Discussion: "The Optimal Rate of Inflation" by Stephanie Schmitt-Grohé and Martin Uribe

- Can Ramsey optimal taxation account for the roughly 2% inflation target central banks seem to follow?

This is not an easy task

- Ramsey optimal taxation fails miserably as a positive theory:
  - Capital should not be taxed
  - Profits should be fully taxed
  - Intermediate goods should not be taxed
  - Consumption taxes are more efficient than labor income taxes
- It is normative theory. A good positive theory should model the effects of taxes on different agents and the political process.

Benchmark model with a money demand distortion

- The Friedman rule, of zero nominal interest rates, is optimal in the first best and in the second best, when taxes must be distortionary.
  - With zero nominal rates, and real rates (on short term riskless bonds) between zero and 2%, inflation should be negative, between zero and minus 2%.
  - These real rates are lower than 3.85%, in the paper. Mehra and Prescott (1985): Mean real rate on riskless security, 1889-1978, 0.8%. It was 2.4% for 1983-2002.

- Reasons for higher inflation:
  - Taxation of profits: higher, but negative, inflation.
  - Underground economy: slightly higher, but negative, inflation
  - Taxation of foreigners: positive inflation, close to the target.
  - Sticky prices:
    - Trade off between the money demand distortion and the price dispersion distortion.
    - Negative inflation, but close to zero.
    - Unless there is indexation.
  - Zero bound: it is hit infrequently
  - Downward nominal rigidity in wages?
  - Quality bias: Which prices are sticky: prices per unit of good, or prices per unit of quality?

Money demand and the optimal rate of inflation

- Preferences over c_t and labor h_t

$$\sum_{t=0}^{\infty} \beta^t U(c_t, h_t)$$

- Technology

$$[1 + s(v_t)]\, c_t + g_t \leq A_t (h_t - \alpha m_t)$$

$$v_t = \frac{c_t}{m_t}$$

- First best:

$$s'(v_t)\, v_t^2 = A_t \alpha$$

- The first best

$$s'(v_t)\, v_t^2 = A_t \alpha$$

- In equilibrium

$$s'(v_t)\, v_t^2 = \frac{R_t - 1}{R_t}$$

  so that

$$\frac{R_t - 1}{R_t} = A_t \alpha$$

- As $\alpha \to 0$, $R_t \to 1$.

- Is the cost of supplying money zero?
- The nominal production costs of currency as a percentage of its nominal value are approximately 0.12%.
  - They are relatively high for small denomination bills (2.18% for one dollar bills),
  - but very low for higher denomination bills (less than 0.01% for 100 dollar bills).
  - The cost of coins is 0.94%.

The Friedman rule has fiscal consequences

$$\sum_{t=0}^{\infty} \frac{Q_{t-1}P_t}{P_0}\left[(g_t-\tau_t)-\frac{R_t-1}{R_t}m_t\right] \leq -\frac{R_{-1}B_{-1}+M_{-1}}{P_0}$$

where $Q_t = \frac{1}{R_0 \ldots R_t}$, with $Q_{-1}=1$.

- Let $P_0 \to \infty$. The seigniorage revenue is

$$\sum_{t=0}^{\infty} \frac{Q_{t-1}P_t}{P_0}(g_t-\tau_t) = \sum_{t=0}^{\infty} \frac{Q_{t-1}P_t}{P_0}\frac{(R_t-1)}{R_t}m_t$$

- At the Friedman rule, there is the initial issuance of money and the subsequent withdrawal of money, at the real rate of interest. The present value is zero.

- Suppose the economy is at a steady state with

$$m_t = \frac{M_{-1}}{P_0} = m$$

Then, seigniorage (on money balances) is

$$\sum_{t=0}^{\infty} \frac{Q_{t-1}P_t}{P_0}\left[(g_t - \tau_t) - \frac{R_t - 1}{R_t} m_t\right] \leq -\frac{R_{-1}B_{-1} + M_{-1}}{P_0}$$

$$\frac{g - \tau}{1 - \beta} = \frac{\frac{R-1}{R} m}{1 - \beta} - m$$

- At the Friedman rule, seigniorage is negative,

$$g - \tau = -(1 - \beta)\, m.$$

- With the Friedman rule, there are initial gains, but subsequent losses.
- This is key without commitment.
- For profit maximizing suppliers of money, negative inflation is not sustainable (Marimon, Nicolini and Teles, 2003, 2008).

Second best

- Why is the Friedman rule still optimal in a second best environment? Shouldn't liquidity be taxed as any other good, as suggested by Phelps?
- Suppose money was costly to produce:
  - Money would be an intermediate good in the production of transactions.
  - Labor can be taxed
    - in the production of the good
    - in the production of transactions
    - in the production of money
  - The transactions technology is CRS.
  - Diamond and Mirrlees (1971). It is not optimal to tax intermediate goods.

Reasons for higher inflation: Taxation of profits

- In the paper: Higher, but negative, inflation.
- Instead, the Friedman rule is optimal, if consumption taxes are used.
- Profits can be taxed with
  - a profit tax
  - a consumption tax
  - the inflation tax, which is the most inefficient way.

$$\left(1+\tau^{c}\right)\left[1+s\left(v_{t}\right)+s'\left(v_{t}\right)v_{t}\right]c=\left(1-\tau^{\pi}\right)\pi+\left(1-\tau^{h}\right)wh$$

$$\left[1+s\left(v_{t}\right)+s'\left(v_{t}\right)v_{t}\right]c=\frac{\left(1-\tau^{\pi}\right)\pi}{\left(1+\tau^{c}\uparrow\right)}+\frac{\left(1-\tau^{h}\downarrow\right)}{\left(1+\tau^{c}\uparrow\right)}wh$$

$$s'\left(v_{t}\right)v_{t}^{2}=\frac{R_{t}-1}{R_{t}}$$

- Why aren't profit taxes used?
  - Because they aren't optimal, as they are in the model?
  - Because they are not politically feasible?
  - If there are reasons not to use profits taxes, most likely they would apply to the other, more inefficient, ways of taxing profits.

Reasons for higher inflation: Taxation of foreigners

- In the paper: Positive inflation, close to the target.
- Abstracts from competition
- Bertrand competition (with commitment) drives interest rates to zero.
- At zero interest rates, there are initial gains, but subsequent losses.
- Without commitment, need inflation to be positive.

Reasons for higher inflation: Sticky prices

- In the paper:
  - The distortions from sticky prices dominate the money demand distortion. Specially in the second best.
  - Negative inflation, but close to zero.
- Instead, with consumption taxes, there is no trade off between the money demand distortion and the price dispersion distortion (Correia, Nicolini, Teles, 2008).

- With only income taxes cannot eliminate both the money demand distortion and the sticky price distortion:

$$\frac{U_c(t)}{1+s\left(v_t\right)+s'\left(v_t\right)v_t}=R_tE_t\frac{\beta U_c(t+1)}{\left[1+s\left(v_t\right)+s'\left(v_t\right)v_t\right]\pi_{t+1}}$$

- But what if there are consumption taxes?

$$\frac{U_c(t)}{1+s\left(v_t\right)+s'\left(v_t\right)v_t}=R_tE_t\frac{\beta U_c(t+1)}{\left[1+s\left(v_t\right)+s'\left(v_t\right)v_t\right]\pi_{t+1}\frac{1+\tau^c_{t+1}}{1+\tau^c_t}}$$

- Both the Friedman rule and zero (producer price) inflation are optimal.

- The consumption taxes here are as flexible as the labor income taxes considered in the paper.

Reasons for higher inflation: Zero bound

- In the paper: It is hit infrequently.
- Instead, in the infrequent cases where the lower bound is hit, can use the consumption taxes to get out of it.

$$\frac{U_c(t)}{1+s\left(v_t\right)+s'\left(v_t\right)v_t}=R_tE_t\frac{\beta U_c(t+1)}{\left[1+s\left(v_t\right)+s'\left(v_t\right)v_t\right]\pi_{t+1}\frac{1+\tau^c_{t+1}}{1+\tau^c_t}}$$

or

$$U_c(t)=E_t\frac{\beta U_c(t+1)}{\frac{1+\tau^c_{t+1}}{1+\tau^c_t}}$$

- The zero bound is not a restriction to the set of implementable allocations, (Correia, Nicolini, Teles, 2008).
- There could be other issues related to the zero bound that would make you want to stay away, but not the possibility that real rates are too low.

Reasons for higher inflation: Downward nominal wage rigidity

- With payroll taxes, can keep the wages and the prices constant and implement the Friedman rule.

To conclude

- Producer price inflation can be zero,
- still consistent with the Friedman rule.
- The questions remain:
  - Why aren't interest rates zero?
  - Why aren't consumption taxes used as they should?
  - Together with:
    - Why is capital taxed?
    - Why aren't consumption taxes used more generally?
- To answer this, need good positive theory. Not good normative theory.

- In the end, with or without arbitrary restrictions on taxes, price stability is optimal.
- And that is precisely the primary objective of the ECB.
- That is defined by the ECB Governing Council as CPI inflation below 2%, and clarified, to be below, but close to, 2% in the medium term.
- The ECB also explains the reasons for aiming at below, but close to, 2%:
  - Margin to avoid the risks of deflation. 'Having such a safety margin against inflation is important because nominal interest rates cannot fall below zero.'
  - Small but positive bias in the measurement of price level changes.
  - Inflation differentials in the euro area. Avoid that individual countries in the euro area have to live with deflation.

Extra:
Taxation of profits at the same rate as labor income

- The net tax on profits is proportional to the tax on labor income.

$$(1-\tau^{\pi}) = \alpha\,(1-\tau)$$

$$c = \frac{\alpha\,(1-\tau)\,\pi}{(1+\tau^{c})} + \frac{(1-\tau)}{(1+\tau^{c})}n$$

- It is not possible to tax the two sources of income at different rates.
- Cannot use consumption taxes to tax profits. The Friedman rule is optimal.

Reasons for higher inflation: Underground economy

- In the paper: Slightly higher, but negative, inflation.
- Not in this set up. If some of the income is not taxed, should tax consumption.
- Inflation is an inefficient way of taxing that income.
- If cannot tax some of consumption, than inflation is a way to tax it (Nicolini, 1998).

Taxation of foreigners

- The way it is done in the paper:
- There is no smoothing of seigniorage revenues.
  - The seigniorage revenues add to the resource constraint period by period.
  - Need to have bonds, and a balance of payments.
- How elastic is the money demand for dollars outside the US?
  - Same demand as the one for dollars demanded by residents in the US.
  - Could use euros, instead. But what if everyone else uses dollars?

Why is the FR optimal in the second best?

$$\left[1 + s\left(\frac{c_t}{m_t}\right)\right] c_t + g_t = A_t h_t$$

or

$$c_t + g_t = A_t \left(h_t - s_t\right)$$

and

$$s_t = \frac{s\left(\frac{c_t}{m_t}\right) c_t}{A_t}$$

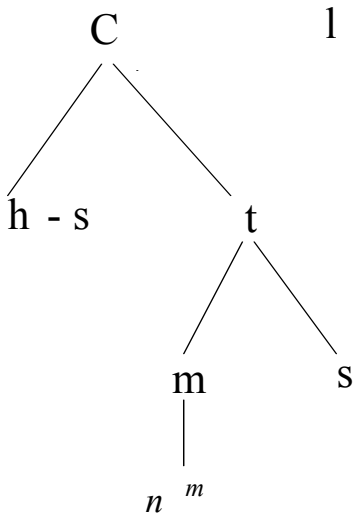
$$c_t + g_t = A_t \left(h_t - s_t \right)$$

and

$$s_t = \frac{s\left(\frac{c_t}{m_t}\right) c_t}{A_t}$$

- Production of the good and production of transactions are Leontieff.
- Production of transactions is constant returns to scale.
- The key point in this formulation is that transactions time is taxed.

- The structure of the economy is



- Labor is taxed in
  - the production of the good,
  - the production of transactions, and
  - possibly in the production of money.
- The transactions technology is constant returns to scale.
- Diamond and Mirrlees (1971): Money should not be taxed.

- What if s could not be taxed, as in Kimbrough (1986) or Correia and Teles (1996)
- Then it would be optimal to subsidize money at some proportionate rate to compensate for the tax on the production of money.
- Since the cost of producing money is negligible, the price of money should be zero.

The welfare cost of the money demand distortion in the first best and in the second best

- The distortion from price dispersion is revenue neutral, while the money demand distortion is not.
- When there are lump-sum taxes, there is no interest in collecting seigniorage revenue, while when taxes are distortionary, there is a gain in reducing distortionary taxes.
  - The welfare cost of the money demand distortion is higher in the first best than in the second best.