transfers resources from those with good luck on lifetime earnings to those with bad luck on lifetime earnings. The bad luck could stem from being born with mental impairments, from job loss luck over the lifetime, or from other idiosyncratic shocks impacting earnings.

2. The benefit function can also be read as providing HIGH marginal earnings tax rates on high lifetime earners and LOW marginal earnings tax rates on low lifetime earners.

\[ \text{Marginal Tax Rate} = \text{SS Tax Rate} - \text{Marginal Benefit} \]
Old-Age transfers:

If one adds up total transfers from US government transfer programs directed at older Americans (roughly age 65+) and expresses total transfers to GDP, then there is a clear pattern for this to increase over time.

What explains this? The median age of voters is increasing? Does this change old-age transfer politics?
Old-Age Transfer/ GDP Ratio

Year

Fraction of GDP

1937
1940
1943
1946
1949
1952
1955
1958
1961
1964
1967
1970
1973
1976
1979
1982
1985
1988
1991
1994
1997
2000
2003
2006

Medicaid to 65+
Medicare supp.
Medicare hospital
DI
OASI
Old-Age Transfer / Earnings Ratio

0 0.02 0.04 0.06 0.08 0.1 0.12 0.14 0.16