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Inflation and Inequality

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Abstract

Cross-country evidence on inflation and income inequality suggests that they are positively correlated. I explore the hypothesis that this correlation is the outcome of a distributional conflict underlying the determination of fiscal policy.

Keywords: Inflation, inequality, distributional conflict, fiscal policy, bargaining.

JEL Classification: E0, E4, E5, E6, H2, H3, D7.

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1. Introduction

Observations from a large sample of countries for the time period between 1966 and 1990 reveal a positive correlation between average inflation and measures of income inequality. I explore the hypothesis that this correlation is the outcome of a distributional conflict underlying the determination of fiscal policy. I describe a political economy model in which equilibrium inflation is positively related to the degree of inequality in income due to the relative vulnerability to inflation of low income households.

I consider a monetary economy in which income inequality is an increasing function of exogenous differences in human capital and the nature of the transaction technology gives rise to the result that low income households are more vulnerable to inflation. In addition, I model the political process as a bargaining game over the determination of fiscal policy, following Bassetto (1999). I assume that fiscal policy is given by a linear income tax and that the level of public spending is exogenous. Furthermore, taxes cannot be raised and the government must resort to inflation if an agreement is not reached. Since high inflation is costly for all types of households, there is an incentive to reach an agreement. Low income households stand to lose more than high income households if an agreement is not reached, given their relative vulnerability to inflation. Consequently, their bargaining position is weaker. Higher inequality, arising from greater differences in income across households, leads to a greater relative vulnerability to inflation of low income households and a further weakening in their bargaining position. I show that these features of the environment imply that equilibrium inflation is positive and increasing in the degree of inequality in human capital. For a plausibly parametrized version of the economy, I find that the correlation between inflation and inequality predicted by the model is quantitatively significant and can account for a significant fraction of the one in the data.

Two elements are key in this framework: the relative vulnerability to inflation of low income households and the fact that the distributional conflict underlying the determination of fiscal policy is described as a bargaining game. I now provide a brief description of the economy and discuss the role of these features.

The economy builds on Lucas and Stokey's (1983) cash-credit good model. There are two types of households who differ in their exogenous endowment of human capital. I assume that larger human capital results in higher labor productivity[1]. Households supply labor and purchase consumption goods. They perform transactions either with previously accumulated currency or by using a

[1] Inequality in human capital is due to features of the economy, like access to public education, which I take to be exogenous.

costly payment technology, produced by a transaction services sector. Households trade-off the cost of transaction services against the foregone interest income associated with holding currency. Following Erosa and Ventura (2000), I assume that there are economies of scale in the costs of the alternative payment technology. This implies that low income households face a higher average cost of transaction services than those with high income. Accordingly, they hold more currency and are more vulnerable to inflation.

The assumption of economies of scale in the cost of acquiring transaction services implies that the model is consistent with cross-sectional evidence on household transaction patterns and with indirect evidence on the distributional consequences of inflation. Erosa and Ventura (2000) report that in the US low income households use cash for a greater fraction of their total purchases relative to high income households. Findings in Mulligan and Sala-i-Martin (2000) also support this notion. They estimate the probability of adopting financial technologies that hedge against inflation and find that is positively related to the level of household wealth and inversely related to the level of education. Easterly and Fischer (2000) use household polling data for 38 countries and find that the poor are more likely than the rich to mention inflation as a top national concern. This suggests that low income household perceive inflation as being more costly. They also find that the likelihood of citing inflation as a concern is inversely related to educational attainment.

I model the political process as a sequential bargaining game. There are two main reasons to prefer a bargaining model. First, a bargaining scheme is applicable to any situation in which government decisions emerge from the consensus between different constituencies. In addition, it is capable of capturing an important feature of most political systems, that minorities are able to exert significant pressure on the policy outcome. In the bargaining equilibrium I study, the political power of different groups of households is a function of their economic attributes. Specifically, the relative vulnerability to inflation of low income households implies that high income households have a greater weight in the political process. Extending the arguments in Coughlin and Nitzan (1981) and Persson and Tabellini (2000), one can show that models of electoral competition based on probabilistic voting and costly lobbying would yield similar predictions.

Alternative strategies have been used to formalize a distributional conflict ultimately resulting in high inflation. Alesina and Drazen (1991) study a war of a attrition between political groups over the timing of a fiscal reform. In the interim, public expenditures are financed with seignorage. The distribution of the burden of the reform is exogenous and asymmetric information on the costs of inflation for each group delays the reform. A bargaining framework has the advantage that the allocation of the fiscal burden is determined endogenously as a function of the distribution of economic characteristics in the population. Moreover, positive inflation occurs in equilibrium even with perfect information on the costs of inflation. Mondino, Sturzenegger and Tommasi (1996) consider a model in which identical pressure groups set government transfers financed with seignorage. A pressure group approach, however, is better suited to describe conflict over policies that target narrow segments of the population.

The plan of the paper is as follows. I document the correlation between inequality and inflation in Section 2. In Section 3, I describe the economic environment and illustrate the distributional consequences of inflation. In Section 4, I study the Ramsey equilibrium for this economy. This establishes a benchmark useful for understanding the properties of the environment and interpreting the results. Section 5 describes the bargaining equilibrium in detail and characterizes the sufficient conditions for inflation to be positively correlated with inequality. Section 6 concludes.

2. The Correlation between Inflation and Inequality

Figure 1 is a scatter plot of the average inflation tax, defined as $\pi/(1+\pi)$ where π is the percentage inflation rate, and the Gini coefficient[2] for a sample of 51 industrialized and developing countries, averaged over the time period from 1966 to 1990. Constraints from availability, quality and comparability of the data on inequality restrict sample size. A more detailed description of the data and the list of included countries is provided in the Data Appendix. Figure 1 shows a strong positive correlation between inequality and inflation. Figure 2 is a scatter plot of inflation on an alternative measure of inequality, $y40/y60$, given by the ratio of the average income per capita in the top 40% of the population to average income per capita in the bottom 60% of the population, computed based on the share of total income accruing to each quintile[3]. The same positive relation emerges.

[2] The Gini coefficient is a summary statistic for inequality derived from the Lorenz curve. It is defined as the ratio of the area between the Lorenz curve and the perfect equality line to the area between the perfect equality line and the perfect inequality line. The Lorenz curve plots the relation between the cumulative percentage of the population and the proportion of total income earned by each cumulative percentage.

[3] I choose this measure instead of the more common index of social distance, defined as the ratio of the percentage of total income accruing to the top 20% of the population to the percentage of total income accruing to the bottom 20% of the population, because I am interested in focussing on inequality between broader income categories. The measure I adopt and the social distance index are positively related, however, implying that inflation is also positively correlated to the index of social distance.

Figures 3 and 4 plot the inflation tax against the Gini coefficient for OECD[4] and developing countries, respectively. Again a positive correlation between inflation and inequality is present in both sub-samples.

I report some statistics on inflation and inequality for the sample in Table 1.A. The simple correlation between inflation and the Gini coefficient is 0.21 for the full sample, while the correlation between inflation and $y40/y60$ is 0.34[5]. A group of four countries, Morocco, Tunisia, Malaysia and Honduras, stand out for having low inflation but very high inequality. Excluding these countries from the sample increases the correlation between inflation and the Gini coefficient to 0.39.

I also compute OLS estimates of the linear relation between inflation and inequality. Findings are reported in Table 1.B for the inflation tax transformation, which reduces the extent to which extreme rates of inflation dominate the estimates and captures the non-linearity of the relation between inflation and inequality. The estimated slope coefficient is 0.4561 (the t-statistic[6] is 5.07 and the R-squared 0.425) for the full sample. This corresponds to a 2% rise in the inflation tax rate associated with a one standard deviation (7 points) increase in the Gini coefficient. The corresponding increase in the percentage inflation rate is given by $2 * (1 + \pi)$. The non-linearity of the relation between inflation and inequality can also be captured by splitting the sample between high and low inflation countries and using the rate of inflation as a dependent variable. An increase in inequality corresponding to a 7 point rise in the Gini coefficient corresponds to an increase in the average inflation rate of 45.8 percentage points for the full sample and of 7.84 percentage points for OECD countries[7].

I also evaluate the conditional correlation between inflation and inequality. I first condition on GDP per capita, which is an important indicator of the ability to collect revenues from direct taxation and presumably is negatively correlated with inflation. I find that the correlation between inflation and inequality after conditioning on GDP per capita is still strong and positive, as shown in figure 5 which plots the residuals from a regression of inflation on GDP per capita against residuals from regressing the Gini coefficient on GDP per capita. Institutional variables have been found to be important determinants of inflation. Edwards and Tabellini (1993) find a positive correlation between political instability and

[4] The sample of OECD countries comprises countries members of the OECD as of 1973. This excludes Mexico and the Republic of Korea which are included in the group of developing countries.

[5] The simple correlation between the Gini coefficient and $y40/y60$ is equal to 0.62.

[6] Standard errors are White-heteroskedasticity consistent.

[7] The slope of the regression of percentage inflation on the Gini coefficient is 6.55 (t-statistic 2.80) for the full sample. Results are similar with the alternative measure of income distribution. For OECD countries, the slope coefficient is 1.1285 (t-statistic 4.1438).

inflation and Cukierman (1992), among others, documents a negative correlation between inflation and central bank independence. In figures 6-8 I display the scatter plot if the residuals from regressing inflation and the Gini coefficient on political instability and central bank independence. The correlation between inequality and inflation is robust to conditioning on these institutional variables. For developing countries it increases substantially, together with the significance of the estimated coefficient on inequality.

These findings are consistent with previous studies of the relation between inequality and inflation. Beetsma (1992) presents evidence of a strong positive correlation between inequality and inflation for democratic countries. He finds that conditioning on measures of political instability and of the degree of political polarization, as well as on the level of government debt outstanding, increases the ability of differences in inequality to explain variations in inflation rates across countries. Al-Marhubi's (1997) also conditions on openness.

Romer and Romer (1998) find a strong positive relation between inflation and inequality, with quantitatively similar results obtained by regressing inequality on inflation. They also find that there is no significant relation between inflation and inequality in the short run over time for the US. Easterly and Fischer (2000) find that direct measures of improvement in the well-being of the poor and inflation are negatively correlated in pooled cross-country regressions. They also find that there is no significant relation between the change in inflation and measures of improvements in the well-being of low income households. They also present a novel set of empirical evidence on the redistributional impact of inflation. Using household level polling data for 38 countries, they find that the poor are more likely than the rich to mention inflation as a top national concern. The estimated probability of mentioning inflation as a top national concern by income categories is 0.36 for the "very poor", 0.31 for the "poor" and 0.28 for households "just getting by"[8]. It is substantially lower for high income categories, with an estimated probability of 0.15 for "comfortable" households and 0.03 for the "very comfortable". This suggests that low income households perceive inflation as being more costly.

3. An Economy with Costly Transactions and Income Inequality

In this section I develop a model economy that builds on Lucas and Stokey's (1983) cash-credit good model. Households consume a variety of differentiated goods, produced by a perfectly competitive firm sector, and supply labor. They are identical but for their endowment of human capital. Larger human capital

[8] Income categories are self-declared.

translates into higher labor productivity. Households can purchase consumption goods with previously accumulated currency or with a costly payment technology, as in the models of Prescott (1987), Cole and Stockman (1991), Dotsey and Ireland (1996), Lacker and Schreft (1996) and Freeman and Kydland (2000). A perfectly competitive financial sector provides the services required to use this alternative payment technology. I will refer to these as "transaction services". The cost of providing transaction services depends on the type of good and on the size of the purchase. Households trade-off the cost of transaction services against the foregone interest income associated with holding currency. At low levels of expected inflation households use cash for a relative large number of transactions, while at high levels of expected inflation little cash is used. As in Erosa and Ventura (2000), I assume that the average cost of transaction services is non-increasing in the level of total purchases. This implies that in equilibrium low human capital households will make a greater fraction of their purchases with cash. This property is consistent with the patters of transactions across households for the US reported in Avery et al. (1987) and Kennickell et al. (1987).

The government in this economy finances an exogenous stream of spending by printing money, issuing nominal debt and taxing labor income at a uniform proportional rate. In each period fiscal and monetary policy are determined first. Households then purchase credit services and the goods and labor markets operate. Finally, the assets market opens. In the asset market, households receive labor income and pay for purchases made with transaction services, they purchase or issue nominal risk-free bonds and accumulate currency. There is no uncertainty.

I now describe the problems faced by the agents in this economy in more detail.

3.1. Production Sector

A perfectly competitive industrial sector hires labor to produce a continuum of consumption goods $\{c(j)\}$ with $j \in [0,1]$ subject to a linear technology:

$$\int_0^1 c(j)\, dj \leq \bar{n},$$

where $\bar{n}$ is labor supplied to the industrial sector in efficiency units. By symmetry and perfect competition:

$$P(j) = P = W, \ j \in [0,1],$$

where $P(j)$ is the retail price of good j and W is the nominal wage rate per efficiency unit of labor.

A perfectly competitive financial sector hires labor to produce transaction services. The cost of producing transaction services in efficiency units of labor for good j is:

$$\theta(j) = \theta_0 \left(\frac{j - \underline{z}}{\bar{z} - j} \right)^{\theta_1}, \tag{3.1}$$

where $\theta_0, \theta_1 > 0$. Goods $j \in [0, \underline{z}]$ with $\underline{z} \in [0, 1)$ can be purchased with the alternative payment technology free of charge, while goods $j \in [\bar{z}, 1]$ with $\bar{z} \in (0, 1)$ cannot be purchased with the alternative payment technology. Perfect competition ensures:

$$q(j) = W\theta(j),$$

where $q(j)$ is the price charged for providing transaction services for the purchase of good j.

3.2. Households

There are two types of households of measure $0 < \nu_i < 1$, $i = 1, 2$, with $\nu_1 + \nu_2 = 1$. All households have identical preferences. Type i households have labor productivity, ξ_i, for $i = 1, 2$, with $\xi_2 > \xi_1$.

Preferences are defined over consumption goods and labor:

$$\sum_{t=0}^{\infty} \beta^t u^i(c_i, n_i),$$

$$u^i(c_i, n_i) = \frac{c_i^{1-\sigma} - 1}{1-\sigma} - \gamma n_i, \tag{3.2}$$

$$c_i = \left[\int_{j=0}^{1} c_i(j)^{\rho} \, dj \right]^{1/\rho}, \tag{3.3}$$

$$\rho \in (0, 1), \ \gamma > 0,$$

for $i = 1, 2$, where $c_{it}(j)$ denotes consumption of good j by type i and n_{it} labor supplied by type i at time t.

Households enter the period with M_{it} units of currency and B_{it} units of outstanding bonds. They can purchase goods with currency or with the alternative payment technology. They pay a dollar amount equal to $q_t(j)$ for each good j they elect to buy with the alternative payment technology. The assumption on the technology for the provision of transaction services and perfect competition in the financial sector ensure that $q_t(j)$ is increasing in j. This implies that households optimally adopt a cut-off rule, choosing to purchase goods $j \leq z_{it}$ with transaction services and goods $j > z_{it}$ with currency. Concavity implies that consumption levels will be the same for goods purchased with the same transaction technology. Consequently, the expression for the consumption aggregator in equilibrium is:

$$c_{it} = \left[(1 - z_{it})\, c_{i1t}^{\rho} + z_{it} c_{i2t}^{\rho}\right]^{1/\rho}, \tag{3.4}$$

where c_{i1t} denotes the level of consumption of goods purchased with cash and c_{i2t} the level of consumption of goods purchased with transaction services, for $i = 1, 2$[9].

Households face the constraint:

$$P_t c_{i1t} (1 - z_{it}) \leq M_{it}, \tag{3.5}$$

on the goods market. During the asset market session, households receive labor income net of taxes, clear consumption liabilities and trade one-period risk-free discount bonds issued by other households or by the government. The bonds entitle their holders to one unit of currency delivered in the following period's asset trading section. I assume that neither households or the government default on their debt. This implies that households are indifferent between holding privately and government issued bonds which both trade at the price Q_t. Total holdings of debt by agent i at the end of time t are denoted with B_{it+1} for $i = 1, 2$. Households face the following constraint on the asset market:

$$M_{it+1} + Q_t B_{it+1} \leq M_{it} + B_{it} - P_t (1 - z_{it}) c_{i1t} - P_t z_{it} c_{i2t} - \int_0^{z_{it}} q_t(j)\, dj + W_t (1 - \tau_t) \xi_i n_{it}, \tag{3.6}$$

for $i = 1, 2$, where n_{it} is total labor supply by type i. The following no-Ponzi game condition is also required for the households' intertemporal optimization problem to be well defined:

$$\left(Q_t^{-1} M_{it+1} + B_{it+1}\right) \Phi_{t+1} + \sum_{s=1}^{\infty} \Phi_{t+s} W_{t+s} (1 - \tau_{t+s}) \xi_i \geq 0, \tag{3.7}$$

where

$$\Phi_t = \prod_{t'=0}^{t-1} Q_{t'}, \; \Phi_0 = 1,$$

is the discount factor.

[9] In this set up, the cost of transaction services varies across consumption goods while the utility weight on each type of consumption good is constant so that all goods with the same price are consumed in equal amounts. An alternative specification in which the optimal level of consumption varies across goods but the cost of credit services is constant for all goods is equivalent under certain conditions and would not alter any of the findings.

3.3. Government

The government finances an exogenous stream of spending $\{\overline{g}_t\}_{t\geq 0}$ by taxing labor income at the rate $\tau_t \in [0,1]$, issuing debt, B_{t+1},and changing the money supply, M_{t+1}. The government is subject to the following dynamic budget constraint:

$$M_{t+1} + Q_t B_{t+1} + W_t n_t \tau_t = P_t \bar{g}_t + M_t + B_t, \tag{3.8}$$

where Q_t is the price of nominal bonds and n_t is aggregate labor supply in efficiency units given by:

$$n_t = \sum_{i=1,2} \nu_i \xi_i n_{it}.$$

3.4. Private Sector Equilibrium

The timing of events in each period is as follows:

1. Government policy is determined subject to (3.8).

2. Households come into the period with holdings of currency and debt given by M_{it} and B_{it}.

3. Households decide to purchase z_{it} goods on credit.

4. Households, firms and the government trade in the goods and labor markets. Household consumption purchases are subject to (3.5). Equilibrium on the goods market requires:

$$\sum_{i=1,2} \nu_i \left((1 - z_{it}) c_{i1t} + z_{it} c_{i2t} + C(z_{it}) - \xi_i n_{it} \right) + \bar{g}_t = 0, \tag{3.9}$$

   where $C(z) = \int_0^z \theta(j)\, dj$.

5. Asset markets open. Households purchase bonds and acquire currency to take into the following period subject to the constraint (3.6).

Definition 3.1. *A private sector equilibrium is given by a government policy* $\{\bar{g}_t, \tau_t, M_{t+1}, B_{t+1}\}_{t\geq 0}$, *a price system* $\{P_t, W_t, Q_t, q_t(j)\}_{t\geq 0, j\in[0,1]}$ *and an allocation* $\{c_{i1t}, c_{i2t}, n_{it}, z_{it}, M_{it+1}, B_{it+1}\}_{i=1,2,t\geq 0}$ *such that:*

1. *given the policy and the price system households and firms optimize;*

2. *government policy satisfies (3.8);*

3. *markets clear.*

The following proposition characterizes the competitive equilibrium.

Proposition 3.2. *A government policy* $\{\bar{g}_t, \tau_t, M_{t+1}, B_{t+1}\}_{t\geq 0}$ *, an allocation* $\{c_{i1t}, c_{i2t}, n_{it}, z_{it}, M_{it+1}, B_{it+1}\}_{i=1,2,t\geq 0}$ *, with* $n_{it} > 0$ *for* $i = 1, 2$ *and* $t \geq 0$*, and a price system* $\{P_t, W_t, Q_t, q_t(j)\}_{t\geq 0, j\in[0,1]}$ *constitute a private sector equilibrium if and only if the conditions (3.8), (3.9) and:*

$$W_t = P_t, \tag{3.10}$$

$$q_t(j) = W_t \theta(j) \;\; \text{for } j \in [0, 1], \tag{3.11}$$

$$Q_t = \beta \frac{P_t}{P_{t+1}} \frac{(1-\tau_t)}{(1-\tau_{t+1})}, \tag{3.12}$$

$$\sum_{i=1,2} \nu_i B_{it+1} = B_{t+1}, \;\; \sum_{i=1,2} \nu_i M_{it+1} = M_{t+1}, \tag{3.13}$$

$$\left(\frac{c_{i1t+1}}{c_{i2t+1}}\right)^{\rho-1} = R_{t+1} \equiv Q_t^{-1} \geq 1, \tag{3.14}$$

$$\frac{\xi_i u_{i2t}}{z_{it}} = \frac{\gamma}{(1-\tau_t)} \;\; \text{for } t \geq 0, \tag{3.15}$$

$$(R_{t+1} - 1)\left(P_{t+1} c_{i1t+1}(1 - z_{it+1}) - M_{it+1}\right) = 0,$$
$$P_{t+1} c_{i1t+1}(1 - z_{it+1}) \leq M_{it+1},$$

$$\left[\left(\frac{1}{\rho} - 1\right)\left(1 - R_t^{\frac{\rho}{\rho-1}}\right) - \frac{\theta(z_{it})}{c_{i2t}}\right] \begin{cases} \leq 0 \text{ for } z_{it} = \underline{z}, \\ = 0 \text{ for } z_{it} \in (\underline{z}, \bar{z}), \\ \geq 0 \text{ for } z_{it} = \bar{z}. \end{cases} \tag{3.16}$$

for $t \geq 0$*, and:*

$$c_{i10} = \min\left\{c_{i20}, \frac{M_{i0}}{P_0(1 - z_{i0})}\right\}, \tag{3.17}$$

$$\sum_{t=0}^{\infty} \beta^t \left[u_{i1t} c_{i1t} + u_{i2t} c_{i2t} + u_{i2t} C(z_{it}) - \gamma n_{it}\right] = \frac{u_{i10}}{(1 - z_{i0})} \frac{M_{i0}}{P_0} + \frac{u_{i20}}{z_{i0}} \frac{B_{i0}}{P_0}. \tag{3.18}$$

hold for $i = 1, 2$.

Equation (3.18) is the households' implementability constraint. It is given by the intertemporal budget constraint in which prices have been substituted using optimality conditions and it incorporates the transversality condition. The proof of this proposition is in Appendix A[10].

[10] A feature of this preference specification is that there are no wealth effects on the level and composition of consumption, which depend on relative prices only. Moreover, in the private

3.5. Distributional Impact of Inflation

Households choose the optimal payment structure by balancing the opportunity cost of holding currency and the cost of acquiring transaction services for the marginal good bought with currency. This trade-off is captured by equation (3.16). The gain from acquiring transaction services for the marginal good bought with currency is given by the increase in the level of consumption of that good due to the decrease in its relative price and the reduction in the foregone interest income associated with holding currency. This gain is increasing in the nominal interest rate and roughly proportional to the level of consumption. The cost of acquiring credit services for the marginal consumption good is decreasing in the level of consumption. Consequently, the per unit gain of adopting transaction services is greater for high human capital households and for a given level of the nominal interest rate they make a greater fraction of their purchases with the alternative payment technology[11]. Figure 9 illustrates this trade-off for high and low human capital households at a given interest rate.

To understand the redistributional implication of this feature of the transaction technology, it is useful to define a household specific consumption price index, $\tilde{P}_t^i$ for $i = 1, 2$. It is the total cost in efficiency units of labor of one unit of the consumption aggregator c_i, given by:

$$\tilde{P}_t^i = P_t^i + \frac{\int_{j=0}^{z_{it}} \theta(j)\, dj}{c_{it}}, \tag{3.19}$$

$$P_t^i = \left[(1 - z_{it}) (R_{t-1})^{\frac{\rho}{\rho-1}} + z_{it} \right]^{\frac{\rho-1}{\rho}}, \tag{3.20}$$

where z_{it} solves (3.16)[12].

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sector equilibrium only the aggregate level of employment and the present discounted value of total labor income for each type of household are pinned down. A higher endowment of initial assets for type i corresponds to lower equilibrium labor supply for type i, for $i = 1, 2$.

[11] Erosa and Ventura (2000) illustrate that this property holds for a large class of marginal costs that have been adopted in the literature on costly credit.

[12] This price index is derived from the solution of the following static optimization problem:

$$\max_{c_{i1}, c_{i2}, z_i} \left[(1 - z_i) c_{i1}^{\rho} + z_i c_{i2}^{\rho} \right]^{1/\rho} \text{ subject to}$$

$$w = R c_{i1} (1 - z_i) + c_{i2} z_i + C(z_i),$$

where w is an exogeous endowment of real wealth. Let:

$$c_i = \left[(1 - z_i) c_{i1}^{\rho} + z_i c_{i2}^{\rho} \right]^{1/\rho},$$

and denote the expenditure function with $e(R; \theta)$ and the value function with $v(R; w, \theta)$. Then, For a given level of inflation, $P_t^1 > P_t^2$, since $z_{2t} > z_{1t}$ by (3.16). Household optimization implies $\tilde{P}_t^i \leq R_{t-1}$ and $\tilde{P}_t^1 \geq \tilde{P}_t^2$, since high income households always have the option of choosing the same structure that is optimal for low income households. This implies that the "actual" net real wage in efficiency units is higher for high income households:

$$\frac{W_t (1-\tau_t)}{P_t} \frac{1}{\tilde{P}_t^2} > \frac{W_t (1-\tau_t)}{P_t} \frac{1}{\tilde{P}_t^1}. \tag{3.21}$$

So a positive nominal interest rate is equivalent to a higher net real wage in efficiency units for high human capital households relative to low human capital households, since the latter make a greater fraction of their purchases with the alternative payment technology.

4. The Ramsey Equilibrium

The Ramsey equilibrium is defined as the private sector equilibrium which maximizes the government's objective function, under the assumption that the government can pre-commit to policy announcements made at time 0. The government's objective function is given by

$$\sum_{i=1,2} \eta_i \sum_{t=0}^{\infty} \beta^t u^i (c_i, n_i), \tag{4.1}$$

where c_i is defined in (3.3) and η_i is the Pareto weight on type i agents, with $\eta_1 + \eta_2 = 1$. I assume that the Pareto weights are time-invariant. The case $\eta_i = \nu_i$ corresponds to a utilitarian government.

Definition 4.1. *A Ramsey equilibrium is given by an allocation, a price system and a government policy such that the allocation maximizes (4.1) and jointly with the price system and government policy it constitutes a private sector equilibrium.*

I characterize the Ramsey equilibrium as the solution to the "Ramsey allocation problem", described in detail in Appendix B. In this problem, the government

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the optimal value of c_i solves $c_i = v(R; w, \theta)$ and:

$$\tilde{P}^i = \frac{e(R; w, \theta)}{c_i}.$$

chooses an allocation at time 0 subject to the constraint that it be a private sector equilibrium. I assume $B_{i0} = 0$[13].

The government here confronts a trade-off between efficiency and redistribution. The Friedman rule is the efficiency maximizing policy. While labor income taxation and inflation both determine a reduction in equilibrium labor supply, inflation also causes an increase in the adoption of costly credit services and distorts the relative price of consumption goods. However, positive inflation amounts to a transfer in favor of high human capital households and the government has an incentive to set positive inflation when the Pareto weight on high human capital households is sufficiently high[14]. The terms of this trade-off depend on the interest elasticity of aggregate money demand, which determines the size of the deadweight loss associated with inflation, and on the degree of inequality. Larger inequality is associated with a greater relative vulnerability to inflation of low human capital households and a larger redistributional impact of inflation in favor of high human capital households. Since the government's objective function is linear in the households' welfare, an increase in the redistributional gain for high income households corresponds to a greater incentive to use inflation.

I first show that the Friedman rule is not necessarily optimal if the government favors high human capital households and the labor tax schedule is linear. The result holds for a general preference specification in which the consumption aggregator is homothetic. I then present numerical results to illustrate the quantitative properties of the Ramsey equilibrium.

4.1. Conditions for Optimality of the Friedman Rule

The first result links equilibrium inflation to the properties of the income tax schedule.

[13] The government's controls are given by $\{c_{i1t}, c_{i2t}, n_{it}, z_{it}\}_{i=1,2,t\geq 0}$ and P_0. The level of P_0 determines the real value of outstanding nominal wealth, defined as the sum of currency and debt, and thus defines the boundary of the households' intertemporal budget set. I restrict attention to the case in which $B_{i0} = 0$ to minimize the influence of the exogenous initial distribution of debt on the Ramsey equilibrium.

The Ramsey policy at time 0 is in general different from the Ramsey policy for $t > 0$ due to different elasticity of relevant tax bases. High values of P_0 amount to a tax on outstanding nominal wealth and on consumption of goods purchased with cash at time 0, which the government is constrained to tax at the same rate. The equilibrium value of the Lagrange multipliers on the implementability constraints depend on the distribution of debt and currency at time 0 as well as on productivity and the utility parameters. These aspects of the Ramsey problem are analyzed in detail in Albanesi (2000).

[14] The linearity of the labor income tax schedule makes labor income taxation redistributionally neutral.

Proposition 4.2. *If the government has access to individual specific labor income taxation, the Friedman rule is optimal.*

The proof is in Appendix B and is analogous to the one in Chari, Christiano and Kehoe (1996). It relies on the homotheticity and separability assumptions on preferences and on the interiority of the equilibrium. The proof of Proposition 4.2 encompasses the proof that the Friedman rule is optimal for the representative agent version of this economy[15]. Heterogeneity introduces the additional condition for the optimality of the Friedman rule, namely that the government can tax households' labor income at different rates based on their productivity[16]. Intuitively, under this assumption net real wages need not be equalized and constraint (3.15) drops out of the problem. Optimality then requires that the relative price of goods purchased with currency and with credit be equalized.

Let $\bar{\eta}_i$ denote the "neutral" Pareto weight. It is defined as the value of η_i for which the constraint that the net real wage be equal across agents is non-binding. Redistributional consideration have no first order effect on the optimal policy for this value of η_i. The following result holds.

Proposition 4.3. *Optimality of the Friedman rule requires* $\eta_1 \geq \bar{\eta}_1$.

The proof is in Appendix B.

The intuition for this result lies in equation (3.21). Since positive nominal interest rates redistribute in favor of type 2 (high human capital) households by raising their "effective" real wage, optimality of the Friedman rule requires the government to be redistributionally neutral or favorable to type 1 (low human capital) households. The proof of Proposition 4.3 nests a more general result. If the tax rate on labor can be different across households but is subject to the constraint:

$$\tau_2 \geq \tau_1, \tag{4.2}$$

[15] Optimality of the Friedman rule in the representative agent version of this economy obtains even though the income elasticity of money demand is below 1 at levels of the nominal interest rate that justify adoption of the costly credit technology. In Chari, Christiano and Kehoe (1996), the Friedman rule is not generally optimal in this case.

They consider an economy with exogenous payment structure and homothetic preferences over cash and credit goods in which the income elasticity of cash and credit goods is the same. In an environment with endogenous payment structure, despite homotheticity of the consumption aggregator, the income elasticity of cash good consumption is weakly greater than that of credit good consumption. This property implies that the Friedman rule is optimal.

[16] This is a version of the uniform taxation result shown by Atkinson and Stiglitz (1976). They show that access to a sufficiently flexible income tax schedule is enough to guarantee optimality of a uniform commodity tax if preferences are weakly separable in leisure and the other goods, even if the government is pursuing redistributional objectives.

optimality of the Friedman rule requires $\eta_1 \geq \bar{\eta}_1$, where τ_i is the tax rate applied to labor income generated by type $i = 1, 2$. In this case, the constraint on redistribution only binds if the government favors high human capital households. Based on these results, I conjecture that if the tax rate on labor is allowed to differ across households but still subject to less stringent constraints than (4.2), a version of Proposition 4.3 holds. I plan to verify this conjecture in future research.

4.2. Properties of Ramsey Policy

When the necessary conditions for optimality of the Friedman rule are not satisfied, the Ramsey equilibrium inflation rate depends on the properties of aggregate money demand, which determine the size of the deadweight loss associated with inflation, and on the degree of inequality[17].

I now study optimal inflation for a version of this economy calibrated to match features of money demand for the US in the post-war period. These features are reported in Table 2 and the corresponding parameter values are displayed in Table 3. The details of the calibration are illustrated in Appendix D. I set $\xi_1 = 1$ and $\nu = 0.60$ and vary ξ_2/ξ_1 to match the ratio of average income per capita accruing to the top 40% of the population to the average income per capita accruing to the bottom 60% in the model to the one in the data (denoted with $y40/y60$ in Section 2)[18].

The results are displayed in Table 4. Here the redistributionally neutral distribution of Pareto weight is $\bar{\eta}_1 = 0.60$ (and $\bar{\eta}_2 = 0.40$). If the government favors high human capital households, i.e. $\eta_1 < \bar{\eta}_1$, the Ramsey inflation rate is positive and it decreases with η_1, the Pareto weight on low human capital households. The same result holds for other parametrizations with a sufficiently low value of the interest elasticity of aggregate money demand.

To trace the relation between inequality and inflation, I compute the Ramsey

[17] For given inequality, the distributional content of inflation will be highest at intermediate levels of the nominal interest rate. At very low nominal interest rate neither type of household purchases credit services. For extremely high values of the interest rate, given that the marginal cost tends to infinity for z_i going to $\bar{z}$, the economies of scale property will have little impact on the incentive to adopt, though adoption will still be more costly for low income households.

[18] This strategy differs from the one adopted by Erosa and Ventura (2000). They use data from the US Bureau of the Census to devide the population in two groups according to education levels and compute the mean labor earnings for each group and the average fraction of the population that belongs to each group. In their calculations the low income group makes up 69% of the population and the ratio of the average income of high income group to the low income group for the US is 1.837. Their strategy is not applicable for the cross-country comparison I am interested in, due to scarsity of accurate and comparable data on education.

equilibrium inflation for increasing values of ξ_2 keeping the value of ξ_1 fixed[19]. I choose a value of the Pareto weight for which inflation is positive in equilibrium for a low value of ξ_2 and I adjust government spending so that it is constant as a fraction total employment. I find that equilibrium inflation increases with ξ_2, since larger inequality reinforces the distributional effect of inflation in favor of high human capital households.

To gauge robustness, I perturb the parameters which determine the redistributional impact and the aggregate costs of inflation. Results are displayed in Table 5.

I first vary the marginal cost of acquiring credit services. For the benchmark specification of $\theta(\cdot)$, the parameter θ_0 determines the level of the marginal cost and has the greatest impact on both the price index $\tilde{P}^i$ and the aggregate cost of inflation[20]. I compute the Ramsey equilibrium at $\eta_1 = 0.40$ for different values of θ_0. I find that equilibrium inflation varies inversely with θ_0. Reducing θ_0 by 50% causes the equilibrium nominal interest rate to rise to 60% from 15%, doubling θ_0 causes the nominal interest rate to fall to 8% in equilibrium[21].

I then explore the sensitivity of the results to ρ. A lower value of ρ leads to a lower elasticity of substitution between consumption goods. This induces households to purchase credit services for a greater fraction of goods and decreases the ratio $\tilde{P}^2/\tilde{P}^1$ for a given interest rate due to the scale economies in the costs of credit services. Consequently, the redistributional effect of inflation in favor of

[19] Other experiments determine an increase in inequality. One experiment corresponds to keeping both ξ_1 and ξ_2 fixed and increasing the percentage of low productivity households in the population, namely ν_1. In this case, the redistributional impact of inflation is held constant but the aggregate interest elasticity of money demand falls as a function of the increased value of ν_1. The second alternative experiment is a decrease in the value of ξ_1 for constant ξ_2 and ν_1. This experiment corresponds to an increase in the relative vulnerability to inflation of low productivity households. It would also determine a fall in the interest elasticity of aggregate money demand, thus reducing the deadweight loss associated with inflation. Only the second experiment, and the one illustrated in the paper, can be mapped into the available data on income quintiles. I conjecture that with this alternative experiment the same qualitative results would obtain.

[20] The parameter θ_1 determines the rate of increase of this cost as a function of j

[21] I also analyze alternative specification of the transaction technology, of the form:

$$v(c, j) = c\theta(j) + \kappa,$$

where $\theta(\cdot)$ is defined in (3.1) and c is the level of consumption of the goods purchased with credit. The fixed cost preserves the economies of scale property, but the presence of variable costs decreases the difference between the relative price of cash and credit goods when the transaction technology is adopted. However, since this specification shares with the benchmark the property that at a low interest rates the elasticity of money demand is very low, the results are qualitatively unchanged.

high income households is stronger. I consider values of ρ between 0.15 and 0.75. Findings for $\eta_1 = 0.40$ are in Table 5, where I also report the interest elasticity of money demand at $R = 1.08$. Equilibrium inflation varies inversely with ρ, starting at 15% for $\rho = 0.15$ and falling to 0 for ρ greater than 0.55. Since the interest elasticity of aggregate money demand is not very sensitive to ρ, the variation in Ramsey inflation is due to the different redistributional effect of inflation for different values of ρ.

5. The Bargaining Equilibrium

In this section, I analyze an explicit model of the political process. I assume that inflation and the tax rate on labor are the outcome of a sequential Nash bargaining game between households, following Bassetto (1999).

Government policy is determined according to the following mechanism. In each period representatives are selected at random from each type of household and bargain on government policy for the subsequent period. The bargaining takes place before households make any relevant economic decisions for the subsequent period, including currency accumulation decisions. Agreement requires unanimity. A proposal made by one representative must be accepted by the other. If the negotiating parties cannot reach an agreement, no taxes can be raised in the subsequent period and the government must resort to the inflation tax to finance spending. This choice of threat point reflects the idea that the inflation tax is easy to implement, since it doesn't require parliamentary approval and it is always feasible -the government can always run the printing press. For simplicity, I assume that the government faces a balanced budget constraint[22], so that nominal debt is in zero net-supply. I concentrate on stationary Markov equilibria of this game in which the policy proposals and their acceptance do not depend on the past history of implemented, proposed or accepted policies. This implies that failure to agree in any period does not influence the equilibrium policies in future periods.

I now proceed to illustrate the equilibrium concept in more detail and characterize the equilibrium outcome.

[22] I interpret currency as a nominal liability for the government. Since I study a closed economy, foreign debt is excluded. I also assume that the government cannot confiscate goods from the households

5.1. Characterization

In this section, I provide an operational definition of a Nash bargaining equilibrium for this environment, building on the stationarity properties of the underlying economy. To do this, I first characterize the private sector equilibrium exploiting these properties.

Proposition 5.1. *Let $B_{iT-1} = 0$ for $i = 1, 2$ and let government policy be given by $\{\tau_t, R_t\}$ for $t \geq T - 1$. Then, household optimization implies that for any t, $\{c_{i1t}, c_{i2t}, z_{it}, n_t\}$ with $n_t = \sum_i \nu_i \xi_i n_{it}$ for $i = 1, 2$ only depends on $\{\tau_t, R_t\}$. Moreover, if $B_t = 0$ for all t then in equilibrium:*

$$B_{it} = 0 \text{ for } t \geq T, \tag{5.1}$$

and $n_{it} = n_i(\tau_t, \tau_{t+1})$, with:

$$n_i(\tau, R; \tau', R') = \frac{\beta}{\gamma} u'_{i1} c'_{i1} + \frac{u_{i2}}{\gamma}\left(c_{i2} + \frac{C(z_i)}{z_i}\right), \tag{5.2}$$

where a prime denotes a realization of the variable corresponding to the policy $\{\tau', R'\}$.

The proof is in Appendix C. Condition (5.1) obtains from the constraint that nominal debt is in zero net supply and the constant marginal utility of labor, which implies that the pattern of debt issuance by each type of household only depends on the real rate of interest in equilibrium.

Representatives bargain over policy for time T at time $T - 1$ taking government policy for $T - 1$ and for $t > T$ as given[23] and the outcome of the bargaining game for the determination of fiscal policy at T is realized at time $T - 1$ before households make any economic decisions relevant for time T. To define the bargaining problem, it is helpful to characterize the determination the equilibrium interest rate for known sequences of tax rates of the type $\{\tau, \tau', \tau, ...\}$.

Proposition 5.2. *Let $B_{iT-1} = 0$ for $i = 1, 2$ and let government policy be given by $\{\tau, R\}$ for $t \neq T$ and $\{\tau', R'\}$ for $t = T$ and let $\bar{g}_t = \bar{g}$ for all $t \geq T - 1$. Then, $R' = \mathcal{R}(\tau', \tau, \bar{g})$ and $R = \mathcal{R}(\tau, \tau, \bar{g})$where $\mathcal{R}(\tau', \tau, \bar{g})$ is implicitly defined by:*

$$\begin{aligned} & \bar{g} + \sum_i \nu_i \left[c'_{i1}(1 - z'_i)\left(1 - \frac{\beta}{\gamma}\tilde{u}'_{i1}\right) + \left(c'_{i2} z'_i + C(z'_i)\right)\left(1 - \frac{\tilde{u}_{i2}}{\gamma}\right)\right] \\ = & \sum_i \nu_i \xi_i \left(c_{i1}\frac{\beta}{\gamma}u_{i1} - c'_{i1}\frac{\beta}{\gamma}u'_{i1}\right), \end{aligned} \tag{5.3}$$

[23] I assume that the policy at time 0 is exogenously given. Propositions 5.1 and 5.2 guarantee that the policy chosen for $t = 0$ doesn't influence the bargaining equilibrium for $t > 0$.

with $\tilde{u}_{i1} = u_{i1}/(1-z_i)$, $\tilde{u}_{i2} = u_{i2}/z_i$ *and prime denotes a realization of the variable corresponding to the policy* $\{\tau', R'\}$.

Propositions 5.1 and 5.2 show that the private sector equilibrium consumption allocation in any period depends on the realized policy, given by the tax rate on labor and the nominal interest rate, for that period only. Equilibrium labor supply in any period depends on the policy in the current period and on the expected policy for the subsequent period. The equilibrium property that $B_{it+1} = 0$ for $i = 1, 2$ and all $t \geq T$ if $B_{iT-1} = 0$ and the assumption that economic policy is chosen one period ahead of its implementation imply that there are no state variables for the bargaining problem.

To provide a formal definition of the bargaining equilibrium, it is also useful to define a temporary private sector equilibrium, given by the allocations and prices arising in any time period for sequences of constant government policies.

Definition 5.3. *A temporary private sector equilibrium corresponding to the government policy* $\{\tau_t, \bar{g}_t\}$ *with* $\tau_t = \tau$ *and* $\bar{g}_t = \bar{g}$ *for* $t > 0$ *is given by an allocation* $\{c_{i1}, c_{i2}, z_i, n_i\}_{i=1,2}$ *and a sequence of interest rates* $\{R_t\}$ *such that* $R = \mathcal{R}(\tau, \tau, \bar{g})$, *at* $\{\tau, R\}$ *households optimize and* $n_i = n_i(\tau, R; \tau, R)$.

The consumption allocation arising in a temporary private sector equilibrium are characterized in Appendix C.

I now derive the objective function for the Nash bargaining problem. Representatives bargaining in period $T-1$ over the policy for period T contemplate various tax rates τ' for a given value of the current tax rate and of the expected tax rate for $t > T$, given by τ.

Based on propositions 5.1 and 5.2, the components of the value function of type i household for $i = 1, 2$ affected by $\{\tau', R'\}$ is given by[24]:

$$\mathcal{P}^i(\tau', R') = \beta \left[\frac{(c_i')^{1-\sigma} - 1}{1-\sigma} - u_{i1}' c_{i1}' - u_{i2}' \left(c_{i2}' + \frac{C(z_i')}{z_i'} \right) \right]. \tag{5.4}$$

[24] This expression obtains from considering the components of equilibrium labor supply that vary with $\{\tau', R'\}$ only. These correspond to $\frac{\beta}{\gamma} u_{i1}' c_{i1}'$ for time $T-1$ and $\frac{u_{i2}'}{\gamma}\left(c_{i2}' + \frac{C(z_i')}{z_i'}\right)$ for time T from $n_i(\cdot)$. This implies that:

$$\mathcal{P}^i(\tau', R') = -\gamma \left(\frac{\beta}{\gamma} u_{i1}' c_{i1}' \right) + \beta \left(\frac{(c_i')^{1-\sigma} - 1}{1-\sigma} - \gamma \frac{u_{i2}'}{\gamma} \left(c_{i2}' + \frac{C(z_i')}{z_i'} \right) \right)$$

which simplified yields (5.4).

The bargaining problem is defined by:

$$\begin{aligned} \mathcal{N}(\tau, R, \bar{g}, \xi_1, \xi_2; p) &= \arg\max_{\tau', R'} \mathcal{V}_1^p \mathcal{V}_2 \text{ subject to} \\ \tau' &\geq 0,\ R' = \mathcal{R}\left(\tau', \tau, \bar{g}\right) \geq 1, \end{aligned} \tag{5.5}$$

where:

$$\begin{aligned} \mathcal{V}_i &\equiv \mathcal{V}_i(\tau', R', \tau^T, R^T, \bar{g}) \\ &= \max\left\{0, \mathcal{P}^i\left(\tau', R'\right) - \mathcal{P}^i\left(\tau^T, R^T\right)\right\}. \end{aligned}$$

for $i = 1, 2$.

The policy $\left\{\tau^T, \bar{g}\right\}$ with corresponding interest rate $R^T = \mathcal{R}\left(\tau^T, \tau, \bar{g}\right)$ defines the "threat point". It is implemented if the representatives fail to reach an agreement. The value of τ^T is the lowest non-negative value of the tax rate on labor for which a temporary private sector equilibrium exists.

Definition 5.4. *A stationary Nash Bargaining equilibrium is given by a government policy* $\{\tau, R, \bar{g}\}$ *and a temporary private sector equilibrium corresponding to this policy such that* $\{\tau, R\} = \mathcal{N}(\tau, R, \bar{g}, \xi_1, \xi_2; p)$ *and* $R = \mathcal{R}(\tau, \tau, \bar{g})$.

The Nash bargaining equilibrium can be characterized by evaluating the first order necessary condition for the Nash bargaining problem, given by:

$$p\left[\frac{\mathcal{V}(\tau, \tau^T, \bar{g}; \xi_2)}{\mathcal{V}(\tau, \tau^T, \bar{g}; \xi_1)}\right] \frac{d\mathcal{P}^1(\tau, R)}{d\tau} + \frac{d\mathcal{P}^2(\tau, R)}{d\tau} = 0, \tag{5.6}$$

at $\mathcal{R}(\tau, \tau, \bar{g})$and solving for τ. The term $\frac{d\mathcal{P}^i}{d\tau}$ is the total derivative type i's equilibrium value function with respect to τ. It includes the effect of changes in the equilibrium value of R as a function of τ as determined by $\mathcal{R}(\tau, \tau, \bar{g})$.

If policy were chosen to maximizes type i's utility only, the term $\frac{d\mathcal{P}^i}{d\tau}$ would be set to 0. Loosely speaking this term can be taken to represent type i's preferences over policy. A higher weight on $\frac{d\mathcal{P}^i}{d\tau}$ corresponds to a bargaining outcome closer to the one preferred by type 1 agents. Two factors affect this weight: type 1 agents' exogenous bargaining weight, p, and the term in square brackets, which represents how much type 2 households stand to loose in case of non-agreement relative to type 1 households. I set $p = 1$ and focus on symmetric bargaining equilibria[25].

[25] A natural alternative is to set $p = \nu_1/\nu_2$ so that the bargaining power of type 1 households reflects their relative size in the population.

If $\xi_2 > \xi_1$, type 2 households face a lower average costs of adopting transaction services due to their higher equilibrium consumption level. This implies that they stand to loose less in case an agreement over tax policy is not reached, if the equilibrium nominal interest rate varies inversely with the tax rate on labor. Therefore, the term in square brackets is smaller than 1 for the bargaining problem in (5.5) and the bargaining outcome will be closer to the policy preferred by high income households. Since they are better able to elude the inflation tax, a relatively low tax rate and positive inflation will result in equilibrium. Larger inequality in human capital across households corresponding to a higher value of ξ_2/ξ_1 reduces the value of agreement for high human capital households relative to low human capital households. It follows that inequality and equilibrium inflation are positively related.

I formalize this reasoning in the following proposition which characterizes the sufficient conditions for the bargaining equilibrium inflation rate to be positively correlated with inequality. To show the result I assume that a certain policy solves the bargaining problem for a given level of inequality - a given value of ξ_2/ξ_1 - and prove that the same policy cannot be a solution to the bargaining problem for an economy with higher inequality, corresponding to a higher value of ξ_2/ξ_1[26]. I show that the tax rate that solves the bargaining problem is lower and, consequently, that the equilibrium interest rate is higher in the economy with higher inequality.

Proposition 5.5. *Assume that* $\mathcal{R}_1(\tau,\tau,\bar{g}) \leq 0$ *in any temporary private sector equilibrium. Let* $\{\tau, R\} = \mathcal{N}(\tau, R, \bar{g}, \xi_1, \xi_2; p)$ *with* $R = \mathcal{R}(\tau,\tau,\bar{g})$ *and* $\left\{\hat{\tau}, \hat{R}\right\} = \mathcal{N}(\hat{\tau}, \hat{R}, \bar{g}', \xi_1, \xi_2'; p)$ *with* $\hat{R} = \mathcal{R}\left(\hat{\tau},\hat{\tau},\widehat{g}\right)$ *for* $\hat{\xi}_2 > \xi_2$, $\hat{\xi}_1 = \xi_1$ *and* $\widehat{g}$ *satisfying:*

$$\mathcal{R}\left(\tau,\tau,\widehat{g}\right)\big|_{\hat{\xi}_2} = R, \tag{5.7}$$

Then, if:

$$\frac{\partial \mathcal{P}^1(\tau,R)}{\partial \tau} \leq 0 \text{ and } \frac{\partial \mathcal{P}^2(\tau,R)}{\partial \tau} \geq 0, \tag{5.8}$$

$$\left.\frac{\partial \mathcal{P}^2(\tau,R)}{\partial \tau}\right|_{\hat{\xi}_2} \geq \left.\frac{\partial \mathcal{P}^2(\tau,R)}{\partial \tau}\right|_{\xi_2} \tag{5.9}$$

$\hat{\tau} \leq \tau$ *and* $\hat{R} \geq R$.

The proof is in Appendix C. The assumption $\mathcal{R}_1(\tau,\tau,\bar{g}) \leq 0$ ensures that in equilibrium the government is operating on the left side of the Laffer curve for

[26] I prove the theorem by assuming that an increase in inequality corresponds to an increase in ξ_2 for a given ξ_1. The proof also holds for a decrease in ξ_1 for a given ξ_2.

both the labor tax and the inflation tax. To see this, consider that a lower tax rate decreases the government's fiscal revenues and increases the equilibrium level of consumption for both types of households for a given interest rate, inducing them to choose a higher value of z_i and cut their holdings of currency. If $\mathcal{R}_1(\tau, \tau, \bar{g}) \leq 0$ holds, a decrease in the labor tax rate corresponds to a fall in fiscal revenues and an increase in the nominal interest rate corresponds to a rise in inflation tax revenues in equilibrium.

Condition (5.7) ensures that the policy which solves the Nash bargaining problem for the economy with low inequality is still feasible for the economy with higher inequality and therefore qualifies as a candidate solution to the bargaining problem for this economy. Condition (5.8) states that households of different type have conflicting views over fiscal policy. Low human capital households would prefer an increase in the tax rate from the current level, while the converse is true for high human capital households. Condition (5.9) ensures that high human capital households in the economy with increased inequality do not prefer a higher tax rate relative to high human capital households in the initial economy. This is true if τ is sufficiently high, in other words if τ is sufficiently greater than the tax rate which characterizes the threat point.

Under these conditions, due to the conflict between households of different types, a weakening of the bargaining position of low income households results in an equilibrium policy which is closer to the one preferred by high income households. Increased inequality generates such a weakening, resulting in lower taxes and higher inflation in equilibrium[27].

These conditions are all verified at parametrizations close to the one considered in Section 4.2. Since these conditions are sufficient, the positive correlation between equilibrium inflation and inequality in the bargaining equilibrium holds for a larger class of economies than that identified by Proposition 5.5.

5.2. Quantitative Properties

To evaluate whether the correlation between inflation and inequality predicted by this model is quantitatively significant, I analyze the bargaining equilibrium for a plausibly parametrized version of the economy.

The restriction that the government cannot issue debt places a constraint on policy which restricts the set of parametrizations that can be considered relative

[27]The same results would follow in an model in which the households bargaing over the tax rate on labor and the level of spending on a public good which additively enters their utility function. In this case, the threat point would involve inability to provide the public good and collect labor income taxes.

to the Ramsey equilibrium. In particular, existence of a temporary private sector equilibrium at the threat point policy requires real money balances to be bounded away from 0. To ensure this, I set $\bar{z}$ below 1 and reduce the degree substitutability between consumption goods. I display the parametrization is Table 6, accompanied by information on the properties of money demand at an interest rate of 6%[28].

I set $\xi_1 = 1$ and compute the bargaining equilibrium for increasing values of ξ_2. I adjust the level of government spending to the productivity differentials in a way that guarantees that the bargaining equilibrium policy for lower values of ξ_2 is still feasible at higher values of ξ_2. In general, the resulting value of $\bar{g}$ is approximately constant as a fraction of total output for all values of ξ_2 considered. Even with this strategy for setting $\bar{g}$, the threat-point policy is not guaranteed to be the same as ξ_2 varies. Typically, at higher values of ξ_2 the interest elasticity of aggregate money demand is higher, so that for the same tax rate higher equilibrium inflation results. I set τ^T as the lowest positive tax rate for which a private sector equilibrium exists; R^T is determined from $\mathcal{R}\left(\tau^T, \tau^T, \bar{g}\right)$.

The results for the benchmark parametrization are presented in Table 6. Larger inequality corresponds to higher inflation and the relation between inequality and inflation is non-linear. Increasing productivity differentials from 1.8 to 2.1 (which corresponds to a 25% increase in $y40/y60$) generates a rise in the inflation rate of 0.4%. An increase in productivity differentials from 2.1 to 4 (which corresponds to a twofold increase in the equilibrium value of $y40/y60$) causes a 3% rise in the equilibrium inflation rate. The weaker bargaining position of type 1 agents can be seen from the value of agreement in equilibrium. For low human capital households it is approximately 3 times greater than for high human capital households.

Table 7 reports results for the same parametrization with $\theta_0 = 0.0421$, double the value in the previous exercise. A higher value of θ_0 reinforces the effect of scale in reducing the cost of transaction services and increases the relative vulnerability to inflation of low human capital households. This effect should strengthen the correlation between inequality and inflation predicted by the model. A higher value of θ_0 also corresponds to a smaller interest elasticity of aggregate money demand. This causes the inflation tax base to be larger and generally produces a smaller value of the inflation rate at the threat point. A lower threat point inflation rate increases the relative bargaining power of low income households and partially offsets the increase in the redistributional effects of inflation stemming from the higher fixed cost of transaction services. The results reported in Table

[28] Government spending is set to equal approximately 30% of total output in equilibrium for the purpose of these experiments.

7 show that the equilibrium inflation rate is consequently more responsive to an increase in ξ_2/ξ_1 relative to Table 6, which is consistent with a greater redistributional impact of inflation. For an increase in ξ_2 from 2.1 to 4, the equilibrium inflation rate reaches 34% from 12%; a further increase in ξ_2 to 4.8 causes inflation to rise to 44%. However, comparison of the equilibrium rate of inflation for the same degree of inequality across Table 6 and Table 7 shows that the effect of a smaller value of threat point inflation is dominant for low levels of inequality, giving rise to lower equilibrium inflation rates.

6. Concluding Remarks

This paper is motivated by the strong positive cross-country correlation between average inflation and measures of income inequality. I explore the hypothesis that the correlation between inflation and income inequality is the outcome of a distributional conflict underlying the determination of fiscal policy. I study an economy in which inequality in income ultimately stems from exogenous differences in human capital and in which money is held for transaction purchases. The fixed cost associated with the adoption of alternative payment technologies results in low income households holding more cash as a fraction of their total purchases, consistent with cross-sectional household data on transaction patterns. This implies that in equilibrium low income households are more vulnerable to inflation. In each period, households bargain over how to finance an exogenous level of government consumption. The government can raise revenues by taxing labor income or by issuing money which leads to inflation. If there is no agreement, the government is unable to levy taxes and must resort to inflation. Low income households have a weaker bargaining position resulting from their greater vulnerability to inflation. Moreover, greater differences in income between low and high income households increase the relative vulnerability to inflation of low income households. I show that this implies that inflation is positive in equilibrium and larger inequality corresponds to higher equilibrium inflation. The same result obtains in the Ramsey equilibrium when high human capital households are weighted more heavily in the social welfare function.

The scope of the analysis is restricted by the fact that the redistributional effect of inflation is based on heterogeneity in holdings of currency for transactions only. Moreover, the menu of redistributional policy instruments is limited. However, it is interesting to evaluate whether this mechanism is quantitatively significant and how much of the correlation between inequality and inflation in the data it can account for. To do this, I compare the slope of the relation between equality and inflation predicted by the model with the one in the data. Results are reported in Table 8. For the parametrization used for Tables 4 and 6, the model predicts a slope of 1.19 in the Ramsey equilibrium and of 0.76 in the bargaining equilibrium. For the bargaining equilibrium in Table 7, corresponding to a greater redistributional impact of inflation, the slope is 4.97. For the available data (excluding countries with average inflation above 60% per annum) the slope coefficient of a regression of inflation on $y40/y60$ is 6.56. Therefore, the mechanism incorporated in this model is able to account for $11-75\%$ of the correlation between inequality and inflation in the data, depending on the size of the costs of transaction services. The relation between inflation and inequality is non-linear in the sample, with a higher slope of the relation at higher inequality. The model also accounts for this effect, as shown in Table 8. In figure 10, I plot the linear relation predicted by the Ramsey and by the bargaining equilibrium[29] against a scatter plot of the data. For the bargaining equilibrium I report the relation for the parametrization with a small and large cost of transaction services, which is characterized by a greater slope. The slope of the relation between inflation and inequality predicted by the model encompasses the one in the data.

[29] The intercept is backed out from the data for this exercise.

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7. Appendix A: Proof of Proposition 3.2

Assume that an allocation $\{c_{i1t}, c_{i2t}, n_{it}, z_{it}, M_{it+1}, B_{it+1}\}_{i=1,2,t\geq 0}$, with $n_{it} > 0$ for $i = 1, 2$ and $t \geq 0$, and a price system $\{P_t, W_t, Q_t, q_t(j)\}_{t\geq 0, j\in[0,1]}$ constitute a private sector equilibrium for a given policy $\{\bar{g}_t, \tau_t, M_{t+1}, B_{t+1}\}_{t\geq 0}$. Then, conditions (3.10) and (3.11) derive from optimality of firm behavior, conditions (3.9) and (3.13) from clearing in the goods and assets markets. The other conditions follow from household optimization.

The Lagrangian for the household problem is given by:

$$\begin{aligned} L &= \sum_{t=0}^{\infty} \beta^t \{u^i(c_{it}, n_{it}) - \mu_{it}(P_t c_{i1t}(1 - z_{it}) - M_{it}) - \lambda_{it}[M_{it+1} + Q_t B_{it+1} \\ &\quad -M_{it} - B_{it} - W_t(1 - \tau_t)\xi_i n_{it} + P_t c_{i1t}(1 - z_{it}) + P_t c_{i2t} z_{it} + \int_0^{z_{it}} q_t(j)\, dj\Big]\Big\}, \end{aligned}$$

where c_{it} is defined in (3.4) and μ_{it}, λ_{it} are the multipliers on the cash in advance constraint and the wealth evolution equation, respectively. Denote with u_{ijt} and u_{int} the marginal utility of good j and of labor for households $i = 1, 2$.

The necessary conditions for household optimization are given by:

$$u_{i1t} = P_t(\mu_{it} + \lambda_{it})(1 - z_{it}), \tag{7.1}$$

$$\mu_{it}(P_t c_{it}(1 - z_{it}) - M_{it}) = 0,\ \mu_{it} \geq 0, \tag{7.2}$$

$$u_{i2t} = P_t \lambda_{it} z_{it}, \tag{7.3}$$

$$-u_{int} = W_t(1 - \tau_t)\xi_i \lambda_{it}, \tag{7.4}$$

$$P_t c_{i1t}(\mu_{it} + \lambda_{it}) - P_t c_{i2t}\lambda_{it} - q_t(z_{it})\lambda_{it} \begin{cases} < 0 \text{ for } z_{it} = \underline{z}, \\ = 0 \text{ for } z_{it} \in (\underline{z}, \bar{z}), \\ > 0 \text{ for } z_{it} = \bar{z}, \end{cases} \tag{7.5}$$

$$\lambda_{it} = \beta\left(\lambda_{it+1} + \mu_{it+1}\right), \tag{7.6}$$

$$\lambda_{it} Q_t = \beta \lambda_{it+1}, \tag{7.7}$$

$$\lim_{T\to\infty} \beta^T \lambda_{iT} M_{iT} = 0,\ \lim_{T\to\infty} \beta^T \lambda_{iT} B_{iT} = 0, \tag{7.8}$$

as well as (3.5) and (3.6). To see that (7.8) is a necessary condition for household optimization, suppose it does not hold and

$$\lim_{T\to\infty} \beta^T \lambda_{iT} M_{iT} > 0,\ \lim_{T\to\infty} \beta^T \lambda_{iT} B_{iT} > 0.$$

(The strictly smaller case is rule out by (3.7).) Then, it is possible to construct a consumption sequence such that the budget constraint is satisfied in each period and utility for each type of household is greater, violating optimality.

Combining (7.1)-(7.3) yields (3.14), while (7.3) and (7.4) determine (3.15). The expression in (3.12) follows from (7.4) and $u_{int} = \gamma$, (7.7) and (3.10), while (3.17) follows from (7.1)-(7.3) at $t = 0$. To derive (3.18), multiply (3.6) by λ_{it} and apply (7.2) and (7.6). This yields:

$$\begin{aligned} 0 &= (\lambda_{it} + \mu_{it}) M_{it} + \lambda_{it} B_{it} + W_t (1 - \tau_t) \xi_i \lambda_{it} n_{it} - P_t c_{i1t} (\mu_{it} + \lambda_{it}) (1 - z_{it}) \\ & -P_t c_{i2t} z_{it} \lambda_{it} - \lambda_{it} \int_0^z q_t(j)\, dj - \beta \left(\lambda_{it+1} + \mu_{it+1}\right) M_{it+1} - \beta \lambda_{it+1} B_{it+1}. \end{aligned}$$

Now use (7.1), (7.3)-(7.5), multiply by β^t and sum over t from 0 to T. Let T go to infinity and apply (7.8).

Now assume that an allocation $\{c_{i1t}, c_{i2t}, n_{it}, z_{it}, M_{it+1}, B_{it+1}\}_{i=1,2,t\geq 0}$, with $n_{it} > 0$ for $i = 1, 2$ and $t \geq 0$, and a price system $\{P_t, W_t, Q_t, q_t(j)\}_{t\geq 0, j\in[0,1]}$ satisfy (3.10)-(3.18) and (3.9) for a given policy $\{\bar{g}_t, \tau_t, M_{t+1}, B_{t+1}\}_{t\geq 0}$ for which (3.8) holds. Then, by (3.10) and (3.11) industrial and credit services firms optimize.

To see that household optimization conditions are satisfied consider an alternative candidate plan $\{c'_{i1t}, c'_{i2t}, n'_{it}, z'_{it}\}_{i=1,2,t\geq 0}$ which satisfies the intertemporal budget constraint for the price system $\{P_t, W_t, Q_t, q_t(j)\}_{t\geq 0, j\in[0,1]}$. This implies that:

$$\Delta \equiv \lim_{T\to\infty} \beta^t \left\{u_{i1t}\left(c_{i1t} - c'_{i1t}\right) + u_{i2t}\left(c_{i2t} + C(z_{it}) - c'_{i2t} - C\left(z'_{it}\right)\right) - \gamma\left(n_{it} - n'_{it}\right)\right\} \geq 0,$$

using (3.12) and the fact that $\{c_{i1t}, c_{i2t}, n_{it}, z_{it}\}_{i=1,2,t\geq 0}$ satisfies (3.14)-(3.18) and that the intertemporal budget constraint holds as a weak inequality using (3.7) and (3.6) for the price system $\{P_t, W_t, Q_t, q_t(j)\}_{t\geq 0, j\in[0,1]}$. By concavity of u^i :

$$D \equiv \lim_{T\to\infty} \sum_{t=0}^{T} \beta^t \left(u^i(c_{it}, n_{it}) - u^i\left(c'_{it}, n'_{it}\right)\right) \geq \Delta,$$

where c'_{it} is defined by (3.4). This establishes the result since (3.13) and (3.9) guarantee market clearing.

8. Appendix B: Proof of Propositions 4.2 and 4.3

For the purpose of characterizing the Ramsey equilibrium, it is useful to redefine household utility as follows:

$$U^i\left(h^i(c_{i1}, c_{i2}; z_i), n_i\right) = \frac{c_i^{1-\sigma} - 1}{1-\sigma} - \gamma n_i, \text{ for } i = 1, 2,$$

$$c_i = h^i\left(c_{i1}, c_{i2}; z_i\right),$$

where h^i is defined in (3.4) and n_{it} is the quantity of labor sold on the market.

The Ramsey allocation problem, expressed in Lagrangian form, is given by:

$$\max_{\{c_{i1t}, c_{i2t}, n_{it}, z_{it}, m_{i0}, r_t\}_{i=1,2,t\geq 0}} \sum_{t=0}^{\infty} \beta^t \sum_{i=1,2} \eta_i W^i\left(c_{i1t}, c_{i2t}, z_{it}, n_{it}\right) \quad (8.1)$$
$$-\sum_{t=0}^{\infty} \beta^t \left[\mu_{it}\left(\frac{u_{11t}/\left(1-z_{it}\right)}{u_{12t}/z_{it}} - r_t\right) + \chi_t\left(1-r_t\right) + \zeta_t\left(\frac{u_{12t}}{z_{1t}}\xi_1 - \frac{u_{22t}}{z_{2t}}\xi_2\right)\right]$$
$$-\sum_{t=0}^{\infty} \beta^t \omega_t \left[\sum_{i=1,2} \nu_i\left(\left(1-z_{it}\right)c_{i1t} + z_{2t}\left(c_{i2t} + C\left(z_i\right)\right) - \xi_i n_{it}\right) + \bar{g}_t\right]$$
$$+\sum_{i=1,2}\left[\lambda_i\left(u_{i10} + b_{i0}u_{i20}\right)m_{i0}\right]$$

where

$$W^i\left(c_{i1t}, c_{i2t}, z_{it}, n_{it}\right) = U^i\left(h^i\left(c_{i1t}, c_{i2t}\right), z_{it}, n_{it}\right) - \frac{\lambda_i}{\eta_i}\left(u_{i1t}c_{i1t} + u_{i2t}\left(c_{i2t} + C\left(z_i\right)\right) - \gamma n_{it}\right)$$

$$m_{20} = \phi_m m_{10},$$
$$b_{it} = \frac{B_{it}}{M_{it}}, m_{it} = \frac{M_{it}}{P_t},$$

for $t \geq 0$ and $i = 1, 2$.

The variables λ_i and ω_t are the multipliers on the implementability constraints and on the resource constraint for $i = 1, 2$ and $t \geq 0$, respectively. The variables μ_{it} are the multipliers for the constraint that the ratio of the marginal utility of consumption goods bought with cash and on credit be the same for both types, while χ_t is the multiplier on the constraint that the nominal interest rate be non-negative. The variable ζ_t is the multiplier on the constraint that the net real wage in efficiency units is the same across agents. Since the multipliers μ_i and ζ correspond to equality constraints and can be either positive or negative.

The first order necessary conditions for c_{i1}, c_{i2}, and r_t in (8.1) for $t > 0$ are as follows (I drop time subscripts to simplify notation):

$$0 = \left(\eta_i + \lambda_i\right)u_{i1} + \lambda_i \sum_{j=1}^{2}\left(U_1^i h_{1j}^i + U_{11}^i h_1^i h_j^i\right)\tilde{c}_{ij} \quad (8.2)$$
$$-\mu_i \frac{z_{it}}{1-z_{it}}\left(\frac{h_{11}^i}{h_1^i} - \frac{h_{21}^i}{h_2^i}\frac{h_1^i}{h_2^i}\right) - \tilde{\zeta}_i\left[U_1^i h_{21}^i + U_{11}^i h_2^i h_1^i\right] - \omega\nu_i\left(1-z_i\right),$$

$$
\begin{aligned}
0 &= (\eta_i + \lambda_i)\, u_{i2} + \lambda_i \sum_{j=1}^{2} \left(U_1^i h_{2j}^i + U_{11}^i h_2^i h_j^i \right) \tilde{c}_{ij} \qquad (8.3) \\
&\quad - \mu_i \frac{z_{it}}{1 - z_{it}} \left(\frac{h_{12}^i}{h_1^i} - \frac{h_{22}^i}{h_2^i} \frac{h_1^i}{h_2^i} \right) - \tilde{\zeta}_i \left[U_1^i h_{22}^i + U_{11}^i \left(h_2^i \right)^2 \right] - \omega \nu_i z_i,
\end{aligned}
$$

$$
\begin{aligned}
\sum_{i=1}^{2} \mu_i \frac{1 - z_i}{z_i} + \chi \begin{cases} \leq 0 \\ = 0 \text{ for } r > 1, \end{cases} \qquad (8.4) \\
0 = \chi (1 - r)\,,\ \chi \geq 0 \text{ and } r \geq 1,
\end{aligned}
$$

where i indexes agents and j indexes goods. For $i = 1, 2$:

$$
\begin{aligned}
\tilde{\zeta}_i &= (-1)^{i-1} \zeta \frac{\xi_i}{z_i}, \qquad (8.5) \\
\tilde{c}_{i1} &= c_{i1},\ \tilde{c}_{i2} = c_{i2} + C(z_i)\,, \\
h_j^i &= \frac{\partial h^i}{\partial c_{ij}} \text{ for } j = 1, 2,\ h_z^i = \frac{\partial h^i}{\partial z_i}, \\
h_{jk}^i &= \frac{\partial h_j^i}{\partial c_{ik}} \text{ for } k = 1, 2, \\
U_1^i &= \frac{\partial U^i}{\partial c_i},\ U_{11}^i = \frac{\partial^2 U^i}{\partial c_i^2}.
\end{aligned}
$$

The expression in (8.3) implies that $\zeta_t > 0$ for $\eta_2 > \bar{\eta}_2$ and $\zeta_t < 0$ for $\eta_1 > \bar{\eta}_1$. Intuitively, $\zeta < 0$ when the government wants to redistribute in favor of type 1 agents, which corresponds to $\eta_2 > \bar{\eta}_2$. In this case, the government would like type 1 to have a higher real net wage in equilibrium, which corresponds to $u_{12t}\xi_1 / (z_1\gamma) < u_{22t}\xi_2 / (z_2\gamma)$. Also, from the first order condition for z_i it is straightforward to verify that $z_2 \geq z_1$ follows from $\xi_2 > \xi_1$.

Combining (8.2) and (8.3) yields:

$$
\frac{u_{i1}/(1 - z_i)}{u_{i2}/z_i} = \qquad (8.6)
$$

$$
\max \left\{ 1, \frac{\eta_i + \lambda_i + \lambda_i \sum_{j=1}^{2} \left(\frac{U_1^i h_{2j}^i + U_{11}^i h_2^i h_j^i}{U_1^i h_2^i} \right) \tilde{c}_{ij} - \tilde{\zeta}_i \left[\frac{U_1^i h_{22}^i + U_{11}^i \left(h_2^i \right)^2}{U_1^i h_2^i} \right] - \frac{\mu_i}{U_1^i h_2^i} \frac{z_{it}}{1 - z_{it}} \left(\frac{h_{12}^i}{h_1^i} - \frac{h_{22}^i}{h_2^i} \frac{h_1^i}{h_2^i} \right)}{\eta_i + \lambda_i + \lambda_i \sum_{j=1}^{2} \left(\frac{U_1^i h_{1j}^i + U_{11}^i h_1^i h_j^i}{U_1^i h_1^i} \right) \tilde{c}_{ij} - \tilde{\zeta}_i \left[\frac{U_1^i h_{12}^i + U_{11}^i h_1^i h_2^i}{U_1^i h_1^i} \right] - \frac{\mu_i}{U_1^i h_1^i} \frac{z_{it}}{1 - z_{it}} \left(\frac{h_{11}^i}{h_1^i} - \frac{h_{21}^i}{h_2^i} \frac{h_1^i}{h_2^i} \right)} \right\} \qquad (8.7)
$$

Proposition 4.2 states that if household specific tax rates are available then the Friedman rule always solves the necessary conditions of the Ramsey allocation problem.

Proof of Proposition 4.2 If taxes are agent specific, the net real wage need not be equalized across agents in a competitive equilibrium. The first order conditions for the Ramsey problem are the same as for (8.1) with $\zeta_t \equiv 0$ for $t \geq 0$, since the constraint drops out of the problem. By homotheticity:

$$\sum_{j=1}^{2} \left(U_1^i h_{2j}^i + U_{11}^i h_2^i h_j^i\right) \frac{\tilde{c}_{ij}}{U_1^i h_2^i} = \sum_{j=1}^{2} \left(U_1^i h_{1j}^i + U_{11}^i h_1^i h_j^i\right) \frac{\tilde{c}_{ij}}{U_1^i h_1^i} \text{ for } i = 1, 2. \tag{8.8}$$

Moreover, at the Friedman rule the homotheticity of h^i implies $h_{11}^i = h_{22}^i = 0$ and $z_i = \underline{z}$ for $i = 1, 2$. Then, by (8.7) $-(1 - z_i)/z_i \leq -1$ is satisfied, from which the assertion follows.■

This proof is analogous to the one in Christiano, Chari and Kehoe (1996) and relies on the separability and homotheticity properties of household utility.

I now prove Proposition 4.3, which asserts that $\eta_1 \geq \bar{\eta}_1$ is a necessary condition for optimality of the Friedman rule.

Proof of Proposition 4.3 Optimality of the Friedman rule implies that the ratio in (8.7) is equal to 1. Using (8.8), it follows that:

$$\begin{aligned} & -\tilde{\zeta}_i \left[\frac{h_{22}^i}{h_2^i} + \frac{U_{11}^i}{U_1^i} h_2^i - \frac{h_{12}^i}{h_1^i} - \frac{U_{11}^i}{U_1^i} h_2^i\right] \\ = \quad & -\mu_i \frac{z_i}{1 - z_i} \left[\left(\frac{h_{11}^i}{h_1^i} - \frac{h_1^i}{h_2^i}\frac{h_{21}^i}{h_2^i}\right) \frac{1}{U_1^i h_1^i} - \left(\frac{h_{12}^i}{h_1^i} - \frac{h_{22}^i}{h_2^i}\frac{h_1^i}{h_2^i}\right) \frac{1}{U_1^i h_2^i}\right], \end{aligned}$$

which simplifies to:

$$\tilde{\zeta}_i \frac{h_{12}^i}{h_1^i} = \frac{\mu_i}{U_1^i h_2^i} \frac{z_i}{1 - z_i} \left(\frac{h_{21}^i}{h_2^i} + \frac{h_{12}^i}{h_1^i}\right),$$

since at the Friedman rule $h_{jj}^i = 0$ for $j = 1, 2$, and further to:

$$\tilde{\zeta}_i = \frac{\mu_i}{U_1^i h_2^i} \frac{1}{1 - z_i} \tag{8.9}$$

using $h_1^i / (1 - z_i) = h_2^i / z_i$. From (8.9), $sign(\mu_i) = sign\left(\tilde{\zeta}_i\right)$ and using (8.5):

$$\frac{\mu_1}{1 - z_1} = -\frac{\mu_2}{1 - z_2}. \tag{8.10}$$

The optimality of the Friedman rule also implies:

$$0 < \chi \leq -\sum_i \mu_i, \tag{8.11}$$

from (8.4). By (8.10):

$$-\sum_i \mu_i = \frac{-\mu_1}{1-z_1}(z_2 - z_1).$$

Using (8.9), the condition in (8.11) is equivalent to:

$$0 < \chi \leq -\zeta \frac{\xi_1 U_1^1 h_2^1}{z_1}(z_2 - z_1).$$

Since $\xi_2 > \xi_1$ implies $z_2 \geq z_1$ at any value of r, optimality of the Friedman rule requires $\zeta < 0$, which is equivalent to $\eta_1 \geq \bar{\eta}_1$■

9. Appendix C: Proof of Propositions 5.1, 5.2 and 5.5

Proof of Proposition 5.1 The first part of the proposition follows from (3.14) and (3.15). Let r_i denote the relative price of current consumption in terms of future consumption for type i, defined as:

$$r_{it+1} = \frac{1}{\beta}\frac{\tilde{u}_{i2t}}{\tilde{u}_{i2t+1}}.$$

where $\tilde{u}_{i2} = u_{i2}/z_2$ for $i = 1, 2$. From (7.3) and (7.7) this is equal to:

$$r_{it+1} = \frac{1}{\beta}\frac{(1-\tau_{t+1})}{(1-\tau_t)},$$

in equilibrium. This implies that both types of households will want to purchase bonds for $\tau_{t+1} < \tau_t$ and want to issue bonds for $\tau_{t+1} < \tau_t$, so that $B_{it+1} = 0$ for $i = 1, 2$ will hold in equilibrium. For $\tau_{t+1} = \tau_t$ households are indifferent between holding and issuing bonds. In this case, $B_{it+1} = 0$ by assumption. The expression for n_i follows from the dynamic budget constraint, substituting prices and government policy using the households' first order conditions (7.1)-(7.8), under the restriction that the cash in advance constraint holds with equality.■

Proof of Proposition 5.2 Using (5.2) and the resource constraint at $t = T$ delivers (5.3), from which the statement follows.■

The following proposition characterizes a temporary private sector equilibrium.

Proposition 9.1. *A mapping* $X(\tau, \bar{g})$ *such that* $\{c_{i1,} c_{i2}, c_i, n_i, z_i; R\}_{i=1,2} = X(\tau, \bar{g})$ *characterizes a temporary private sector equilibrium if and only if* $c_{i1,}$ c_{i2}*,* c_i*,* z_i *and* n_i *solve (3.16), (5.3) and the following conditions hold for* $i = 1, 2$*:*

$$c_i = w_i^{1/\sigma}, \tag{9.1}$$

$$n_i = \frac{c_i}{w_i \gamma} \left[(\beta - 1) \left(R P^i \right)^{\frac{\rho}{\rho - 1}} + \frac{\tilde{P}^i}{P^i} \right], \tag{9.2}$$

$$c_{i2} = c_i \left(P^i \right)^{\frac{1}{1-\rho}}, \tag{9.3}$$

$$\left(\frac{c_{i1}}{c_{i2}} \right)^{\rho - 1} = R, \tag{9.4}$$

$$R = \mathcal{R}(\tau, \tau, \bar{g})$$

where

$$P^i = \left[(1 - z_i) R^{\frac{\rho}{\rho-1}} + z_i \right]^{\frac{\rho-1}{\rho}}, \tag{9.5}$$

$$\tilde{P}^i = P^i + \frac{C(z_i)}{c_i}, \tag{9.6}$$

$$w_i = \frac{\xi_i (1 - \tau)}{\gamma P^i}, \tag{9.7}$$

and $\mathcal{R}(\cdot)$ *is implicitly defined by (5.3).*

Proof of Proposition 9.1 The first order conditions in Proposition 3.2 characterize a private sector equilibrium. The condition in (9.1) follows from (3.15), (9.5) and (9.7). The condition in (9.4) follows from (3.14), while (9.2) follows from (5.2) evaluated at $\tau' = \tau$ and $R' = R$ using (9.5), (9.6) and (9.7).■

Proposition 5.5 characterizes the sufficient conditions for increased inequality to correspond to higher inflation in the bargaining equilibrium.

Proof of Proposition 5.5 Proof of this Proposition requires establishing that the expression in (5.6) which is equal to 0 for the low value of ξ_2 is non-negative at $\xi_2' > \xi_2$, due to the quasicovexity of $\mathcal{P}^i$ with respect to $(1 - \tau)$, which implies that $\mathcal{P}^i$ is quasiconcave with respect to τ. Given (5.9), it is sufficient to show that $\mathcal{V}_2$ is decreasing in ξ_2. From (5.4) and the characterization in Proposition 9.1, the analytical expression for the value function can be rewritten as:

$$\mathcal{P}^i = (w_i)^{\frac{1-\sigma}{\sigma}} - \gamma \frac{\tilde{P}^i (w_i)^{\frac{1}{\sigma}}}{w_i P^i \gamma},$$

This implies:

$$\mathcal{P}^i (\tau, R) = -\frac{\gamma}{\xi_i} \frac{C (Z (\tau, R; \xi_i))}{1 - \tau}, \tag{9.8}$$

where $Z (\tau, R; \xi_i)$is implicitly defined by:

$$\left(\frac{1}{\rho} - 1\right) \left(1 - R^{\frac{\rho}{\rho-1}}\right) \left(\frac{\xi_i (1 - \tau)}{\gamma}\right)^{1/\sigma} \left(P^i\right)^{\frac{1}{1-\rho} - \frac{1}{\sigma}} - \theta (z_i) = 0, \tag{9.9}$$

for z_i interior, and (9.9) is derived from (3.16) and Proposition 9.1. Differentiating (9.9) with respect to ξ_i obtains:

$$\frac{\partial Z (\tau, R; \xi_i)}{\partial \xi_i} = \left[\frac{\sigma + \rho - 1}{\rho} \left(1 - R^{\frac{\rho}{\rho-1}}\right) P_i^{\frac{-1}{\rho} - 1} + \sigma \frac{\theta' (z_i)}{\theta (z_i)}\right]^{-1} \geq 0. \tag{9.10}$$

From (9.8):

$$\mathcal{V}_i = \max \left\{0, -\frac{\gamma C (Z (\tau, R; \xi_i))}{(1 - \tau) \xi_i} + \frac{\gamma C \left(Z \left(\tau^T, R^T; \xi_i\right)\right)}{(1 - \tau^T) \xi_i}\right\}.$$

To see that $\mathcal{V}_2/\mathcal{V}_1$ is decreasing in ξ_2, it is sufficient so analyze the derivative of $\mathcal{V}_i$ with respect to ξ_i :

$$\frac{\partial \mathcal{V}_i}{\partial \xi_i} = \gamma \left[-\frac{\partial Z (\tau, R; \xi_i)}{\partial \xi_i} \frac{\theta (Z (\tau, R; \xi_i))}{(1 - \tau) \xi_i} - \frac{1}{\xi_i} \mathcal{V}_i\right] \leq 0,$$

by (9.10).■

10. Appendix D: Calibration

Here I describe the strategy to determine the parameters values displayed in Table 3.

The intertemporal elasticity of substitution also determines the elasticity of labor supply with respect to the real wage. A value of σ smaller than 1 is required to ensure that consumption and labor supply are gross substitutes and that equilibrium labor supply increases with the net real wage. I set $\sigma = 0.7$ which corresponds to a value of the elasticity of household labor supply with respect to the real wage of at most 33%. Estimates of the labor supply elasticity vary greatly in the literature, as documented by Christiano, Eichenbaum and Evans (1996)[30]. I perform a sensitivity analysis by varying this parameter between 0.60 and 1. The results on Ramsey inflation do not appear to be highly sensitive to the value of σ.

The parameters ρ, θ_0 and θ_1 determine the properties of money demand. I set them to match the estimates of the interest elasticity of M1 and the ratio of the M1 to output in the US economy for the post-war period reported by Dotsey and Ireland (1996) and also used by Erosa and Ventura (2000). These statistics are reported in Table 2. The substitutability between consumption goods allows an extra degree of freedom in the calibration, since ρ also needs to be pinned down. The value of ρ determines the sensitivity of currency holdings to changes in the nominal interest rate for a given payment structure. I use results in Aiyagari, Braun and Eckstein (1998) to determine an upper bound for ρ. They run a regression of inverse velocity for the US on the nominal interest rate and the relative size of the banking sector, which they interpret as a proxy for the size of the credit services sector. They measure the relative size of the banking sector as the percentage of bank to total employees. The coefficient on this variable is an estimate of the interest elasticity of money demand along the extensive margin (the long run elasticity of money demand) and the coefficient on the nominal interest rate measures the interest elasticity along the intensive margin (the short run interest elasticity of money demand). Their estimate of -1.15 for the coefficient on the nominal interest rate corresponds to $\rho = 0.5349$ since the elasticity of substitution between consumption goods equals $\rho / (\rho - 1)$ in the model. I take this value as an upper bound because their estimate uses $M0$ velocity while M1 is used for the rest of the calibration. The estimate of the overall interest elasticity of money demand in Aiyagari, Braun and Eckstein (1998) is equal to 10.02, close to double the one found by Dotsey and Ireland (1996) for $M1$. I conjecture that the same difference would arise for the short run elasticity.

I set government spending so that it equals approximately 30% of aggregate employment in equilibrium.

[30] Micro studies report a labor supply elasticity close to 0, corresponding to a value of σ close to 1, but estimates of up 5, corresponding to σ close to 0.16, have been used in macro studies of the labor supply elasticity.

11. Data Appendix

The data on inflation from Easterly, Rodriguez and Schmidt-Hebbel (1994) and the data on income inequality is from Deinenger and Squire (1996). For each country only the "high quality" data according to their definition was used. For countries in which such data is based on net of tax income, I use the data from the Luxemburg Income Study, which is not defined as high quality, but uses before tax income. This adjustment is made for Belgium, Norway, Sweden, Finland and the UK. For Argentina no high quality data is available. The measures provided are based on household surveys conducted in urban centers and the greater Buenos Aires area.

Political instability is measured as the actual frequency of transfers of power in the period 1971-1982, from Cukierman and Tabellini (1992). A transfer of power is defined as a situation where there is a break in the governing political party control of executive power. It measures the instability of the political system by capturing the changes in the political leadership from the governing party or group to an opposition party. It varies between 0 and 1, where 0 represents perfect stability. Data on central bank independence is from Cukierman (1992). Legal central bank independence is measured based on a number of indicators, including the power of the central bank governor, the independence in policy formulations and in the definitions of objectives and on the presence of limitations on lending to the treasury. The included index measures overall independence for the 1980's. The values of this variable range from 0 (minimal independence) to 1 (maximum independence). The turnover rate for central bank governors is the average number of changes per annum in the period 1950-1989 and measures actual central bank independence. The IMF International Financial Statistics are used for data on GDP per capita.

I provide a list of countries and variables included in the sample below.

List of Available Data for Countries Included in the Sample

Country	Gini 66-90	y40/y60	% Inflation 66-90	Political Instability	Legal Independence	Turnover
Argentina	40.13	3.53	375.41	na	0.44	0.93
Australia	39.53	3.15	8.06	0.154	0.31	na
Austria	37.99	2.39	4.59	0.077	0.58	na
Bangladesh	35.33	2.74	13.51	0.019	na	na
Belgium	30.45	2.15	5.50	0.077	0.19	0.13
Bolivia	52.74	3.53	561.33	0.538	0.25	na
Brazil	55.91	6.43	262.26	0.000	0.26	na
Canada	31.84	2.43	6.39	0.154	0.46	0.1
Chile	53.12	4.87	83.35	0.154	0.49	0.45
Colombia	50.83	4.76	20.03	0.154	na	0.2
Costa Rica	45.02	4.18	15.84	na	0.42	0.58
Denmark	37.12	2.53	7.66	0.308	0.47	0.05
Dom.Rep.	46.27	4.15	14.82	0.154	na	na
Ecuador	51.28	3.96	21.07	0.231	na	na
Egypt	48.40	2.50	11.18	na	0.53	0.31
El Salvador	44.20	4.60	12.22	0.231	na	na
Finland	35.53	2.60	8.18	0.308	0.27	0.13
France	40.48	2.68	7.28	0.077	0.28	0.15
Germany,Fed.Rep.	32.13	2.43	3.57	0.000	0.66	0.1
Greece	40.85	na	13.91	0.308	0.51	0.18
Guatemala	57.83	5.61	10.212	na	na	na
India	37.18	na	8.13	0.154	0.33	0.33
Indonesia	40.30	2.53	21.79	0.000	0.32	na
Ireland	37.20	3.11	9.70	0.308	0.39	0.15
Israel	37.07	2.85	66.11	na	0.42	0.14
Italy	35.82	2.45	10.08	0.000	0.22	0.08
Japan	34.60	2.86	5.56	0.000	0.16	0.2
Korea, Rep. of	35.20	2.75	11.62	na	0.23	0.43
Mexico	52.62	5.68	35.08	0.000	0.36	0.15
Netherlands	30.27	2.37	4.89	0.385	0.42	0.05
Norway	32.27	2.58	7.03	0.308	0.14	0.08
Pakistan	35.81	2.23	8.67	0.231	0.19	na
Paraguay	47.40	na	14.45	0.000	na	na
Peru	49.49	6.37	504.18	0.154	0.43	0.33
Philippines	45.90	4.32	12.97	0.000	0.42	0.13
Portugal	38.70	2.87	15.38	0.385	na	na
Spain	33.70	2.18	10.81	0.154	0.21	0.2
Sweden	31.64	2.29	7.63	0.154	0.27	0.15
Tanzania	41.28	3.04	19.60	0.000	0.48	0.13
Thailand	42.15	4.13	6.26	0.385	0.26	0.2
Trinidad and Tobago	46.27	4.07	10.46	0.000	na	na
Turkey	45.29	4.81	33.42	0.692	0.44	0.4
UK	32.93	2.52	9.07	0.154	0.31	0.1
Uruguay	41.47	na	63.596	na	0.22	0.48
USA	35.58	2.87	5.89	0.231	0.51	0.13
Venezuela	42.59	3.79	13.72	0.154	0.37	0.3

Figure 1: Inflation Tax and Inequality− Full Sample

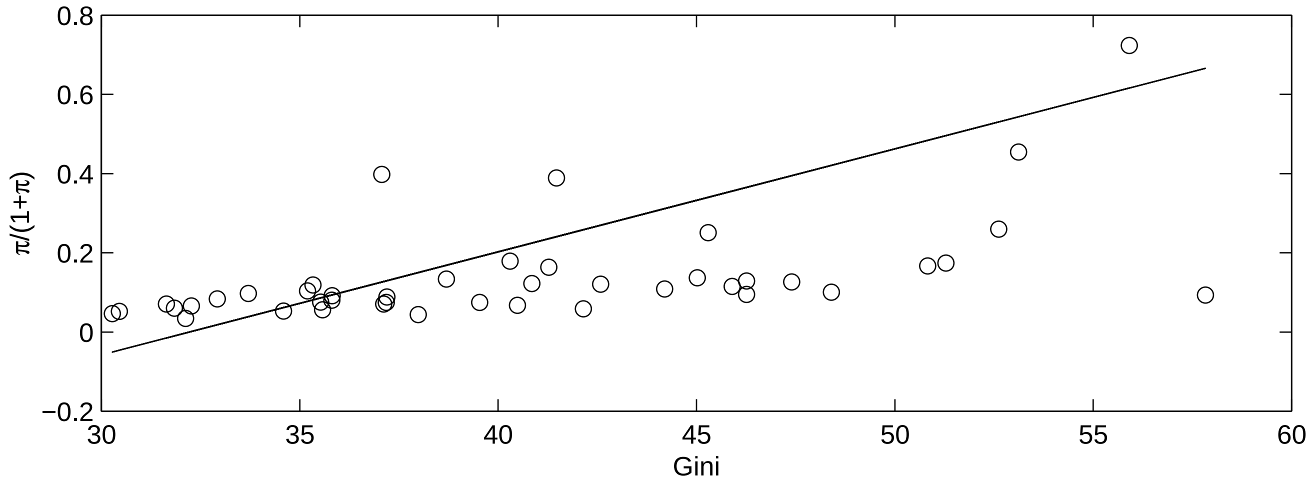


Figure 2: Inflation Tax and Income Differentials− Full Sample

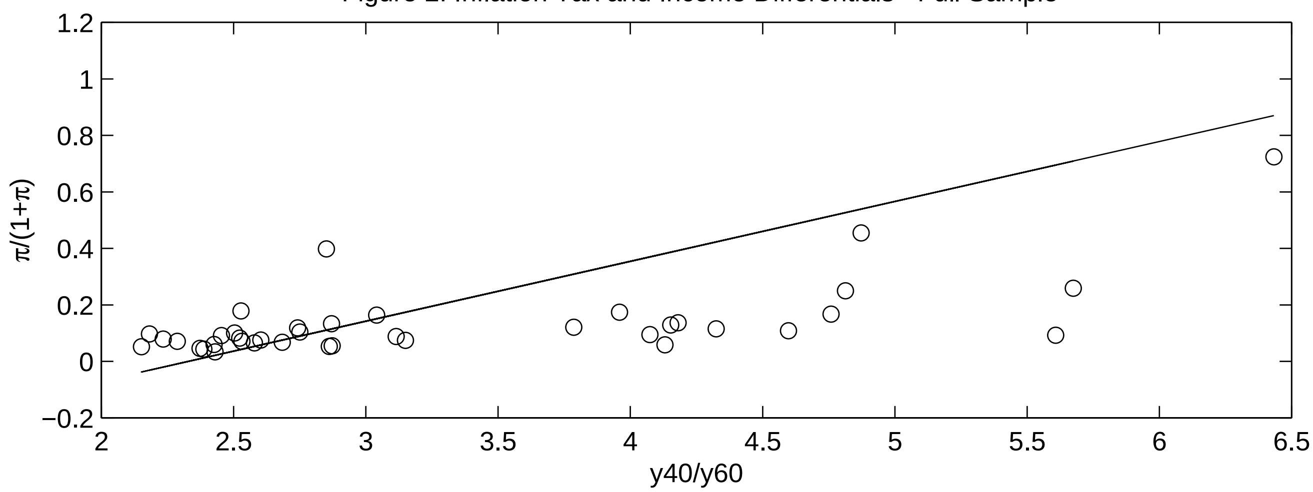


Figure 3: Inflation Tax and Inequality− OECD

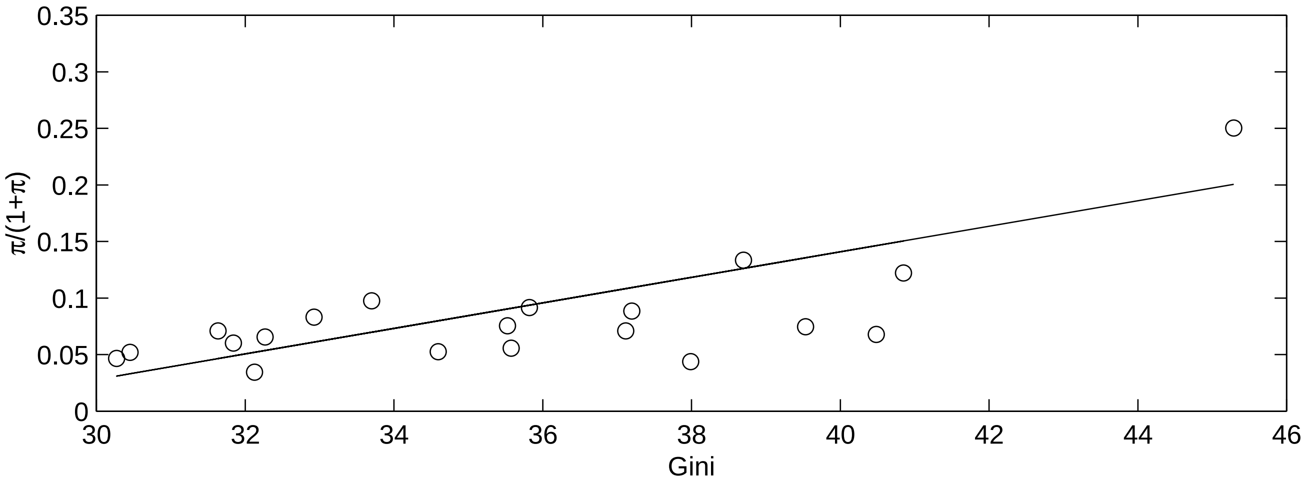


Figure 4: Inflation Tax and Inequality− Developing

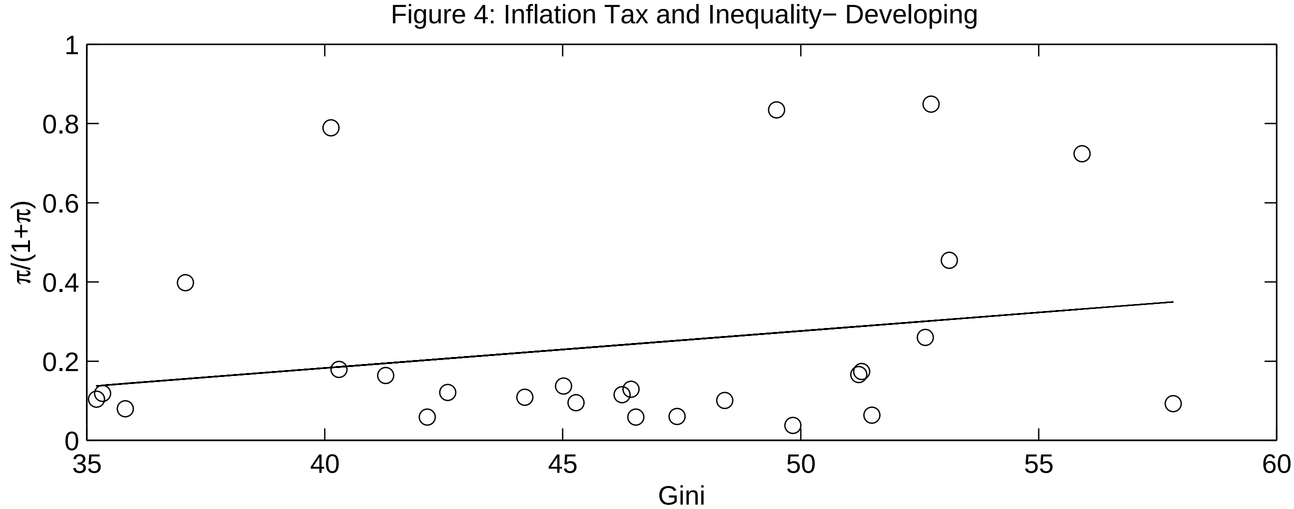


Figure 5: Correlation conditional on GDP per capita− Full sample

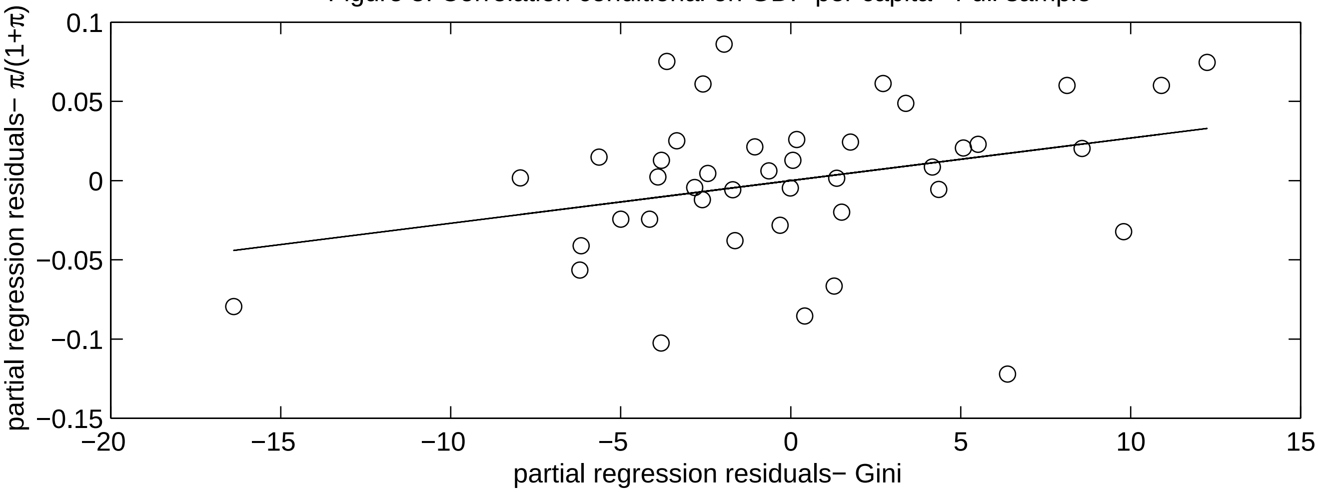


Figure 6: Correlation conditional on instab and CB indep− Full sample

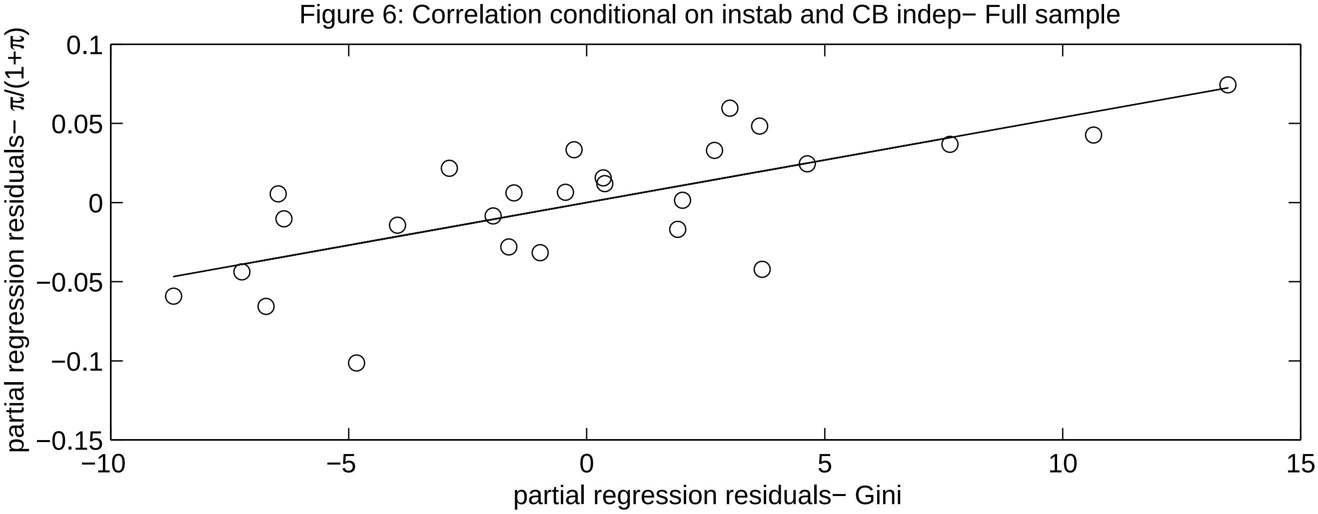


Figure 7: Correlation conditional on CB indep− OECD

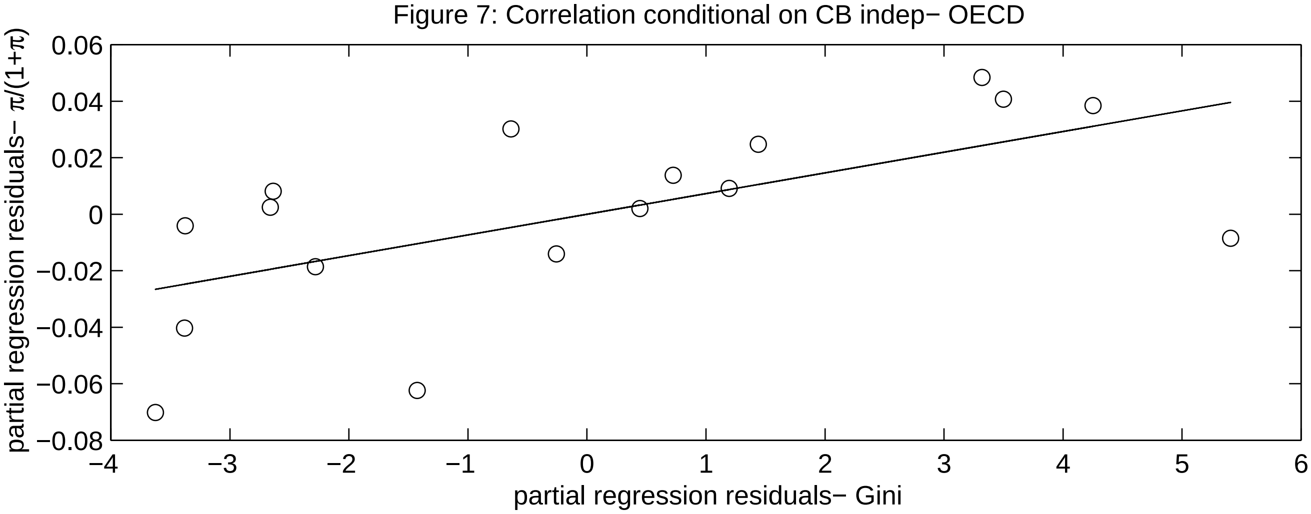


Figure 8: Correlation conditional on instab− Developing

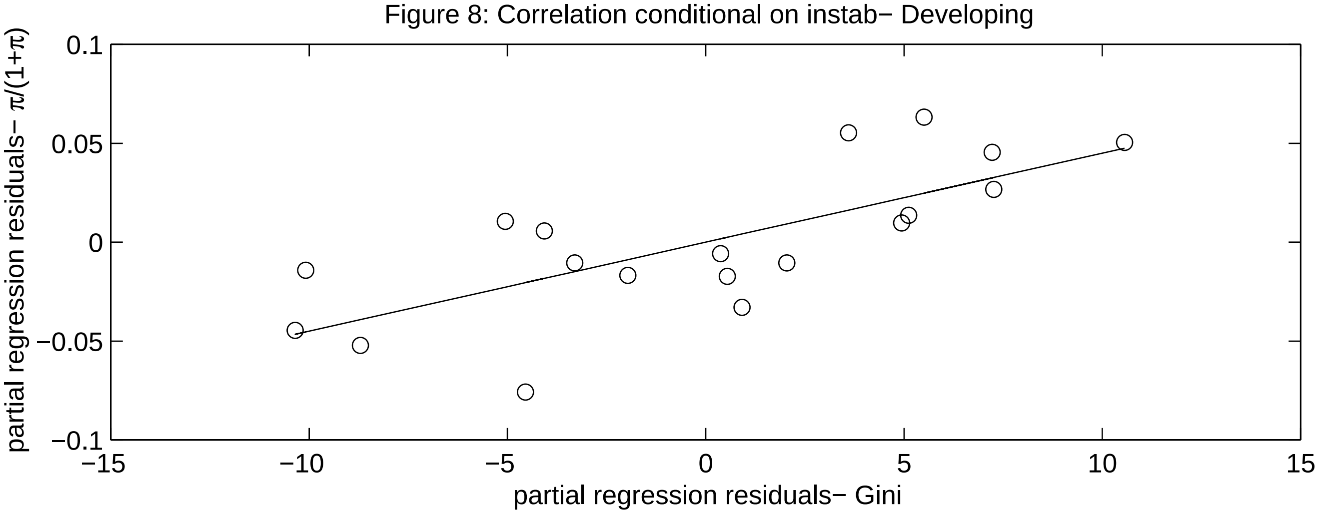


Table 1.A

Statistics on Inflation and Inequality

	y40/y60	(Country)	Gini	(Country)	Inflation	(Country)
max	6.43	(Brazil)	57.83	(Brazil)	689.31	(Nicaragua)
min	2.15	(Belgium)	30.27	(Belgium)	3.57	(Germany)
median	3.11	(Ireland)	38.70	(Portugal)	10.46	(Spain)
st. dev.	1.21		7.34		15.45*	

	%CPI Inflation	Gini	y40/y60
USA	5.89	35.57	2.87

Outliers

	Morocco	Tunisia	Malaysia	Honduras	(Guatemala)
%CPI Inflation	6.48	6.29	3.96	6.83	10.21
Gini	47.40	49.15	49.84	51.50	57.83
y40/y60	3.83	4.14	4.60	6.33	5.61

Correlation with Inflation

	Full Sample	Excluding Outliers	Ex. Outliers and Hyperinflations
Gini	0.21	0.39	0.40
y40/y60	0.34	0.41	0.42

	OECD Countries	Developing Countries	Dev. Countries Ex. Outliers
Gini	0.70	0.22	0.27
y40/y60	0.85	0.23	0.30

Sample Size	51	**Correlation Between Gini and y40/y60**	0.62

y40/y60 Ratio of Average Income per Capita in Top 40% of Population to Bottom 60%.

* Excludes countries with per annum inflation above 100%

Table 1.B

The Relation between the Inflation Tax and Inequality*

White Heteroskedasticity-Consistent Standard Errors

	Full Sample		OECD Countries		Developing Countries	
	coeff	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.73	21.8914	0.6391	8.6298	0.8657	16.6387
Slope	0.4561	5.7042	0.6784	3.289	0.1765	1.5641
R-squared	0.4251		0.3754		0.1043	

The Relation between the Inflation Tax and the Distribution of Income

White Heteroskedasticity-Consistent Standard Errors

	Full Sample		OECD Countries		Developing Countries	
	coeff	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.8247	40.6735	0.7646	18.6738	0.9077	34.6076
Slope	0.0265	4.7356	0.0422	2.8427	0.0096	1.5344
R-squared	0.3592		0.3222		0.1008	

Adding Conditioning Variables - Dependent Variable: Inflation Tax

White Heteroskedasticity-Consistent Standard Errors

Full Sample

Sample Size	39		25		39		31		26	
	coeff	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.8673	7.1874	0.6775	15.6812	0.6768	22.77	0.7143	17.2376	0.6794	16.8875
Gini*	0.4267	3.9192	0.608	4.5892	0.5634	7.97	0.5063	4.2972	0.5264	4.5204
Instability			0.0207	0.5015	0.0325	1.03			0.0133	0.3219
Legal Indep.			-0.0718	-1.37			-0.0674	-1.2349		
Turnover			0.0587	0.7075			0.1011	2.6615	0.0826	1.0261
GDP per capita	-0.0145	-1.4599								
R-squared	0.56		0.6965		0.6415		0.61		0.6755	

Developing Countries

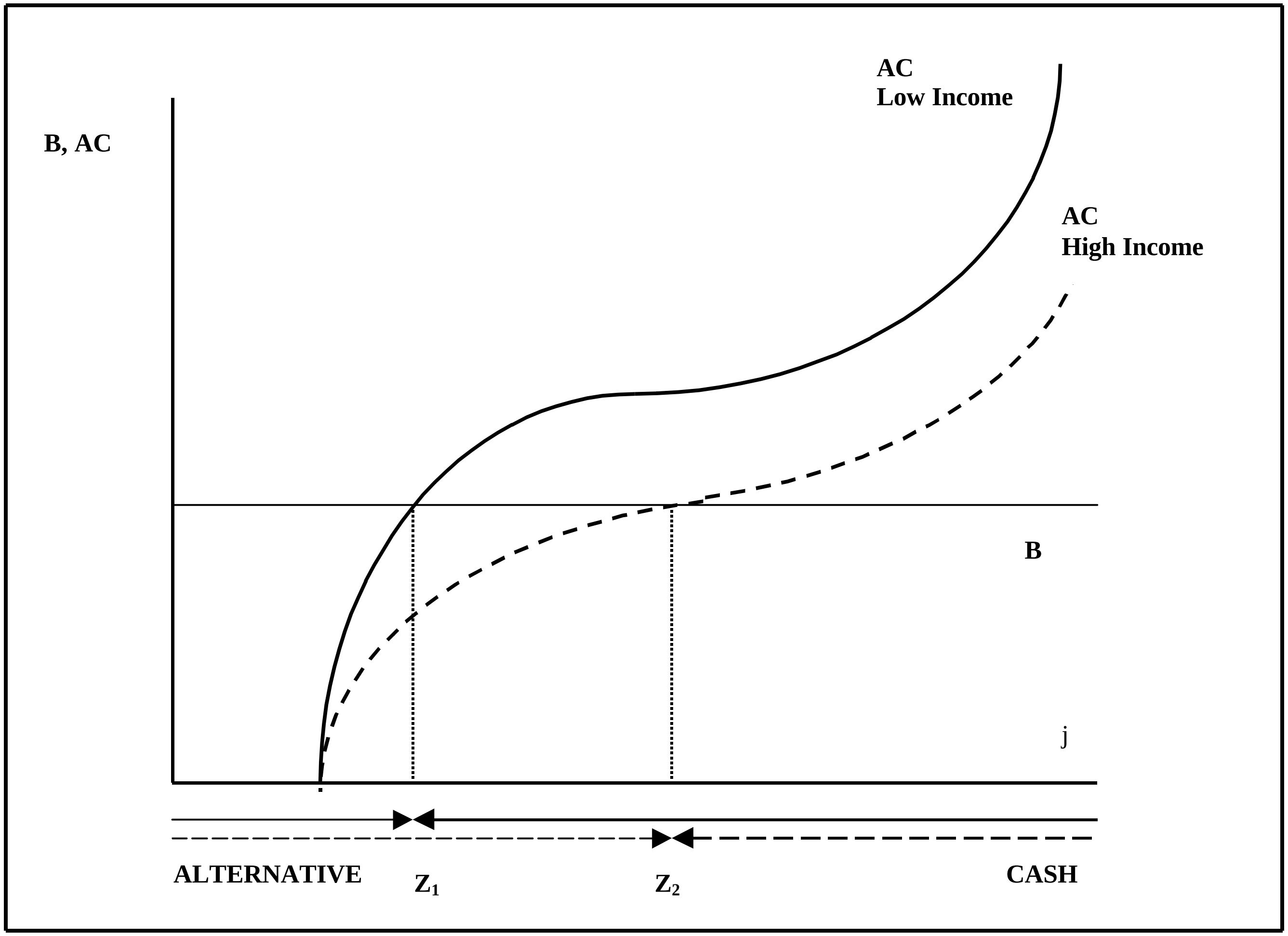
Sample Size	19		15	
	coeff	**t-stat**	**coeff**	**t-stat**
Intercept	0.7415	15.5363	0.81	9.3394
Gini*	0.4501	4.3462	0.25	1.3708
Instability	-0.0354	-0.8238		
Legal Indep.				
Turnover			0.07	1.4735
R-squared	0.5442		0.2235	

OECD Countries

Sample Size	17		17		21	
	coeff	**t-stat**	**coeff**	**t-stat**	**coeff**	**t-stat**
Intercept	0.6567	8.83	0.6901	1.4235	0.6425	8.7412
Gini*	0.7207	2.87	0.467	2.8702	0.6384	3.0137
Instability			0.0548	0.7929	0.0648	1.3079
Legal Indep.	-0.1139	-2.2158				
Turnover	0.0722	0.5849	0.1044	1.6716		
R-squared	0.6382		0.5363		0.4649	

*Gini coefficient devided by 100.

Figure 9: Optimal Choice of Transaction Services- Effect of Scale Economies



B= Benefit of purchasing good j with alternative payment technology per unit of consumption
AC= Cost of purchasing good j with alternative payment technology per unit of consumption

Table 2

Money Demand Calibration	
$v=PY/M^d$	$elasticity = dln(v)/(dR)$
From Dotsey and Ireland (1996)	
Data for the US for 1959-1991	
Average annualized nominal interest rate	
	6%
Interest elasticity of money demand- M1	
	5.95
Average M1 velocity	
	5.4
From Ayagari, Braun and Eckstein (1998)	
Short Run Elasticity of Money Demand-M0	
	1.15
Inequality Calibration	
Data for the US for 1965-1990	
y40/y60	2.87

Table 3

Benchmark Parameters				
σ	0.7			
θ_0	0.021			
θ_1	0.3232			
$\rho <=$	0.5349			
Statistics at R=1.06 and ξ_2=1.837				
ρ	**0.2**	**0.3**	**0.4**	**0.5**
v	2.11	*2.11*	2.12	2.14
z_1	0.11	*0.11*	0.12	0.12
z_2	0.33	*0.33*	0.33	0.33
elasticity	5.81	*5.90*	6.02	6.19
Income Inequality at R=1.05 and τ=0.30				
ξ_2/ξ_1	1.7	2.2	2.7	3.2
y40/y60	2.12	3.08	4.13	5.27

Table 4

Properties of the Ramsey Equilibrium

	η_1=0.40				ξ_2=1.837		
ξ_2	**1.84**	**3.67**	**5.51**	η_1	**0.40**	**0.50**	**0.70**
R	1.15	1.18	1.26	**R**	1.21	1.14	1.00
τ	0.22	0.20	0.17	τ	0.23	0.27	0.38
c_1	0.11	0.11	0.11	c_1	0.10	0.10	0.11
z_1	0.30	0.39	0.56	z_1	0.37	0.17	0.00
n_1	0.17	0.17	0.18	n_1	0.17	0.17	0.16
c_2	0.29	0.80	1.45	c_2	0.27	0.26	0.25
n_2	0.22	0.31	0.37	n_2	0.23	0.22	0.22
z_2	0.84	0.99	1.00	z_2	0.90	0.75	0.00
P_2/P_1	0.95	0.90	0.87	P_2/P_1	0.93	0.96	1.00
y40/y60	2.36	6.54	11.37	**y40/y60**	2.49	2.42	2.50

Table 5

Sentitivity of Ramsey Equilibrium

Response of Ramsey Policy to θ_0				
ρ=0.30, θ_1=0.3232, σ=0.7, ξ_2=1.837, gbar/GDP=0.30, η_1=0.40				
θ_0	**0.0105**	**0.021**	**0.0315**	**0.042**
R	1.6082	1.1523	1.068	1.0884
τ	0.1092	0.2165	0.2351	0.2205
Response of Ramsey Policy to ρ				
θ_0=0.0421, θ_1=0.3232, σ=0.8, η_1=0.40				
ρ	**0.15**	**0.35**	**0.55**	**0.75**
τ	0.1616	0.1974	0.2455	0.297
R	1.121	1.0855	1.0452	1
θ_0=0.021, θ_1=0.3232, σ=0.7, gbar/GDP=0.17, ξ2=3.6740, η_1=0.40				
ρ	**0.2**	**0.5**	**0.65**	**0.8**
R	1.5857	1.0005	1.0064	1.0468
τ	-0.0405	0.1965	0.1857	0.1493

Table 6

Parameters

σ	γ	β	
0.7	3	0.97	
ρ	θ_0	θ_1	
0.05	0.021	0.3232	

Statistics at R=1.06 and ξ_2=1.837

Elasticity	z1	z2	Velocity
8.2002	0.0736	0.3119	1.97044

ξ_2	**1.837**	**3.674**	**5.511**
gbar	0.0846	0.1501	0.2315
Threat Point			
τ	0.25	0.25	0.25
% inflation	508.25	539.18	559.79
Equilibrium			
τ	0.30	0.30	0.30
% inflation	20.25	22.99	28.63
R	1.17	1.19	1.25
z_1	0.32	0.39	0.65
z_2	0.84	0.94	0.94
V_1	0.04	0.04	0.03
V_2	0.01	0.01	0.01

Table 7

Parameters

σ	γ	β	
0.7	3	0.97	
ρ	θ_0	θ_1	
0.05	0.0421	0.3232	

Statistics at R=1.06 and ξ_2=2.85

Elasticity	z1	z2	Velocity
9.6334	0.0025	0.2235	2.13174

ξ_2	**2.1**	**4**	**4.8**
gbar	0.11	0.21	0.26
Threat Point			
τ	0.27	0.27	0.27
% inflation	68.41	233.08	115.89
Equilibrium			
τ	0.33	0.31	0.30
% inflation	12.20	34.26	44.25
R	1.09	1.30	1.40
z_1	0.01	0.24	0.41
z_2	0.21	0.95	0.95
V_1	0.10	0.10	0.05
V_2	0.00	0.02	0.00

Table 8

Slope of the Relationship between Inflation and Inequality Predicted by the Model

	Ramsey Equilibrium			Nash Bargaining Equilibrium					
	From Table 4			From Table 6			From Table 7		
ξ_2/ξ_1	**1.8**	**3.7**	**5.5**	**1.8**	**2.1**	**4**	**1.8**	**2.1**	**4**
y40/y60	2.36	6.54	11.37	2.3	2.9	7.21	2.32	2.91	7.24
% inflation	18.79	22.10	29.56	20.25	20.64	23.99	9.80	12.20	34.26
Slope	**1.19**			**0.76**			**4.97**		
Slope at low ξ_2	0.79			0.65			4.07		
Slope at high ξ_2	1.54			0.78			5.09		

Slope of the Relationship between Inflation and Inequality in the Data

	Gini Coefficient	y40/y60
OECD	1.13	2.56 **
Full*	0.98	6.56

*Excludes countries with average inflation surpassing 100% per annum.
** Excludes Turkey

Figure 10: Predicted relation between inequality and inflation