Should Central Banks Have an Inequality Objective?[1]

Roberto Chang

Rutgers University and NBER

This Draft: November 2022

[1]I thank Michael Bordo, Gauti Eggertsson, Cesar Martinelli, Gonzalo Pastor, Ken Rogoff, and participants of seminars at the Central Bank of Paraguay and the LACEA-LAMES 2022 conference for useful comments, suggestions, and encouragement. Of course, any errors or omissions are mine alone. I will appreciate any additional reactions. `chang@econ.rutgers.edu`

Abstract

Should central banks care about inequality? To address this question, we extend a standard model of time inconsistency in monetary policy to allow for heterogeneity. As in the standard analysis, lack of policy commitment leads to a bias towards socially excessive inflation. But the novel result is that, in the presence of heterogeneity, the bias can be offset by assigning the central bank a mandate under which agents with higher nominal wealth are given a higher relative weight than under the social welfare function. In other words, society should choose a central banker that is less egalitarian than itself, a result reminiscent of Rogoff's "conservative central banker". Our analysis underscores that including a concern for redistribution in the central bank's mandate can enhance policy credibility, but the details can be unexpected and should reflect the role of the mandate in overcoming policy distortions.

1 Introduction

Should central banks care about inequality? The question has recently become the subject of intense debate, especially in policy circles, where proposals to amend the mandates of central bankers have become prominent.[1]

In spite of its notoriety and importance, however, it is fair to say that the debate remains far from producing a consensus on the issue. This is not to ignore recent and important advances in the study of the links between central bank policy and inequality. In fact, some of the most celebrated recent advances in macroeconomics involve the solution and analysis of New Keynesian models with heterogeneous agents. Novel techniques are now available to identify and characterize the impact of monetary policy on distributional outcomes.[2]

However, being able to say how monetary policy affects inequality does not tell us how much weight central banks should place on inequality, or even if inequality should be included as part of a central bank's mandate at all. The latter question has a strongly normative flavor, not just a positive side. Its resolution involves taking a stance on what should be the ultimate objective of monetary policy, or of public policy for that matter, when policy actions have conflicting impacts on different members of the population.

Reasonable people can disagree on the social welfare function, and especially on the appropriate weight that inequality might have in that function. How to deal with such disagreement is one of the hardest obstacles to dialogue. It is apparent that participants in the debate spend considerable time and effort trying to convince others to agree on their own view of what the social welfare function should be. But this brings the debate to the domain of ethics and political philosophy, a treacherous terrain, to say the least.

[1] In the U.S. a prime case is the Federal Reserve Racial and Economic Equity Act, a major aspect of which is, according to Senator Elizabeth Warren (2021), to make "reducing inequality part of the Fed's mission", adding "a new section to the Federal Reserve Act that would require the Fed to carry out its functions in a way that 'minimizes and eliminates racial disparities in employment, wages, wealth, and access to affordable credit. ' " Similar debates are occurring in the rest of the world, as discussed in Carstens (2021), who observes that "the share of a sample of central bankers' speeches mentioning the words "inequality" and "distributional impact of monetary policy" has grown over time.

[2] A key reference is Kaplan, Moll, and Violante (2018), and the abundant literature since.

To be more specific, the view that a central bank should include inequality as one of their objectives is often justified on the basis that, because inequality does exist, it is ethically just for policymakers (including central bankers) to fight against it using the policy tools at their command. But however intuitive, this argument is grounded on the claim that there is a "right" social welfare function, which is decreasing in inequality (and in the particular way that proponents of this view believe in), which central bankers should embrace. An implication of this argument is that central bankers would adopt inequality as one of their objectives if only they learned what the right social welfare is; a corollary is that it is the economists' duty to teach central bankers about the right social objective.

In this paper, I propose to approach the debate from a different perspective. I do not offer an answer to the question of what the social objective function should be. In fact, I do not think that that is the role of economists, but it is a question for society as a whole. Instead, I propose to focus on the related, complementary question of what the *central bank's* mandate should be, for a given social objective function. This is a question for which, I will argue, the economist's perspective is useful, natural, compelling, and surprising.

The proposed change of perspective directs our attention not towards a debate about social objectives but, rather, how it is that the central bank's mandate can help accomplishing those objectives. In other words, it emphasizes that the definition of the goals and objectives of a central bank can play a useful role in optimizing social welfare.

To be specific, I focus on the choice of a central bank's mandate in mitigating and even offsetting distortions arising from lack of commitment (time inconsistency). Imperfect credibility and low commitment power are conventionally accepted as a major reason for including inflation as a main goal of central banks, therefore justifying institutions such as central bank independence and inflation targeting. The conjecture in this paper is that an analogous argument can be articulated to rationalize the addition of inequality as an additional objective assigned to the central bank. The conjecture turns out to be correct – but in perhaps unexpected ways.

I develop a simple example of a central bank that conducts monetary policy with a typical time inconsistency problem. The example extends the model of Persson and Tabellini (1992), which is a well known presentation of the influential ideas of Kydland and Prescott (1977) and Calvo (1978), so it provides a convenient vehicle for our analysis.

The economy lasts two periods and is inhabited by a large number of individuals. In the initial period, individuals receive an endowment of goods that they can consume or save in the form of fiat money. In the last period, individuals consume the value of their savings, which can be reduced by inflation, and their labor income, which can be taxed. In the last period, also, the government must raise enough revenue, from inflation and labor taxes, to pay for an exogenously given amount of public expenditure.

In the absence of heterogeneity in the population, the analysis of the model is quite standard. Social optimality is simply defined with reference to the utility of the representative agent, and it is natural to assume that utility function also as the central bank's objective. If the central bank can commit at the beginning of time to a policy mix of inflation and labor taxes, the optimal (Ramsey) outcome prescribes that public expenditure be financed partly via the inflation tax and partly via labor taxes, in proportions inversely related to the elasticities of each tax base (money demand and labor supply). In the absence of commitment (the discretionary case), in contrast, the central bank effectively chooses policy at the start of the second period. At that time, the elasticity of real money balances to inflation is zero, since money balances were chosen in the first period; as a consequence, the central bank will finance all of the public expenditure primarily via inflation. Anticipating the central bank's incentive to create higher than expected inflation, individuals will reduce their holdings of money in the first period. Equilibrium under discretion thus displays higher inflation and lower welfare than socially optimal, which is the Kydland-Prescott-Calvo fundamental inflationary bias result.

The novelty of our analysis is to explore what happens if agents differ in wealth. In that case, the definition of social optimality is delicate, since there is no representative agent. But, as suggested above, we analyze policy options under the assumption that there is some given, well defined social welfare function, which depends on individual utilities.

The simplest case is when social welfare is given by the average of individual utilities. The linearity imposed by that assumption, coupled with the assumption in the Persson-Tabellini model that individual utility is linear in second period consumption, implies that social preferences depend only on average consumption. As a consequence, the analysis of policy under commitment is almost the same as in the case of no heterogeneity. The analysis of policy under discretion is also almost the same as with a representative agent, under the assumption the central bank maximizes average utility (an assumption that proves to be crucial).

I say "almost the same" because, if agents differ in their endowments, inflation does have a redistributive impact. The inflation tax collects more revenue from agents that arrive to the second period with higher money balances, which are also the agents with higher endowments. In this sense, an inflation surprise is more costly for wealthier agents than for poorer agents, which is intuitive and natural.

This fact implies that, in the absence of policy commitment, a superior outcome can be obtained if the central bank is assigned a mandate that differs from the social welfare function (average utility). To prove this claim, I examine the consequences of a central bank mandate that assigns different weights to individual utilities. I then show that there is a choice of weights that, under discretion, implements the Ramsey outcome. And, perhaps surprisingly, the required weights turn out to be increasing in individual endowments. In other words, it turns out to be optimal for society to instruct the central bank to pay attention to inequality, but in this case the central bank should give relatively more weight to wealthier agents, not to poorer ones.

Our main result can be regarded as a 21st Century version of the celebrated and influential "conservative central banker" argument of Rogoff (1983). Rogoff showed that, in the presence of time inconsistency, it may be welfare improving to appoint a central banker that placed a higher weight on inflation relative to unemployment than society. Here we find that, in the presence of heterogeneity, it is beneficial to appoint a central banker that is less egalitarian than society. This result may be paradoxical at first but it is quite intuitive in the context of this model. Given the time inconsistency problem, a key role of the central bank mandate is to offset the temptation to create surprise inflation; to do that, the mandate should incorporate a sufficiently strong distaste for redistribution. This occurs because inflation redistributes resources from agents with higher nominal wealth to those with lower nominal wealth, and therefore the central bank's objective needs to assign higher relative weight to the former group in order to discourage the central bank from raising the inflation tax.

The case of an average utility social welfare function is convenient and most transparent because it starkly demonstrates the role of a central bank inequality objective. In that case, a distributional goal in the central bank's mandate is beneficial only because of its incentive effects, and not at all because inequality matters from the social point of view. On the other hand, some readers may feel uncomfortable with the argument, especially if they believe that social welfare "obviously" depends on inequality.

For that reason, and also to examine how our arguments can be extended to more general settings, the paper also analyzes a case in which the social welfare function does care about inequality. I show that the analysis of the average utility social welfare function carries carries on, with some intuitive modifications.

With a more egalitarian social welfare function, if there is commitment, the Ramsey outcome implies more reliance on inflation and less on labor taxes than under average utility. This is natural since, as mentioned already, the inflation tax collects more from wealthier agents than from poorer agents, so that inflation an additional social benefit in terms of reducing inequality. On the other hand, and for the same reason, a central bank that maximizes the egalitarian social welfare function has a stronger temptation to create surprise inflation in the second period of the model than under an average utility social criterion. Hence, in the no commitment case, the inflationary bias related to time inconsistency is worse when the social welfare function depends on inequality.

Then again, better (from the egalitarian social welfare function itself) outcomes can be achieved if the central bank is given a mandate that differs from the social welfare function. In this case, the Ramsey outcome can be attained under discretion provided that the central bank is assigned an objective function that places more weight than the social welfare function on wealthier agents. To be more precise, the optimal central bank mandate in the case of discretion requires that the correlation of individual weights with nominal wealth be more positive in the mandate than in the social welfare function. In this sense, the result is still that the central banker should be more conservative than society.

It must be noted that it is quite possible for the optimal central bank mandate to require penalizing inequality, although by not as much as the social welfare function does. And it cannot be overemphasized that the optimal central bank mandate results in an outcome that is best from the social welfare viewpoint, even given that the latter is egalitarian and, more strikingly, even if the mandate turns out not to be. This fact underscores the main point of our analysis: the inclusion of a redistributional motive as part of the central bank mandate can be justified by its role in offsetting policy distortions, in this case lack of a credible commitment and time inconsistency.

This paper is related to several strands of literature. Its starting premise is that the mandate assigned to a central bank can be important in dealing with policy distortions, such as lack of credibility in the absence of commitment. This was the crucial insight of Rogoff (1983) in the context of the time inconsistency problem first identified by Kydland and Prescott (1977), Calvo (1978), and Fischer (1980). Rogoff's conservative central banker argument spurred a number of studies discussing the optimal design of a central bank in the presence of time inconsistency. For example, see Walsh (1995).

In the context of time inconsistency in capital taxation, the issues (and opportunities) associated with heterogeneity were first identified by Rogers (1986). Subsection 7.3.3. of Persson and Tabellini (1990, PT hereon), which is a very useful reference, presented a fiscal policy problem in a model of capital versus labor taxation, presented an example in which distorting government preferences in favor of capitalists implements the Ramsey outcome under discretion. In this paper I discuss a similar argument in a monetary economy (in fact, an extension of the model in subsection 6.4.1 of PT). Also, I go into the main argument in some more detail than PT, which will hopefully be useful.

Finally, this paper may be relevant for the literature on heterogeneity and monetary policy, in particular the recent generation of heterogeneous New Keynesian models (for instance, Kaplan, Moll, and Violante 2018). In particular, our discussion suggests the need to think more carefully about what we take to be the right criterion of policy optimality and the proper design of the central bank's objective function in models with heterogeneous agents. In that regard, the very recent work of Davila and Schaab (2022), which develops new methods to analyze optimal monetary policy in dynamic models with heterogeneous agents, suggests an approach that seems quite similar to the one I discuss here.

Section 2 describes the economic environment, which is an extension of PT to allow for heterogeneity. A main observation is that inflation has a redistributional impact. Section 3 analyses the Ramsey policy problem, and also time consistent outcomes, under the assumption that the social welfare function is utilitarian, and that the central bank is charged with maximizing that function. Section 4 then examines if better outcomes can be attained under discretion if the central bank's mandate differs from the social welfare function. The answer is found to be yes, and in fact it is shown that the Ramsey outcome can be achieved if the central bank's objective favors wealthier agents. Under the alternative assumption that the social welfare function is egalitarian, section 5 then shows that the previous results hold, and in particular that the implementation of the Ramsey outcome obtains if the central bank is less egalitarian than society. Section 6 concludes with a discussion of the central assumptions underlying our analysis, as well as conjectures and suggestions for further research.

2 A Monetary Policy Problem

I extend the model of PT, subsection 6.4.1, to allow for inequality. There is a continuum of agents indexed by i in the interval $[0, 1]$. We assume that the distribution is Uniform, which entails no loss of generality.

There are two periods, $t = 1, 2$. In period 1, agent i receives an endowment $e^i > 0$ of the only final good. Without loss of generality, assume that e^i is increasing in i.

Initial endowments can be consumed or sold in the market for fiat money. Fiat money is the only asset.

To simplify, we follow PT in assuming that only the government has access to a storage technology. Agent i can sell part of their endowment in period 1 to the government, at price P_1, receiving M_1^i units of money to carry to period 2. Then the agent can exchange money for goods, at price $P_{2.}$. The central bank chooses the supply of fiat money, and the price level adjusts to clear markets. One consequence is that the government can control the rate of inflation, but also that the real quantity of money in period 1 is determined by expectations about inflation.

The budget constraint of agent i in period $t = 1$ is then $P_1 c_1^i + M_1^i \leq P_1 e^i$ or, in real terms,

$$c_1^i + m_1^i \leq e^i$$

where $m_1^i = M_1^i / P_1$ denotes agent i's real money holdings at the end of period $t = 1$.

In period $t = 2$, all agents can work and produce goods via a linear technology. By choice of units, assume that each hour worked yields a unit of output. The budget constraint is then $P_2 c_2^i + M_2^i \leq (1 - \tau) P_2 l^i + M_1^i$ or, equivalently,

$$c_2^i + m_2^i \leq (1 - \tau) l^i + (1 - \pi) m_1^i$$

where $m_2^i = M_2^i / P_2$, l^i is agent $i's$ labor supply, τ is a tax rate in labor, and $1 - \pi = P_1 / P_2$. Thus π denotes the rate of the inflation tax.

Agent i has preferences

$$W^i = U(c_1^i) + c_2^i - V(l) + H(m_2^i) \tag{1}$$

where the functions U, V, and H are continuously differentiable and strictly increasing, U and H are strictly concave, and V is strictly convex.

The need for taxes (labor and inflation) arises because in period 2 the government must finance a nonnegative amount of expenditure. The budget constraint is:

$$g \leq \tau l + \pi m_1 + m_2$$

where variables without superscripts denote per capita counterparts, i.e.

$$\begin{aligned} l &= \int l^i di \\ m_t &= \int m_t^i di \end{aligned}$$

In this model, the government chooses the rate of inflation, π, and the rate of the labor tax,τ. For future reference, we record the implications for the choices of household i, which takes τ and π as given.

Household $i's$ money demand is given by:

$$U'(e^i - m_1^i) \geq 1 - \pi, \text{ with } = \text{ if } m_1^i > 0 \tag{2}$$

In turn, if $m_1^i > 0$,

$$c_1^i = c_1$$

where c_1 is defined by

$$U'(c_1) = 1 - \pi$$

In other words, all households with strictly positive savings have the same initial level of consumption, equal to c_1. This simplifies computations considerably.

The optimal choice of terminal money holdings is given by

$$H'(m_2^i) = 1$$

This implies that $m_2^i = m_2$ for all i, where m_2 is independent of policy. In fact, the value of m_2 turns out to be irrelevant, and for simplicity we assume $m_2 = 0$ from now on.

Finally, optimal labor supply in period 2 satisfies

$$V'(l^i) = 1 - \tau$$

The implication is that $l^i = l$ for all i.

Hence the model embodies several strong simplifying assumptions, which limit the impact of heterogeneity. But heterogeneity still plays an important and interesting role. In particular, second period consumption can be expressed as

$$\begin{aligned} c_2^i &= (1-\tau)l^i + (1-\pi)m_1^i \\ &= (1-\tau)l + (1-\pi)m_1 + (1-\pi)(m_1^i - m_1) \\ &= l + m_1 - g + (1-\pi)(m_1^i - m_1) \end{aligned}$$

where the last equality follows from the government budget constraint. The preceding expression shows that, in the presence of heterogeneity, inflation has a redistributive role: in the last period, $(m_1^i - m_1)$ is given, so an increase in the inflation tax raises more revenue more from agents that carry higher money balances.

3 Commitment Versus Discretion

The time inconsistency problem that emerges in this model is well known. It is summarized here for convenience, emphasizing some novel aspects that appear because of heterogeneity.

In order to analyze policy, it is usual to posit the existence of a *social welfare function.* This assumption raises no issues in the absence of heterogeneity (here, if $e^i = e$, all i), in which case it is conventional and natural to identify social welfare with the welfare of the representative household. But, what if there is heterogeneity? This is a thorny issue, for a variety of reasons (for example, the fact that preference orderings can be represented in different ways).

For our analysis, however, we will sidestep how society comes to choose a social objective. Instead, we will assume that there is some exogenously given social welfare function. Even in that case, the question remains as to whether it is optimal for society to give the central bank a *mandate* to maximize that function, or some other one. We will focus on that question and argue that the answer is no, in general. Then we will explore what kind of central bank mandate is best for society.

In this section and the next, we assume that the social welfare function is simply *average* utility, i.e. the sum of utilities over households. In spite of the issues alluded to already, the assumption of average utility has been adopted in several recent papers, so our discussion will be applicable to them. In addition, average utility has the advantage of tractability.

In this section, also, we assume that the central bank's mandate is in fact to maximize the (average) social welfare function. We depart from that assumption in the next section.

Given the mentioned assumptions, we analyze policy under two alternative scenarios: the central bank *commits* to a policy (π, τ) at the beginning of time, that is, before $t = 1$; or the central bank effectively sets (π, τ) at the start of period 2, a *discretionary* scenario. It is well known that, under discretion, there is a time inconsistency policy that results in a bias towards higher inflation than under commitment. We review the argument here.

3.1 Optimal Policy With Commitment

Under commitment, the central bank chooses a policy (π, τ) and an allocation $(c_1^i, m_1^i, l^i, c_2^i)$ for all i that maximizes average utility $\int W^i di$ subject to the constraints that (i) $(c_1^i, m_1^i, l^i, c_2^i)$ be optimal for agent i given the policy (π, τ) and (ii) the government budget constraint be satisfied.

For simplicity, we focus on the case in which $m_1^i > 0$, all i, under commitment. Then it turns out that the problem just stated (often called the *Ramsey problem*) is almost the same as in an economy with no heterogeneity, i.e., the same as if $e^i = e$ for all i. To see this, note first that, under the assumption that $m_1^i > 0$, all i, first period consumption is the same for all agents, i.e. $c_1^i = c_1$ for all i, as noted above. The optimality conditions for household i are then given by

$$\begin{aligned} U'(c_1) &= 1 - \pi \\ V'(l) &= 1 - \tau \end{aligned} \tag{3}$$

which are the same for all i. In turn. the government budget constraint

$$g \leq \tau l + \pi m_1 \tag{4}$$

depends only on labor effort and average money holdings. Finally, the average objective function is

$$\begin{aligned} \int W^i di &= \int [U(c_1^i) + c_2^i - V(l^i)] di \\ &= U(c_1) + c_2 - V(l) \end{aligned}$$

which depends only on c_1, l, and average second period consumption $c_2 = \int c_2^i di$. Heterogeneity only affects the distribution of second period consumption; but under the average utility criterion, plus the assumption of linear utility of terminal consumption, implies that the central bank cares only about averages.

Hence, under our maintained assumptions, the Ramsey outcome is exactly the same as that derived by Persson and Tabellini in their model, which features no heterogeneity. It is not too hard to derive that the optimal policy is given by the condition

$$\frac{U'(c_1^*)-1}{(e_1-c_1^*)U''(c_1^*)}=\frac{1-V'(l^*)}{l^*V''(l^*)} \tag{5}$$

which essentially equalizes the distortions created by the inflation tax and the labor tax (note that we identify the Ramsey outcome with asterisks). The intuition is well known; under commitment, both kinds of taxes raise revenue but reduce the tax bases, in this case real money balances and labor income. The Ramsey outcome entails choosing the tax rates so that the amount of revenue per unit of distortion is the same. Note that the optimal choice involves setting both τ^* and π^* at positive levels.

3.2 Policy Under Discretion and Inflation Bias

The time consistency problem now is apparent. Under discretion, when the policymaker chooses τ and π in period 2, the inflation tax is no longer distortionary, since the base of the tax (real money balances carried from the previous period) can no longer respond to the rate of the tax (the inflation rate). In contrast, labor taxes are still distortionary, so it is no surprise that the discretionary outcome involves recurring only to the inflation tax, as long as that is possible.

More formally, at the start of $t=2$, the distribution of real money balances, $\{m_1^i\}$, is given. Also, initial consumption has already taken place, and it does not affect welfare from that point on. Then the central bank effectively maximizes

$$\int [c_2^i - V(l^i)]di = c_2 - V(l) \tag{6}$$

subject to (4), (3) and, for all i,

$$c_2^i = l + m_1 - g + (1-\pi)(m_1^i - m_1)$$

But note that the previous equation implies that

$$c_2 = l + m_1 - g$$

Therefore the central bank's problem is to choose π and τ to maximize

$$l + m_1 - g - V(l)$$

subject to (4) and (3).

In this problem, the inflation tax rate π appears only in the budget constraint (4), which indicates that inflation is not distortionary *ex post*. In contrast, the labor tax rate τ appears in the optimal labor supply condition (3). The central bank optimal choice is then: it finances the expenditure g by resorting only to the inflation tax, if that is possible; if the maximum revenue from inflation does not suffice to cover g, the remainder is paid for with labor taxes.

In equilibrium, in period $t = 1$ households anticipate the central bank's incentives, and the rate of inflation that will be imposed in period $t = 2$. As a consequence, they adjust their money demand and savings in $t = 1$ accordingly. A discretionary equilibrium is, then, a policy (τ, π) and an allocation $(c_1^i, m_1^i, l^i, c_2^i)$ for each i such that (i) the allocation $(c_1^i, m_1^i, l^i, c_2^i)$ is optimal for i given (τ, π) and (ii) (τ, π) solves the $t = 2$ problem just described, given the distribution of money balances $\{m_1^i\}$.

Solving for discretionary equilibria is somewhat more involved than solving the Ramsey problem: see Persson and Tabellini for details. For concreteness, we focus on a particular case: let $m_1(\pi)$ denote the aggregate demand for money implied by (2), and assume that there is a π^D such that $g = \pi^D m_1(\pi^D)$, that is, government expenditure can be financed only with the inflation tax, when the inflation rate is anticipated by households. Then there is a discretionary equilibrium with inflation rate $\pi = \pi^D$ and a zero labor tax.

It is not hard to show that $\pi^D > \pi^*$, i.e. that inflation under discretion is higher than inflation under commitment: this is the inflationary bias associated with time inconsistency.

And importantly, average welfare under discretion is lower than under commitment. This occurs in spite of the fact that the labor tax is zero in the discretionary outcome just discussed, and expresses the fact that while inflation is not distortionary *ex post,* it is distortionary *ex ante.*

Remarkably, all of these results are the same as in Persson and Tabellini, in spite of the presence of heterogeneity in the present setting (and its absence in theirs). Two assumptions are responsible for this result: the marginal utility of consumption in period 2 is one; and the central bank mandate is to maximize the average social welfare function, which gives the same weight to all agents.

4 An Optimal Central Bank's Mandate

We have seen that, under the assumptions maintained thus far, the presence of heterogeneity implies essentially no change to the analysis of policy under commitment vis a vis discretion. As in Persson and Tabellini's model, and others with a representative agent, lack of commitment results in an inflationary bias that hurts social welfare. But aggregate outcomes, including the rate of inflation, are unaffected by heterogeneity.

This is not to say, however, that monetary policy has no impact on *individual* outcomes. For, as we have seen, if there is heterogeneity, the inflation tax represents a heavier burden on households that enter period 2 with higher money holdings.

This observation represents, in fact, an opportunity to improve social outcomes in the no commitment case. We shall see that the Ramsey outcome can be implemented if the central bank is assigned an objective function that deviates from the social welfare function.

Let us assume, then, that the central bank mandate is to maximize an objective function of the form

$$\int \phi^i W^i di$$

where ϕ^i is the weight assigned to agent i. The assumption of average utility is a special case with $\phi^i = 1$ for all i. Here we allow for ϕ^i to differ across agents. We will also assume that $\int \phi^i di = 1$, which is a normalization.

Consider policy under discretion, given the above mandate. In period 2 the central bank chooses inflation and the labor tax rate to maximize:

$$\int \phi^i [c_2^i - V(l)] di = \int \phi^i c_2^i di - V(l) \tag{7}$$

subject to

$$c_2^i = l + m_1 - g + (1 - \pi)(m_1^i - m_1)$$

$$V'(l) = 1 - \tau$$

and

$$g \leq \tau l + \pi m_1$$

In the above problem, the distribution of first period money balances $\{m_1\}$ is given. Note that the problem is the same as in subsection 3.2, except that for the central bank's mandate (compare (6) versus (3.2)).

Let $\lambda \geq 0$ denote the Lagrange multiplier associated with the government budget constraint. The first order conditions for the optimal choices of l and τ lead to

$$(1 + \lambda)[1 - V'(l)] = \lambda l V''(l)$$

while the optimality condition associated with inflation is:

$$\int \phi^i (m_1^i - m_1) di = \lambda m_1 \tag{8}$$

If the central bank maximizes average welfare, which is the social welfare function, $\phi^i = 1$, all i, so that the preceding condition implies that $\lambda = 0$. In turn, the first order condition for labor taxes reduce to $1 - V'(l) = \tau = 0$. This is consistent with the analysis of the last section.

But other choices of $\{\phi^i\}$ may result in different values for λ and, therefore, for τ and π. This just reflects that alternative settings for $\{\phi^i\}$ change the incentives to the central bank.

In fact, noting that

$$\int \phi^i(m_1^i - m_1)di = \int (\phi^i - 1)(m_1^i - m_1)di$$

it is seen that, given the distribution of money balances $\{m_1^i\}$ at the beginning of period 2, the value of λ is higher the stronger the covariance between ϕ^i and m_1^i. The covariance between ϕ^i and m_1^i expresses, of course, the relative weight that the central bank's mandate assigns to households depending on their money holdings and wealth. The higher that covariance, the more the central bank's mandate requires to avoid the redistribution implied by inflation, and the higher the revenue that needs to be collected from the labor taxes.

In other words, by changing the weights of different households in the central bank's mandate, society can alter the discretionary outcome. Notably, this is possible *only if* there is heterogeneity: with no heterogeneity, $m_1^i = m_1$ all i implies $\lambda = 0$ and $\tau = 0$ in the previous analysis.

The natural question then emerges: can the weights ϕ^i to chosen so that the discretionary outcome implements the Ramsey (commitment) outcome? To answer, note that the only first order condition of the Ramsey problem that differs from those in the discretionary case is the one for inflation, which is in the Ramsey case:

$$\begin{aligned} (1+\lambda^*)\left[U'(c_1^*) - 1\right] &= \lambda^*(e - c_1^*)U''(c_1^*) \\ &= \lambda^* m_1^* U''(c_1^*) \end{aligned} \tag{9}$$

recalling that asterisks denote the Ramsey outcome.

Recall also that we have assumed that the Ramsey outcome is such that $m_1^{i*} = e^i - c_1^* > 0$, all i. It follows that $m_1^{i*} - m_1^* = e^i - e$ and then, comparing (8) and (9), the discretionary outcome with weights ϕ^i will coincide with the Ramsey outcome only if

$$(1+\lambda^*)\left[\frac{U'(c_1^*)-1}{U''(c_1^*)}\right]=\int\phi^i(e^i-e)di$$

Letting Δ denote the LHS of the preceding equation, note that $\Delta > 0$. We have arrived at the following:

Proposition. Under the assumptions of this section, if the central bank is given the mandate to maximize (7) in period 2, the discretionary outcome coincides with the Ramsey outcome provided that

$$Cov(\phi^i, e^i)=\int\phi^i(e^i-e)di=\Delta>0$$

The Proposition implies that there may be many ways to choose the weights $\{\phi^i\}$ that result in the Ramsey outcome. In an optimal mandate, however, the weights should increase with wealth on average.

For a specific choice, consider weights of the form $\phi^i=\phi(e^i-e)$, with ϕ a constant. Then:

$$\Delta=\phi\int(e^i-e)^2di$$

or

$$\phi=\frac{\Delta}{Var(e_i)}$$

This choice would assign more weight to households in proportion to their endowments, with the constant of proportionality inversely related to the dispersion in initial endowments.

More generally, a choice of weights ϕ^i that implements the Ramsey outcome must satisfy $Cov(e^i,\phi^i)=\Delta>0$, that is, that the central bank be instructed to give more relative weight to wealthier households.

These results may be surprising but are natural and intuitive in the context of this model. In order to offset the time inconsistency problem, an appropriate charge for the central bank must discourage it from eroding the currency via inflation. One way is to give the central bank a mandate with a sufficiently strong distaste for redistribution. Since inflation redistributes resources from agents with larger nominal balances to agents with smaller balances, the central bank's objective needs to assign higher relative weight to the former.

It cannot be overemphasized that, while the central bank's optimal mandate entails giving more weight to wealthier agents, the outcome is the best one available to society, as evaluated by the average social welfare function. This is because the reason for the discrepancy between the optimal central bank's mandate and the social welfare function is to provide proper incentives to overcome the time inconsistency problem.

The argument is clearly reminiscent of Rogoff's (1983) "conservative" central banker. Here we find that the central banker should be conservative, as in the Rogoff model. But the meaning of "conservative" is different: society should appoint a central banker that favors wealthy agents, even if society's own welfare function is egalitarian.

5 Generalization: Egalitarian Social Objectives

In our model, the assumption that the social welfare function is average utility, coupled with linearity of preferences in second period consumption, leads to the paradoxical result that a society that does not care about the distributional impact of inflation finds it beneficial to assign the central bank an objective that depends on inequality.

The interested reader will wonder whether our results survive generalizations of our model. In particular, the reader may conjecture that, if there is heterogeneity in wealth, the social welfare function may not be linear, but instead give more weight to the less fortunate. In that case, would our analysis change, in particular the result that the central bank should be less egalitarian than society? This section develops a variation of our previous analysis, and finds that the mentioned result survives in an interesting way.

To proceed, take the model we have been analyzing, but suppose that the social welfare function is not average utility but

$$\int \Gamma(W^i)di \tag{10}$$

where Γ is a smooth, strictly increasing, strictly concave function. Strict concavity means, of course, that society dislikes inequality across agents.

With this change, we examine the implications for optimal (Ramsey) policy with commitment. Then, assuming lack of commitment, we discuss what kind of central bank mandate implements the Ramsey outcome.

5.1 The Ramsey Problem

Recalling that agent i's second period consumption is:

$$\begin{aligned} c_2^i &= (1-\tau)l + (1-\pi)m_1^i \\ &= (1-\tau)l + (1-\pi)\left(e^i - c_1\right) \end{aligned}$$

we can express the agent's utility as

$$W^i = U(c_1) - V(l) + (1-\tau)l + (1-\pi)\left(e^i - c_1\right) \tag{11}$$

This is convenient to discuss the Ramsey problem, because the choice variables can now be taken to be economywide averages, with heterogeneity affecting W^i only through the term e^i .

The Ramsey problem can now be formulated as follows: choose c_1, l, τ, π to maximize $\int \Gamma(W^i)di$, with W^i given by the preceding expression, subject to

$$U'(c_1) = 1 - \pi \tag{12}$$

$$V'(l) = 1 - \tau \tag{13}$$

$$g \leq \tau l + \pi(e - c_1) \tag{14}$$

(For simplicity, we are still assuming that the Ramsey outcome prescribes $m_1^i = e^i - c_1 > 0$, all i.) Letting the Lagrangian be:

$$\int \Gamma(W^i)di + \lambda\left[\tau l + \pi(e - c_1) - g\right] - \mu\left[U'(c_1) - (1-\pi)\right] - \nu\left[V'(l) - (1-\tau)\right]$$

the first order conditions can be written as:

$$-\mu^* U''(c_1^*) = \lambda^* \pi^* \tag{15}$$

$$\lambda^* \tau = \nu^* V''(l^*)$$

$$-l^* + \lambda^* l^* - \nu^* = 0 \tag{16}$$

$$\int p_i^*(e^i - c_1^*)di = -\mu^* + \lambda^*(e_1 - c_1^*) \tag{17}$$

where we use asterisks to identify the optimal (Ramsey) solution. We also use $p_i^* = \Gamma'(W^{i*})$ to denote the marginal weight of agent i in the social welfare function, and normalize units so that $\int p_i^* di = 1$.

Heterogeneity appears only in the last equation. To proceed, note that

$$\begin{aligned}\int p_i^*(e^i - c_1^*)di &= \int p_i^*(e^i - e)di + \int p_i^*(e - c_1^*)di \\ &= \Delta^* + (e - c_1^*)\end{aligned}$$

where

$$\begin{aligned}\Delta^* &= \int p_i^*(e^i - e)di \\ &= \int (p_i^* - 1)(e^i - e)di = Cov(p_i^*, e^i)\end{aligned}$$

Δ^* is the covariance between $p_i^* = \Gamma'(W^{i^*})$ and e^i at the Ramsey solution, and captures the redistributive motive. It must be negative because $\Gamma'(W^{i^*})$ is decreasing in W^{i^*} but W^{i^*}

is increasing in e^i. This accords with intuition: to reflect equality concerns, the weights that the social welfare function assigns to different individuals must be inversely related to their endowments.

After manipulation, the previous equations yield the appropriate version of the Persson-Tabellini condition:

$$\frac{l^* V''(l^*)}{1 - V'(l^*)} = \left[e_1 - c_1^* - \frac{\Delta^*}{(\lambda^* - 1)} \right] \frac{(e_1 - c_1^*) U''(c_1^*)}{U'(c_1^*) - 1}$$

Compare with (5), keeping in mind that Δ^* is negative and represents the redistributive motive. The inclusion of the Δ^* term increases the expression in brackets in the RHS compared to the corresponding term in (5) (which is just $e_1 - c_1^*$). Hence, relative to (5), either the LHS must be larger or the ratio in the RHS must be smaller, or both. In any case, the key result is that the Ramsey outcome relies less on labor taxes and more on the inflation tax.

The result is intuitive and in line with the work of Rogers (1986). The more emphasis the Ramsey planner places on equality, the more reliance on the inflation tax, reflecting again that inflation has a redistributive aspect in this model.

5.2 Discretion and the Optimal Central Bank Mandate

We turn to the case without commitment. As the reader may have realized, time inconsistency and the associated inflation bias become a more acute problem when there is heterogeneity and the social welfare function is more egalitarian than average welfare. This is because, as agents arrive to $t = 2$ with different levels of nominal wealth, inflation at that point causes a redistribution from richer agents to poorer ones, as discussed. Hence, the more equality is valued by the social welfare function, the more attractive surprise inflation becomes *ex post.*

As in the case of an average social welfare function, however, the time inconsistency issue can be mitigated by assigning the central bank a mandate that differs appropriately from the egalitarian social welfare function. To see how, we assume that the central bank receives the mandate to maximize not the social welfare function $\int \Gamma(W^i)di$ but instead

$$\int \phi^i \Gamma(W^i)di \tag{18}$$

where, for each i, ϕ^i is a parameter that indicates the relative weight of household i in the mandate. As in the previous section, we ask what configurations for $\{\phi^i\}$ are socially desirable, and in particular whether a configuration exists which implements the Ramsey outcome under discretion.

Under discretion, the central bank's problem is then to choose l, τ, and π to maximize $\int \phi^i \Gamma(W^i)di$, with W^i given by (11), and subject to (13) and (14), with c_1 and m_1^i are given by previous decisions. Writing the Lagrangian as

$$\int \phi^i \Gamma(W^i)di + \lambda\left[\tau l + \pi(e - c_1) - g\right] - \nu\left[V'(l) - (1-\tau)\right]$$

the first order conditions are

$$\lambda\tau = \nu V''(l)$$

$$-l\int q^i di + \lambda l - \nu = 0 \tag{19}$$

$$-\int q^i(e^i - c_1)di + \lambda(e_1 - c_1) = 0 \tag{20}$$

where

$$q^i = \phi^i \Gamma'(W^i)$$

is the weight assigned to individual i in the central bank mandate.

Heterogeneity now enters through the last two equations. Comparing equations in this subsection and the preceding one, it can be seen that, in order for the central bank's mandate to implement the Ramsey allocation, it is necessary and sufficient to choose $\{\phi^i\}$ so that (19) and (20) coincide with (16) and (17). Note that this cannot be the case if ϕ^i is a constant independent of i, since in that case $q^i = \phi^i \Gamma'(W^i)$ would reduce to p^i, but then (20) would differ from (17) since $\mu^* > 0$. This indicates the time inconsistency problem if the central bank's objective is the social welfare function.

For (19) to coincide with (16), $\{\phi^i\}$ must satisfy $\int q^i di = 1$, that is,

$$\int \phi^i \Gamma'(W^i) di = 1$$

Recalling that $\int p_i^* di = \int \Gamma'(W^{i*}) di = 1$, the preceding expression says that an optimal mandate requires a mean preserving spread of the social marginal weights $\Gamma'(W^{i*})$.

The remaining condition for Ramsey implementation is that (20) coincide with (17). This will be the case if $q^{i*} = \phi^i \Gamma'(W^{i*})$ satisfies

$$\int q^{i*}(e^i - c_1^*) di = \int p_i^*(e^i - c_1^*) di + \mu^*$$

which can be rewritten as:

$$\int \phi^i \Gamma'(W^{i*})(e^i - e) di = \int \Gamma'(W^{i*})(e^i - e) di + \mu^* \tag{21}$$

This is the crucial result. We restate it as

Proposition. When the social welfare function has the form $\int \Gamma(W^i) di$, with $\Gamma(.)$ increasing and concave, a central bank mandate of the form $\int \phi^i \Gamma(W^i) di$ results in the Ramsey outcome if and only if

$$Cov(\phi^i \Gamma'(W^{i*}), e^i) = Cov(\Gamma'(W^{i*}), e_i) + \mu^*$$

Since $\mu^* > 0$ (from (15)) we obtain the following:

Corollary. $Cov(\phi^i \Gamma'(W^{i*}), e^i) > Cov(\Gamma'(W^{i*}), e_i)$.

Recall that $\Gamma'(W^{i*})$ is the marginal weight of individual i in the social welfare function, while $\phi^i\Gamma'(W^{i*})$ is i's weight in the central bank mandate. Hence the result is, again, that an optimal mandate for the central bank assigns weights to individual agents that are more strongly correlated with endowments than the corresponding weights in the social welfare function. In this sense, it is optimal for society to appoint a central banker that is less egalitarian than itself.

For added insight, rewrite the condition of the Proposition as $Cov((\phi^i - 1)\Gamma'(W^{i*}), e^i) = \mu^*$. Under discretion, time inconsistency means that the central bank can, when setting inflation in the second period of the model, ignore the fact that higher inflation induces agents to reduce their money holdings in the first period. In order to discourage the central bank to succumb to that temptation, an optimal mandate must penalize the central banker for engineering surprise inflation. Such a penalty can be created by setting appropriate individual weights in the central banker's objective; and because inflation is a tax on nominal wealth, the optimal weights for higher wealth individuals must be raised over their weights social welfare function. Thus the $Cov((\phi^i - 1)\Gamma'(W^{i*}), e^i)$ term expresses that the optimal mandate raises the cost to the central banker that arises from the redistributional effect of surprise inflation.

Why is it optimal to set $Cov((\phi^i - 1)\Gamma'(W^{i*}), e^i)$ equal to μ^*? The Lagrange multiplier μ^* is the shadow cost to the Ramsey planner associated with the constraint (12) which links money demand at $t = 1$ to expected inflation. This is precisely the constraint that the central bank ignores under discretion. Hence the condition $Cov((\phi^i - 1)\Gamma'(W^{i*}), e^i) = \mu^*$ of the Proposition says that, under discretion, an optimal mandate must raise the cost to the central banker from generating unexpected inflation so as to give him the exact same incentives as those of the Ramsey planner.

The Proposition leaves open the possibility that there may be many optimal choices for the weights $\{\phi^i\}$. For a specific choice, consider:

$$q_i^* = p_i^* + \phi(e_i - e)$$

where ϕ is a constant, we get (from (21)):

$$\phi = \frac{\mu^*}{Var(e_i)}$$

and hence

$$q_i^* = p_i^* + \mu^* \frac{e_i - e}{Var(e_i)} \tag{22}$$

Recalling that $q_i = \phi^i \Gamma'(W^i)$ an optimal choice of weights is given by

$$\phi^i = 1 + \frac{\mu^*}{\Gamma'(W^{i*})} \frac{e_i - e}{Var(e_i)}$$

The RHS increases with $e^i - e$ and with W^{i*}, which itself increases with e^i. This confirms that, to implement the Ramsey outcome, the central bank objective should give higher weight to households with higher endowments: the central bank's mandate should be less egalitarian than the social welfare function.

We close this section with two observations. First, the optimal mandate for the central bank may, at the end, be egalitarian in the sense of giving heavier weight to poorer agents. In other words, under an optimal central bank mandate, $Cov(\phi^i \Gamma'(W^{i*}), e^i)$ may be negative. But our results imply that this would be a reflection of the egalitarian nature of the social welfare function, and that $Cov(\phi^i \Gamma'(W^{i*}), e^i)$ would be less negative than $Cov(\Gamma'(W^{i*}), e^i)$. In terms of the specific implementation given by (22), the optimal mandate may prescribe that q^i decrease in e^i; but this can be the case only because p^{i^*} is decreasing in e^i, and sufficiently so to more than offset the impact of the term $\mu^*(e_i - e)/Var(e_i)$.

Second, while it is optimal to give the central banker a mandate that is less egalitarian than the social welfare function, the resulting outcome is optimal from the perspective of society, and correctly incorporates social concerns about distribution. This underscores the fact that the main role of the central bank mandate is to provide proper incentives to the central banker in the presence of a commitment problem.

6 Discussion, Extensions, and Final Remarks

Our analysis reveals that it may be socially beneficial to give central banks a mandate that incorporates distributional concerns, if there is heterogeneity and the central bank lacks commitment power. In that case, changing the central bank's mandate to reflect such concerns in an appropriate direction can change the central bank incentives so as to offset, and even to completely eliminate, the social losses associated with time inconsistency. This is the general message of this paper, one whose intuition is compelling and strong enough that it should be generally applicable in policy problems where heterogeneity is present.

A more specific message is that, in the presence of time inconsistency, the central bank mandate should be less egalitarian than the social welfare function. The validity of this message depends, of course, on the particular model that we have examined. So it may be useful to discuss which aspects of that model are essential for this version of the "conservative" central banker result.

The model we have developed is quite standard (as mentioned, is a direct extension of PT), and has as a key aspect that, in the absence of commitment, the central bank has an incentive to engineer surprise inflation. This is the source of the well known inflationary bias associated with time inconsistency. With heterogeneity, the model also implies that wealthier agents carry higher nominal balances, and hence they pay more of the inflation tax than the less wealthy. Hence, if a central bank mandate is to offset the inflation bias, it seems natural that the mandate should give higher weight than society to those agents that are more strongly affected by surprise inflation.

These considerations stress that the basic ingredients for our "conservative" result are that the central bank have an incentive to engineer surprise inflation and also that, *ex post*, the base of the inflation tax be nominal wealth. These two ingredients, or analogs to them, are intuitive and likely to be present in many settings.

For example, in any economy where there are creditors and debtors, and debts are denominated in nominal terms, surprise inflation will hurt creditors and benefit debtors. Adapting the analysis of our model to such a setting would suggest that, if the central bank lacks commitment power and has an incentive to inflate unexpectedly, changing its mandate to increase weight on creditors relative to debtors (relative to the social welfare function) will offset that temptation, and even possibly implement the best social outcome.

As usual, there are many extensions and variations of our analysis that are worth investigating. One is to examine what is the optimal central bank mandate in dynamic models with heterogeneous agents. A promising effort in that direction is the work of Davila and Schaab (2022). One aspect of their analysis is that the divergence between the central bank mandate and the social welfare function is likely to vary with time and respond to shocks. This is not counterintuitive, given that the central bank incentives to generate surprise inflation depend on time and uncertainty. On the other hand, that feature may be unrealistic as, in practice, the central bank mandate changes infrequently. How to reconcile this fact with the analysis of Davila and Schaab may be an interesting avenue for future work.

A different objection to our analysis might be that, in reality, central banks are not only charged with controlling inflation, but with possibly many other duties, such as financial regulation, supervision, and stability. One could then conjecture that the conservative central banker result may be overturned in models that focus on the role of the central bank as financial policymaker. That conjecture may well be true, but the appropriate model deserves to be fleshed out, and its implications compared with the ones that we have obtained here.

Ultimately, this paper is a call to focus on the questions on which, as economists, we can shed light. At least at this point, we hardly enjoy a comparative advantage in debates about the "right" social welfare function. On the other hand, we can offer a coherent analysis of how a central bank mandate can help overcome a policy distortion, in our case lack of credibility and time inconsistency, that results in suboptimal inflation bias. My discussion hopefully makes it clear that, in the presence of heterogeneity, including inequality concerns as a central bank objective may be welfare improving. The details turn out to be surprising, however, but (hopefully) insightful, suggesting that a useful approach may start by asking not about social objectives but, rather, about the role of the central bank mandate in accomplishing those objectives.

References

[1] Calvo, G., "On the Time Consistency of Optimal Policy in a Monetary Economy, " *Econometrica* 46 (1978), 647-661

[2] Carstens, A. "Central Banks and Inequality", Remarks to Markus' Academy, Princeton University's Bendheim Center for Finance. BIS, May 6 2021.

[3] Davila, E. and A Schaab, "Optimal Monetary Policy With Heterogenous Agents: A Timeless Ramsey Approach ", Working Paper, 2022

[4] Fischer, S. "Dynamic Inconsistency, Cooperation, and the Benevolent Dissembling Government, " *Journal of Economic Dynamics and Control* 2 (1980), 93-107

[5] Kaplan, G., B. Moll and G. Violante, "Monetary Policy According to HANK ", *American Economic Review* 108 (2018), 697-743

[6] Kydland, F. and E. Prescott, "Rules Rather Than Discretion: The Inconsistency of Optimal Plans, " *Journal of Political Economy* 85 (1977), 473-490

[7] Persson, T. and G. Tabellini, *Macroeconomic Policy, Credibility and Politics.* Harwood Academic Publishers, 1990.

[8] Rogers, C. A. , "The Effect of Distributive Goals on the Time Inconsistency of Optimal Taxes, " *Journal of Monetary Economics 17* (1986), 251-269

[9] Rogoff, K. (1985), "The Optimal Degree of Commitment to an Intermediate Monetary Target," *Quarterly Journal of Economics* 100 (1985), 1169-1190

[10] Warren, E. (2021), "Federal Reserve Racial and Economic Equity Act One Pager", at https://www.warren.senate.gov

[11] Walsh, C. "Optimal Contracts for Central Bankers ", *American Economic Review* 85, 1995, 150-67