Inequality and Policy Changes: The case of the decline of inflation in open economies

Bernardino Adao and Isabel Correia

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- Strong evidence on household inequality inside countries and differences of inequality across countries.
- How important is this evidence for policy evaluation? Not just the equity effect but even when the focus is on efficiency.
- We evaluate a policy change which should take into account this inequality: the decline in average inflation (the most widespread and sustained policy change in the last decades).
- Compatible with empirical evidence on transactions patterns

Empirical evidence on transactions

- High income individuals use cash and cash plus checks for a smaller fraction of their transactions than low income individuals.
- The fraction of household wealth held in liquid assets decrease with income and wealth.
- A nontrivial fraction of households does not own a checking account and/or does not use credit cards to perform transactions.

Questions:

- To evaluate welfare costs of inflation is it relevant to take into account the effect on inequality across households?
- How important is, for that question, that the model is able to replicate empirical facts on transaction?
- How strong is the assumption of a closed economy for the results? Or how important is that the policy is taken simultaneously within a set of countries that trade with the one under analysis?
- How important is the different distributions across countries to understand the welfare cost of inflation?
- Given the results of previous answers how could we measure the consequences of the observed change of regime from high to low inflation?

Set up:

- Deterministic model: the change of regime is a change of average inflation, and cost of inflation driven by monetary distortions.
- Monetary model where there is just one consumption good and no capital, technology linear in labor.
- The inflation tax would be compensated by the more similar one: the consumption tax. We would have a lower bound for the effects of the change of regime.
- Households differ on:
  - Exogenous differences in labor productivity
  - Differences in initial wealth.
  - Heterogeneity results from the joint distribution of labor efficiency and the initial wealth.
- Open economies with countries identical in every dimension except on distribution of characteristics across households.

Environment

- Monetary economy
  - Households held money because it is an alternative means of payment to costly credit.
  - Technologies of transactions with constant or increasing economies of scale.
- Households choices over consumption and leisure and over cash and credit payments.
- Exogenous government consumption financed by proportional taxes on consumption and on money.

Literature

- Erosa and Ventura (2002)
- Albanesi (2007)
- Correia (1999)

Households

$$U_i = \sum_{t=0}^{\infty} \beta^t \frac{\left(\widehat{u}(C_{it}, N_{it})\right)^{1-\sigma}}{1-\sigma}$$

$$\widehat{u}(C_{it}, N_{it}) = C_{it} - \chi N_{it}^{\varphi},\ \chi > 0, \varphi > 1$$

s. to

$$P_t'(1+\tau_c)C_{it} + wP_t's_{it} + M_{it+1} + B_{it+1} \leq wP_t'E_iN_{it} + M_{it} + (1+R_t)B_{it}$$

where τ_c represents the tax on consumption expenditures, R the nominal interest rate and w the wage rate.

$$s_{it} = l(C_{it}, m_{it})$$

$$\lim_{t\to\infty}\left[d_t\left(m_{it} + \frac{B_{it}}{P_t'}\right)\right] = 0$$

where $d_t = P_t'/(P_0'(1+R_0)(1+R_1)...(1+R_t))$

- Intertemporal budget constraint

$$\sum_{t=0}^{\infty} d_t(1+\tau_c)C_{it} + \sum_{t=0}^{\infty} d_t w l(C_{it}, m_{it}) + \sum_{t=0}^{\infty} d_t R_t m_{it} = \sum_{t=0}^{\infty} d_t w E_i N_{it} + A_{i0}$$

where $A_{i0} = \frac{m_{i0}}{(1+R_0)} + \frac{B_{i0}}{P_0'}$. P_0' could play a role. Undetermined.

- Stationarity

$$(1+\tau_c)C_i + wl\left(m_{i,}C_i\right) + R_t m_i = wE_iN_i + (1-\beta)A_{i0},$$

$$N_i = \left[\frac{wE_i}{\chi\varphi(1+\tau_c)(1+wl_{ci})}\right]^{\frac{1}{\varphi-1}}$$

$$-l_{mi}w = R$$

No economies of scale (CRS)

The homogeneity of degree one of l

$$-l'(\frac{m_i}{c_i}) = \frac{R}{w}$$

Result 1: Transaction technologies with CRS: $\frac{m_i}{c_i}$ constant across households.

$$\left[(1+\tau_c) + wL\left(\frac{w}{R}\right) + RH(\frac{w}{R})\right] C_i = wE_iN_i + (1-\beta)A_{i0},$$

Gorman aggregation.

$$(1+\tau_c)(1+wl_{ci})C_i = wE_iN_i + (1-\beta)A_{i0},$$

$$P_i = (1+\tau_c)(1+wl_c) = P$$

Utility index can be written in this case as

$$v_i = \left[\frac{[wE_i/P]^{\frac{\varphi}{\varphi-1}}}{(\chi\varphi)^{\frac{1}{\varphi-1}}}(1-\frac{1}{\varphi}) + (1-\beta)A_{i0}/P\right]$$

Result 2: (Friedman Rule)

$$v_i = \frac{1}{P}\left[\frac{[wE_i]^{\frac{\varphi}{\varphi-1}}}{P^{\frac{1}{\varphi-1}}\,(\chi\varphi)^{\frac{1}{\varphi-1}}}(1-\frac{1}{\varphi}) + (1-\beta)A_{i0}\right]$$

$A_{r0} \geqslant 0.$

A decrease of inflation increases v_r and therefore P declines.

Method

Definition: Policy 2 is equity improving in relation to policy 1 iff policy 2 dominates policy 1 in relative differential, that is :

$$\frac{v_i^2}{v_j^2} > \frac{v_i^1}{v_j^1}, \text{ for } i < j \tag{1}$$

Proposition : Policy 2 dominates policy 1, if:

1) $\alpha\left(p\right)^{2}\geq\alpha\left(p\right)^{1}$,

$$\alpha\left(p\right)=\frac{P\left[w/P\right]^{\frac{\varphi}{\varphi-1}}}{\left(\chi\varphi\right)^{\frac{1}{\varphi-1}}}(1-\frac{1}{\varphi})$$

and

2) $\frac{E_{i}{}^{\frac{\varphi}{\varphi-1}}}{A_{i0}}\geq\frac{E_{j}{}^{\frac{\varphi}{\varphi-1}}}{A_{j0}}$ when $A_{s0}>$, for all i and j such that $v_{i}\leq v_{j}$.

Proof. For $A_{i0} < 0$

$$\frac{v_i}{v_j} = \frac{-A_{i0}}{A_{j0}} \frac{\alpha\left(p\right) \frac{E_i{}^{\frac{\varphi}{\varphi-1}}}{\beta(-A_{i0})} - 1}{\alpha\left(p\right) \frac{E_j{}^{\frac{\varphi}{\varphi-1}}}{\beta A_{j0}} + 1}$$

$$\frac{\widehat{v_i}}{v_j}{}^2_1 \simeq \widehat{\alpha\left(p\right)}^2_1 \left(\frac{\alpha\left(p\right)}{v_i^1 v_j^1}\right) \left(\frac{E_i{}^{\frac{\varphi}{\varphi-1}}}{-A_{i0}} + \frac{E_j{}^{\frac{\varphi}{\varphi-1}}}{A_{j0}}\right)$$

.

Compensating inflation with a VAT tax

$\alpha\left(p\right)=\frac{P^{\frac{-1}{\varphi-1}}(w)^{\frac{\varphi}{\varphi-1}}}{(\chi\varphi)^{\frac{1}{\varphi-1}}}(1-\frac{1}{\varphi}).$

w/P increases. w is constant P declines.

Then $\alpha\left(p\right)$ increases.

Result 3: A decline in inflation compensated by an increase in the consumption tax rate improves welfare distribution.

Result 4: A decline in inflation compensated by an increase in the consumption tax is a Pareto movement. Even when the agent is a debtor, and real debt increases, the agent is better off.

Economies of scale

- Budget constraint:

$$(1+\tau_c)C_i + wl\left(m_{it,}C_{it}\right) + R_t m_{it} = wE_iN_i + (1-\beta)A_{i0},$$

- Transactions technology

$$l\left(m_{it,}C_{it}\right) = k(1-\left(\frac{m}{C}\right)_i)^2 C_i + (1-\left(\frac{m}{C}\right)_i)\overline{N}$$

$$(1+\tau_c)C_i + R\left(\frac{m}{C}\right)_i C_i + w\left[k(1-\left(\frac{m}{C}\right)_i)^2 C_i + (1-\left(\frac{m}{C}\right)_i)\overline{N}\right] = wE_iN_i + (1-\beta)A_{i0},$$

The choice of $\left(\frac{m}{C}\right)_j$ is such that

$$\left(\frac{m}{C}\right)_j = 1 - \frac{R}{2wk} + \frac{\overline{N}}{2kC_j}$$

1) $m_i = C_i$
2) $m_j = (1 - t_j)C_j$

$$\left[(1+\tau_c) + R\left(\frac{m}{C}\right)_j + wk(1 - \left(\frac{m}{C}\right)_j)^2\right] C_j + w(1 - \left(\frac{m}{C}\right)_j)\overline{N} = wE_jN_j + (1-\beta)A_{j0},$$

$$P_j = (1+\tau_c) + R\left(\frac{m}{C}\right)_j + wk(1 - \left(\frac{m}{C}\right)_j)^2$$

$$\partial\frac{P_j}{\left(\frac{m}{C}\right)_j} = R - 2wk(1 - \left(\frac{m}{C}\right)_j) = \frac{w\overline{N}}{C_j} > 0$$

Result 5: When transactions technology is IRS, $\frac{m}{C}$ is no more constant across households. "Rich" agents (j) held a lower share of cash for transactions than "poor" agents.
No longer Gorman aggregation.

Result 6: The effective price of consumption declines with consumption. Therefore IRS amplifies the inequality across households.

Result 7: Inflation acts like a regressive tax on consumption.

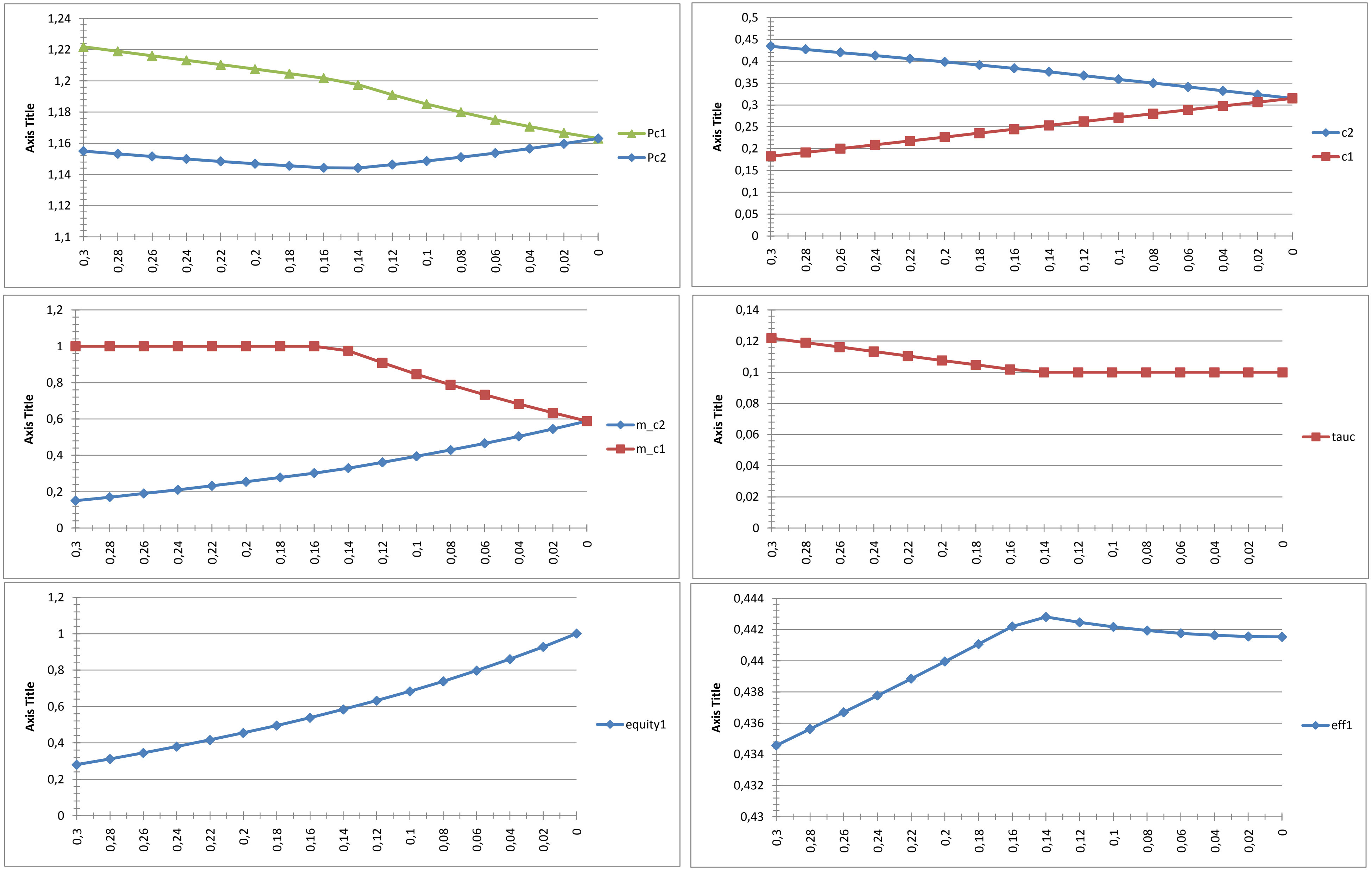
$$\frac{dP_j}{dR} = \partial\frac{\partial P_j}{\partial R} + \frac{\partial P_j}{\partial\left(\frac{m}{C}\right)_j}\frac{\partial\left(\frac{m}{C}\right)_j}{\partial R} > 0.$$

$$\frac{d\frac{Pi}{Pj}}{dR} > 0$$

The numerical solution

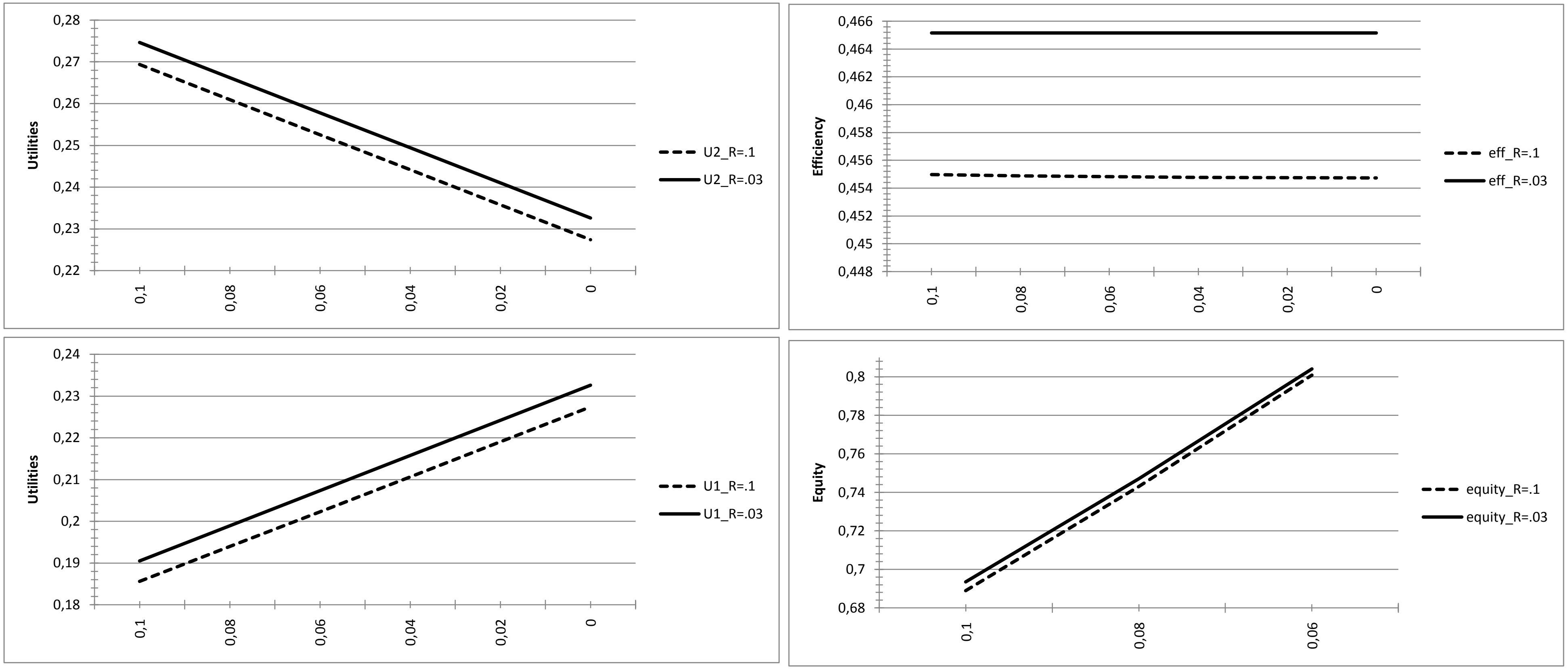
Result 8: When households are heterogeneous a pure redistribution policy increases efficiency.

Figure 1: Nominal interest Rate equal 0.1
(the difference in endowment is in the horizontal axis)



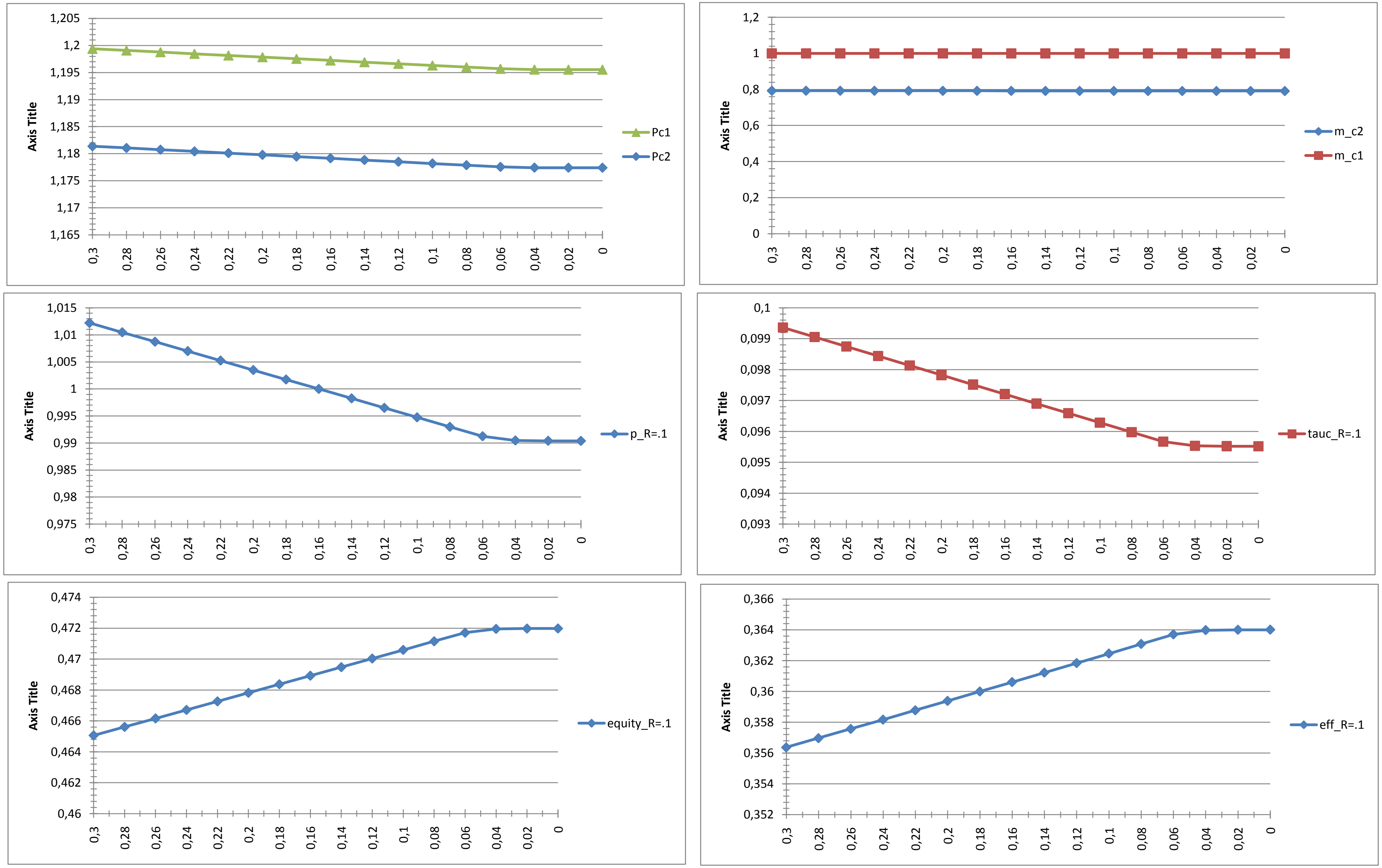
Result 9: The decline of inflation in a closed economy has a significative effect on efficiency and a positive effect on equity. The magnitude of these effects are the same irrespective of the exogenous heterogeneity.

Figure 2: Change in Inflation with Non-negative Wealth
(the difference in endowment is in the horizontal axis)



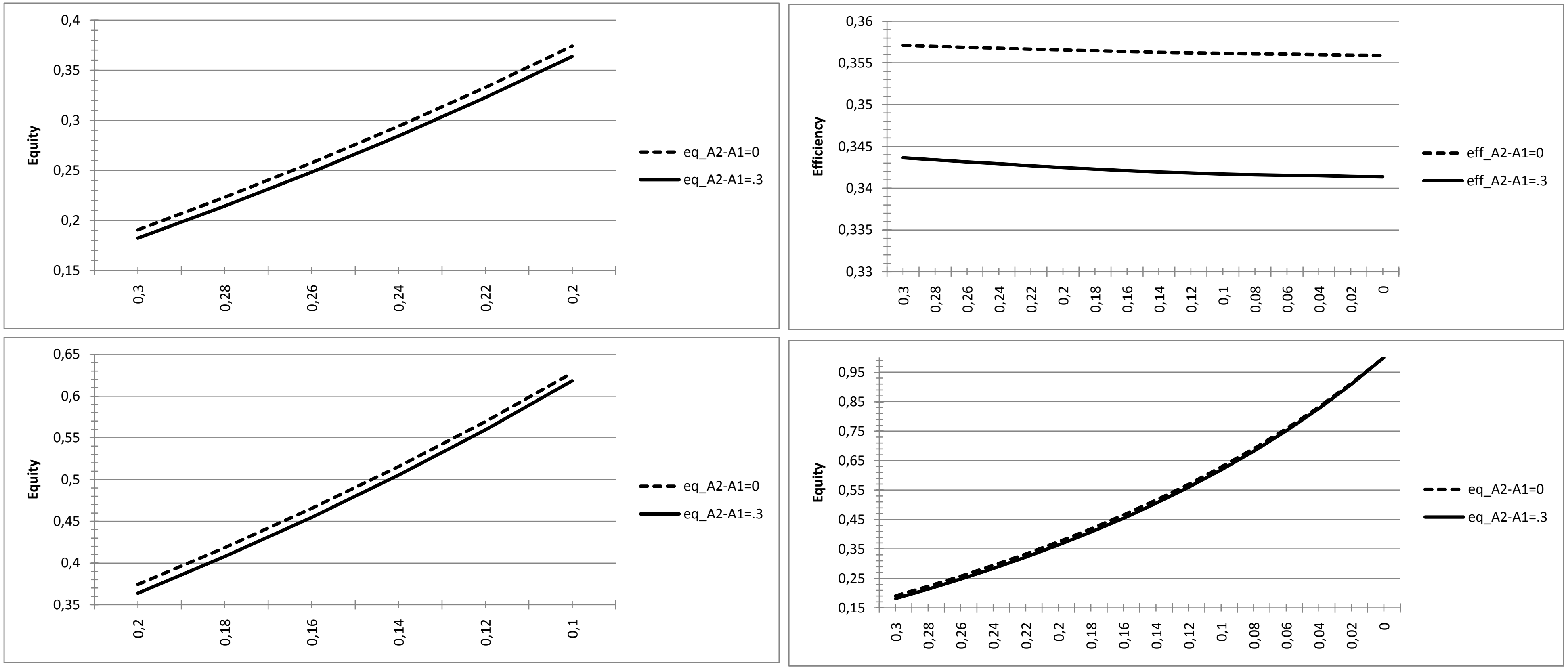
Result 10: In open economies, for a given distribution of characteristics in the home economy, the higher the inequality in the foreign country the higher the efficiency in the home country for a given interest rate. The terms of trade decline with the inequality of the foreign country.

Figure 3: The country has a constant distribution of wealth, and nom. int. rate=0.1
(the difference in the distribution of initial wealth of the second country is in the horizontal axis)



Result 11: Efficiency at home depends more on inequality abroad than on inequality at home. The opposite occurs with equity.

Figure 4: How important is the second country distribution and R=.1
(the difference in endowment is in the horizontal axis)



Result 12: The gain on efficiency and on equity of the decline of inflation is higher the more unequal is the foreign country.

Figure 5: The first country has a constant distribution of wealth and two different nom. int. rates R=0.1 and R=.03
(the difference in endowment of the second country is in the horizontal axis)

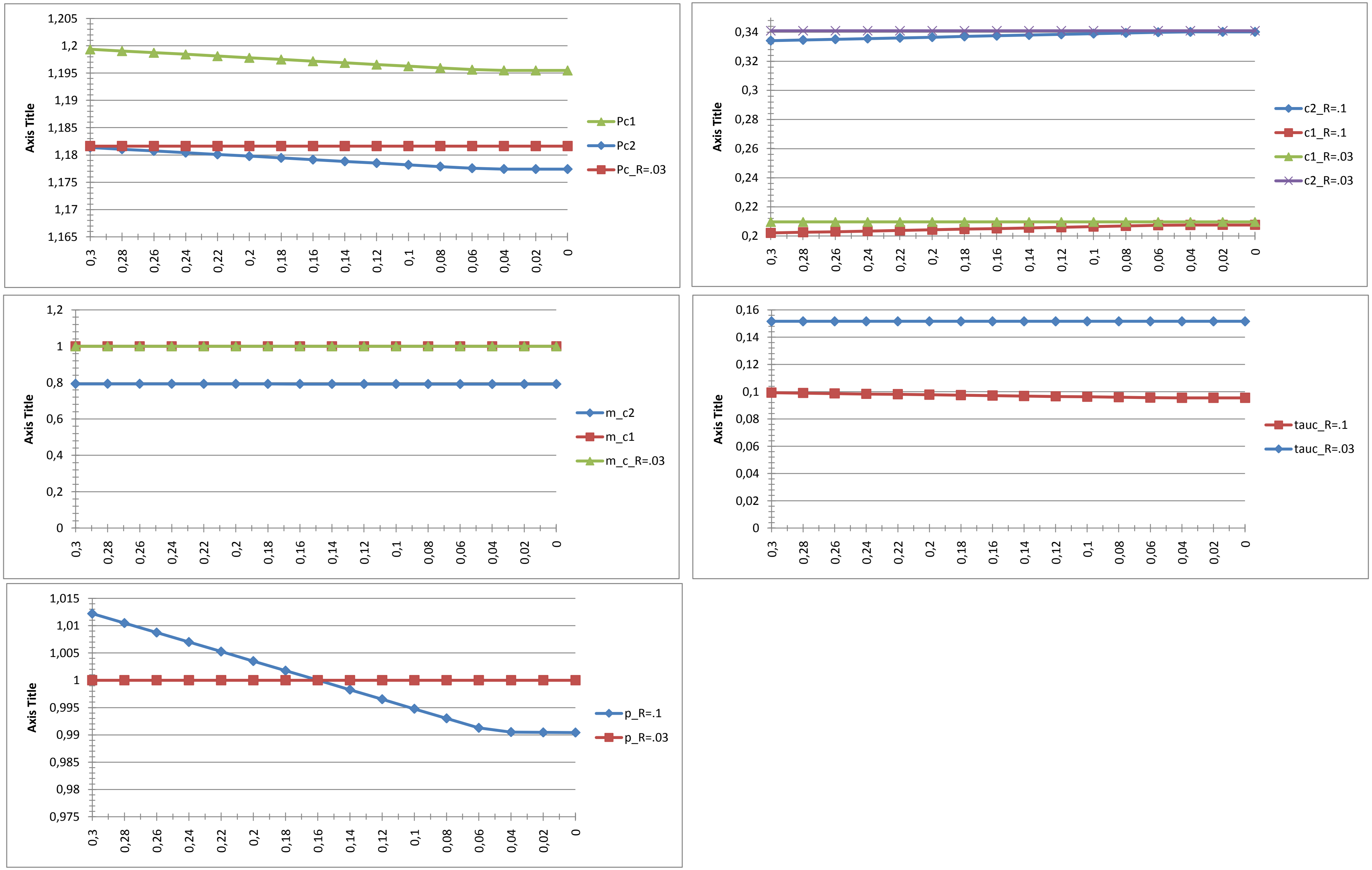
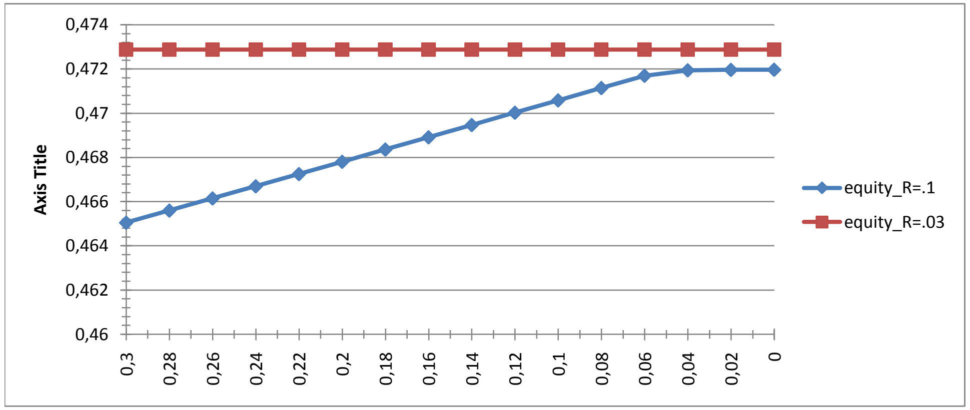
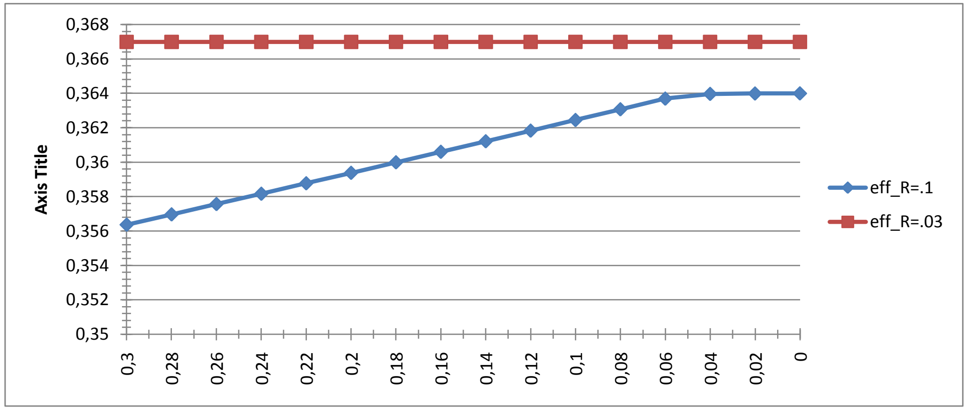


Figure 6: The first country has a constant distribution of wealth and two different nom. int. rates R=0.1 and R=.03
(the difference in endowment of the second country is in the horizontal axis)





Conclusions

- Inequality is relevant to evaluate policy changes.

- In open economies inequality abroad is more relevant than inequality in the country.