Inequality, inflation, and central bank independence

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Abstract. What can account for the different contemporaneous inflation experiences of various countries, and of the same country over time? We present an analysis of the determination of inflation from a political economy perspective. We document a positive correlation between income inequality and inflation and then present a theory of the determination of inflation outcomes in democratic societies that illustrates how greater inequality leads to greater inflation, owing to a desire by voters for wealth redistribution. We conclude by showing that democracies with more independent central banks tend to have better inflation outcomes for a given degree of inequality. JEL Classification E5, H0

Inégalité, inflation et l'indépendance de la banque centrale. Quels sont les facteurs qui pourraient expliquer les expériences inflationnistes tellement différentes des divers pays dans le passé récent, et l'expérience tellement différente d'un pays donné dans le temps? Les auteurs analysent ce problème de la détermination du taux d'inflation dans une perspective d'économie politique. Ils déterminent qu'il y a une corrélation positive entre l'inégalité et l'inflation, et présentent une théorie de la détermination de l'inflation dans les sociétés démocratiques qui montre comment une inégalité plus grande entraîne une inflation plus grande à cause du désir des électeurs de demander une redistribution de la richesse. Le mémoire montre en terminant que les démocraties eqúipées de banques centrales plus indépendantes tendent à avoir de meilleurs résultats en terme d'inflation pour un degré d'inégalité donné.

1. Introduction

What can account for the different inflation experiences of different countries at any given point in time and of the same country over time? Between 1980 and

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1990, the average annual rate of inflation worldwide ranged from a low of −2.7 per cent in Kuwait to a high of 432.3 per cent in Nicaragua (*World Development Report 1992*, table 1). Since 1960, inflation in the United States has varied between a low of 0.7 per cent in 1961 to a high of 13.3 per cent in 1979. (*Economic Report of the President 1994*, table B-62). Both economic theory and experience tell us that the primary determinant of inflation is the rate of growth of the money stock relative to the demand for money. Thus, the inflation rate is determined solely by the policies pursued by a country's central bank or monetary authority. But this raises the question of what it is that determines the policies pursued by central banks. Why does one country's central bank consistently pursue a policy that produces low inflation, while another country's bank pursues a policy that generates relatively high inflation? Why does the same central bank generate widely different inflation rates at different times?

While there is undoubtedly a myriad of factors that underlie the process whereby decisions are made about how high (or low) the inflation rate should be, in this article we will explore the relationship between income inequality and inflation. We will start by showing that there is an empirical link between these two factors: countries with a high degree of income or wealth inequality also tend to have high inflation rates. Although it would be incorrect to infer that there is a direct link between these two factors, we will show that the political mechanism, operating through the conduct of monetary policy (as determined by the operation of the central bank), can generate a causal link from income inequality to redistribution policies that ultimately result in inflation.

It is by now well established that there is a significant relationship between the average inflation rates of various countries and the degree of independence of their central banks. In particular, countries with more independent central banks typically experience lower average rates of inflation, whereas countries with central banks that are more subject to direct political control tend to experience higher rates of inflation. The reason for this is fairly obvious. If the institution charged with the conduct of monetary policy is not subject to political pressure, it can concentrate solely on the pursuit of goals such as price stability. The growing appreciation on the part of politicians of all stripes of the importance of an independent central bank has led in recent years to several countries' granting their central banks greater autonomy from the executive and legislative branches of government and mandating the pursuit of price stability as the sole goal of monetary policy. The pioneers in this regard were New Zealand and Canada, followed by France and most recently by the United Kingdom. The recently established European Central Bank (or, more properly, the European System of Central Banks) will enjoy a degree of independence that is unprecedented, and it is also charged with the pursuit of price stability in the eleven-nation euro area as its primary objective.

There is a large literature evaluating the impact of independent central banks on economic performance. Banaian, Laney, and Willett (1983), Bade and Parkin (1992), as well as Cukierman et al. (1993), among others, study the impact of

central bank independence on price stability, while attempting to hold fixed other subjective features. They find a negative relationship between independence and inflation: more independence is typically associated with lower inflation. Alesina and Summers (1993) further confirm the negative relationship between independence and inflation and show that the superior inflation performance of countries with independent central banks does not come at a cost of worse performance in terms of real economic activity, whether measured by the growth rate of real GDP, the variability of real interest rates, or the unemployment rate. However, one question this literature leaves unanswered is: Given the institutional relationship between the central bank and the central government, why is it that we still see remarkable differences in inflation outcomes across countries? Alesina and Summers (1993) show that there tend to be greater differences in inflation outcomes across countries for a given degree of central bank independence the less independent is the central bank. This naturally begs the question of what gives rise to these differences.

To date there are relatively few general equilibrium models that attempt to explain why different economies would generate such widely different inflation outcomes.[1] Huffman (1997) is a notable exception. He studies an environment in which the inflation rate is determined by a political process in which individual agents vote on the desired inflation rate. He shows that under such an institutional arrangement, both the average rate of inflation and fluctuations in the inflation rate are higher than they otherwise might be. This institutional arrangement might be considered to be an extreme case of no central bank independence.

In this article we construct a dynamic general equilibrium model in which agents are heterogeneous in terms of their wealth levels and consequently prefer different rates of inflation. Following conventional practice in the political economy literature, we assume that in equilibrium the median voter determines the rate at which the money supply increases and, consequently, the rate of inflation. We show that greater income (or wealth) inequality in conjunction with a particular political mechanism can lead to higher rates of inflation. Finally, it is shown that if inequality is sufficiently large, the resulting rate of inflation may be higher than that which maximizes seignorage revenue.

Our model suggests that greater wealth or income inequality may lead to greater pressure on the monetary and fiscal authorities to print money to finance government expenditure programs. This leads us naturally to the question of whether countries with more independent central banks (greater separation of the monetary from the fiscal authority) are better able to resist pressure of this kind. We reexamine the inflation-inequality relationship, taking account of the degree of separation between the fiscal and monetary authorities by using some recently constructed measures of central bank independence prepared by Cukierman, Webb,

1 In a recent study Beetsma and van der Ploeg (1996) examine the same inequality-inflation nexus that is the focus of this paper, but they do so in the context of a partial equilibrium model.

and Neyapti (1992), and we show that greater central bank independence seems to alleviate the pressure to create more rapid inflation that comes from greater income inequality in a democratic society.

2. Inflation and inequality

There are two empirical strategies for studying the determination of inflation. The first is to examine the pattern of inflation in a single country over a long period of time. Over periods of time as long as fifty or a hundred years there may be sufficient variation in institutional arrangements and inflation outcomes to allow meaningful tests of different theories of the determinants of inflation. The second is to compare the experiences of a number of different countries over a shorter time period. The idea here is to use the differences in institutional arrangements across countries to shed light on the political determinants of inflation outcomes. We choose to follow the second course of action here, primarily because of data constraints. Our empirical strategy involved the construction of a data set consisting of observations on the degree of income or wealth inequality within a country and its inflation experience over the past forty years or so. The data on inequality were drawn from Deininger and Squire (1996), who construct a high-quality data set on income inequality for a large number of countries. The data on inflation were drawn from the *International Financial Statistics* published by the IMF.[2]

In table 1 we report some simple regressions that illustrate the strength of the inequality-inflation correlation.[3] We look at two different measures of income inequality. The first is the Gini coefficient of the distribution, which is formally defined as $G = 1 - 2 \int_0^1 L(y)\, dy$, where $L(y)$ is the Lorenz curve of the income distribution. The Lorenz curve plots the cumulative percentage of income earned by the bottom y-per cent of the population. If everyone earned the same income, the Lorenz curve would be a 45-degree line, and the Gini coefficient would be zero. As the distribution of income becomes more unequal, the Gini coefficient increases and is bounded above by 1. The second measure we look at is the difference between the proportion of income accruing to households in the top quintile of the income distribution, minus the proportion accruing to households in the bottom quintile.

The first two rows of the table show that regardless of which measure of inequality we use, there is a statistically significant relationship between inequality at the beginning of a decade and inflation over the course of the decade for the

2 The full sample for the inequality data is described in the data appendix. The measure of inequality that is used is that which is closest to the decade for which the inflation rate is available. For example, a single observation for a country may imply a data point corresponding to income inequality in 1980 and the inflation rate throughout the decade of the 1980s.

3 These and subsequent regressions are conducted using OLS. However, the standard errors for all these regressions and the significance levels of the parameter estimates reflect calculations done using White's (1980) method to correct for heteroscedasticity. This correction leads to slightly different estimates of these standard errors.

TABLE 1
Inflation and inequality

Intercept	Gini	Top 20% – Bottom 20%	*N*	$\overline{R}^2$
All countries				
1.159***	0.025**		101	0.07
(0.380)	(0.011)			
0.984**		0.029***	84	0.10
(0.402)		(0.011)		
Democracies				
1.180***	0.024*		56	0.05
(0.457)	(0.014)			
0.908*		0.031*	48	0.09
(0.542)		(0.016)		
Non-democracies				
1.238*	0.024		45	0.04
(0.686)	(0.018)			
1.102		0.026	36	0.05
(0.676)		(0.017)		

NOTES: * Denotes significance at the 10 per cent level; ** denotes significance at the 5 per cent level; *** denotes significance at the 1 per cent level. Heteroscedastic-consistent standard errors in parentheses. *N* denotes the number of observations included in the regression. The dependent variable in each case is the log of the average annual inflation rate, since there is some evidence of a non-linear relationship between the average annual inflation rate and the measures of inequality that we employ.
SOURCE: Author's calculations

countries in our sample. We then investigated whether this relationship depends at all on whether the countries in question are democracies or non-democracies.[4] The bottom four rows of the table show that while there is a relationship between inequality and inflation in democracies, the same is not true of non-democracies. For democracies, the degree of income inequality is capable of accounting for as much as one-tenth of the difference in the inflation experiences of these countries. Furthermore, the fact that the relationship is stronger in democracies reinforces the suspicion that the direction of causality might be from inequality to inflation rather than the other way around.

4 The classification of countries as democracies or non-democracies is drawn from appendix 1 of Alesina and Rodrik (1994). A country is classified as a democracy if it has at least two political parties and has regular general elections. This classification is also used by Beetsma and van der Ploeg (1996).

This simple statistical analysis is at least suggestive of a relationship between inequality and inflation, and it is to the formal modelling of this relationship that we now turn.

3. A Model of inequality, voting, and inflation

Consider an economy in which time is discrete and is indexed by $t = 1,2,3....$ In each period a new generation is born, and the individual members of each generation live for two periods. Each individual is endowed with some finite amount of a homogeneous consumption good in the first period of his life and with nothing in the second period. This endowment is idiosyncratic among the members of the agent's generation, in that it is determined by a probability distribution that will be denoted by $\mu(\cdot)$. We will periodically refer to this endowment as income, and the fact that it varies in size across members of a generation is the source of income inequality.[5]

Each agent has preferences defined over consumption in the two periods of his life. We assume that these preferences are described by the following utility function:

$$u(c_1,c_2) = \log(c_1) + \log(c_2), \tag{1}$$

where c_1 denotes consumption in the first period of life, and c_2 denotes consumption in the second period. Thus, agents want to consume in both periods of their lives, but they possess the consumption good only in the first period. These preferences over consumption are identical for all individuals. Hence, any differences on the part of individuals (as voters) in terms of their preferences for different government policies will not be due to differences in their fundamental or primitive preferences.

Agents in this economy are able to consume in the second period of their life (when they have no endowment) because of the existence of an asset that can be traded. This asset is fiat money. Agents 'purchase' money when young (by selling part of their initial endowment) and hold it until they are old. They use their holdings of fiat money in the second period of their life to purchase some of the consumption good.

We will also assume that agents receive a transfer payment from the government in the second period of their life, which will be labelled τ.[6] Therefore, the agent's budget constraints take the following forms:

$$c_1 = y - m \tag{2}$$

$$c_2 = mR + \tau. \tag{3}$$

Here, m represents the real value of currency holdings for an agent who

5 Thus we do not consider income inequality that is 'endogenously' determined by different individuals' decisions about how hard to work or how much capital (physical or human) to accumulate.

6 One could alternatively think of this as some public good which appears additively in the utility function of the agents.

possesses an endowment y, and R represents the real rate of return to holding fiat money. Additionally, the net rate of inflation can then be written as $\pi = (1/R) - 1$.

Agents form a plan for consumption and fiat money holdings by choosing values of c_1, c_2, and m to maximize (1) subject to (2) and (3). Straightforward substitution allows us to reformulate the agents problem as one of choosing a value for m. The solution to this optimization problem can then be written as

$$m = \frac{y}{2} - \frac{\tau}{2R}. \tag{4}$$

This relationship is more appropriately considered a savings function rather than a money demand function. Under the savings function interpretation, it has the usual properties that savings are positively related to income and real interest rates and negatively related to government transfers.

What remains is to specify how the government policies are determined. In particular, we assume that at the beginning of each period t, before consumption has taken place, the young agents vote on the desired inflation rate that will prevail from period t to period $t + 1$.[7] The increase in the money stock needed to implement the chosen policy is generated through lump-sum transfers of currency of the same amount to all old agents in period $t + 1$ – the same agents who, when young, voted to determine this policy during the previous period. Of course, this results in a relationship between the level of the lump-sum transfer τ, the level of the inflation rate, and the amount of aggregate real money holdings. Let M_t denote the stock of nominal money balances outstanding at the end of period t. If we assume that the money stock grows at a constant rate each period, then

$$M_t = (1 + \pi)M_{t-1}$$

or

$$M_t - M_{t-1} = \pi M_{t-1} = \left(\frac{\pi}{1 + \pi}\right) M_t.$$

We are assuming that the only activity undertaken by the government in this economy is making transfer payments to the old, and that all of these transfer payments are financed by money creation. Thus, the government's budget constraint (in nominal terms) is simply

7 Since the utility of the existing old generation at date t does not depend on the rate of inflation from t to $t + 1$, our assumption that only the current young vote is not a restrictive one; the current old are indifferent as to the voting outcome. If, instead, we had let the voting take place at the end of the period after any purchases had taken place – and young agents' money-holdings decided on – then this would be an entirely uninteresting problem since inflation then acts as capital levy on (fixed) money balances. In the assumed timing arrangement, the voting outcome amounts to a decision to transfer wealth *within* a given generation, rather than *between* generations.

$$T_t = M_t - M_{t-1},$$

where T_t denotes the dollar value of transfer payments made during period t. Substituting for the growth of the money stock during the period using the expression above, dividing by the price level to put everything in real terms, and dropping time subscripts, we obtain

$$\tau = \left(\frac{\pi}{1 + \pi}\right)\overline{m} = (1 - R)\overline{m},$$

where $\overline{m}$ is the average quantity of money held by agents. From the agents' savings functions, as given in equation (4), we have that

$$\overline{m} = \frac{\overline{y}}{2} - \frac{\tau}{2R},$$

where $\overline{y} = \int y\mu\ (dy)$ is the average level of wealth among a cohort of agents. Substituting this into the previous expression, and solving for τ, we obtain

$$\tau = \overline{y}\left[\frac{(1 - R)R}{(1 + R)}\right]. \tag{5}$$

We can substitute this expression for the level of transfers back into the agent's utility function (1), together with the budget constraints (2) and (3) and savings function (4), to obtain an 'indirect' utility function. The indirect utility function expresses the maximum attainable lifetime utility of an agent as a function of the rate of return to money (R), given the agent's own wealth (y) and the average wealth of agents in the economy ($\overline{y}$). Specifically,

$$V(R;y,\overline{y}) = 2\log(y) + \log(R) + 2\log\left[1 + \frac{(\overline{y}/y)(1 - R)}{(1 + R)}\right] - 2\log(2). \tag{6}$$

Obviously, the individual's utility is then dependent upon three factors:

1. the individual's own endowment or income (y);
2. the real rate of return to holding fiat money (R) or equivalently, the inflation rate, (π); and
3. the average level of income of the individual's cohort ($\overline{y}$).

The latter factor is important, since it is the average level of income that will determine the size of the real transfer payment that the agent receives from the government. In particular, given y, the agent's utility is increasing in the average wealth of his cohort $\overline{y}$, since a higher average income increases the size of the transfer payment.

Note that the utility function given by equation (6) is concave in R for $R \geq 0$. Therefore, in this instance, for a fixed level of income (y) an agent has a most preferred value of R, and hence a most preferred level of inflation. Figure 1 plots equation (6), as a function of various inflation rates, for various values of $\overline{y}/y \equiv$

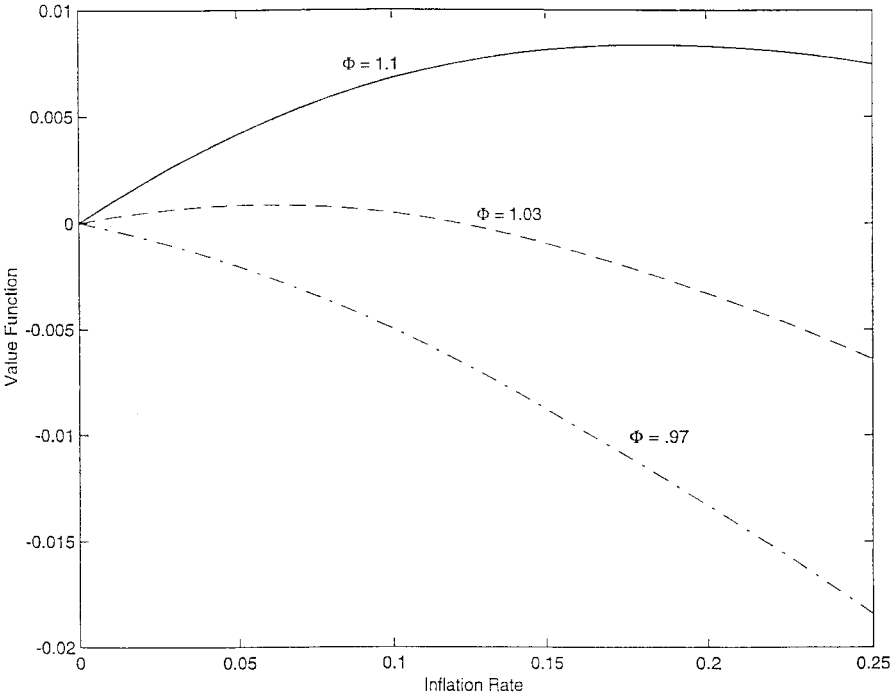

FIGURE 1

Φ, holding fixed the level of income (y). Clearly for higher values of Φ, higher inflation is preferred by the agent. That is, the lower the agent's endowment relative to the mean of his cohort, the more inflation he prefers.

Now, consider the problem faced by an agent who could choose the rate of return on money (R). For a randomly chosen agent, his welfare may or may not be increasing in the rate of return to currency. The agent will choose a value for R to maximize (6), subject to the constraint that $R \in (0,1]$. It should be clear that $R > 0$ is not much of a constraint, since $V(R;y,\bar{y}) = -\infty$ for $R = 0$. Restricting $1 \geq R$ simply limits the agents to choosing non-negative inflation rates.

Let $R(\Phi)$ denote the preferred value of R for an agent whose ratio of average income to own income is Φ. For $\Phi \leq 1$ we have $R(\Phi) = 1$, since the objective function (6) is strictly increasing in R over [0,1] when $\Phi \leq 1$ (see figure 1). That is, agents who are wealthier than average prefer a zero inflation rate. For an agent who is poorer than average, one with $\Phi > 1$, the preferred value of R is interior to [0,1] and is given by a quadratic equation that has the following solution:[8]

8 The other solution to the quadratic first-order condition has the return R being a large negative number – between $-\infty$ and -5, for $\Phi > 1$ – which is neither a sensible solution for a gross rate of return nor even a point at which the indirect utility function V is defined.

$$R(\Phi) = \frac{\sqrt{5\Phi^2 - 4\Phi} - (2\Phi - 1)}{\Phi - 1}. \tag{7}$$

To map the preferred rate of return on money of each individual agent into a policy outcome, we follow the conventional practice of invoking the median voter theorem.[9] Let y_m denote the median level of income in a cohort – that is, y_m satisfies $\int_0^{y_m} \mu(dy) = 0.5$ – and let $\Phi^m = \bar{y}/y_m$. We assume that the rate of return to money is set to the preferred rate of return for the agent with income y_m; that is, $R(\Phi^m)$, which is equal either to one or to the value given by expression (7), depending on whether $\Phi^m \leq 1$ or $\Phi^m > 1$. With the outcome of the voting process determined by the median voter, just less than 50 per cent of the individuals will prefer a higher inflation rate (i.e., the poorer agents), while just less than 50 per cent of the individuals will prefer a lower inflation rate (i.e., the richer agents).

We can also calculate the value of R, or equivalently of π, that maximizes government revenue. This amounts to finding the value of R that maximizes the value of τ given by equation (5). After some algebra, it can be shown that this rate of return is $R_{\max} = -1 + \sqrt{2}$. For values of $R < R_{\max}$, further increases in the inflation rate or decreases in R result in less seignorage revenue. We sometimes refer to this as being on the 'wrong side of the Laffer curve' (for a related result see Faust 1996).

From (7), higher values of Φ result in lower values of R (equivalently, higher values of π). Thus, comparing two economies that differ only in their degrees of income inequality, as measured by the ratio of mean to median income, the economy with a higher degree of inequality will have a lower rate of return to holding money. It is also possible to show that when $\Phi^m > 1 + \sqrt{2}$, then the resulting $R < R_{\max}$. That is, if there is a sufficiently large degree of inequality in this economy, the result could be *too much inflation*.[10] This is a novel result, since typically, when such an outcome is possible, it is because of the 'stability' of this high-inflation equilibrium and the instability of a corresponding low-inflation equilibrium. After all, for any equilibrium in which $R < R_{\max}$, there is also another equilibrium in which the inflation rate is lower ($R' > R_{\max}$) and in which the government seignorage revenue is identical. Since the latter equilibrium has a higher rate of return to saving, why would an economy instead arrive at an equilibrium in which the rate of return was so low? The answer hinges on the fact that the median voter in this economy considers not only the welfare impact of changes in the rate of inflation, but also the impact of the (real) size of the government transfer payment. If the benefit to the median voter of a higher transfer payment from the government outweighs the detrimental effect of the higher inflation rate

9 The median voter theorem is clearly applicable in this case, as agents' preferences over R are single peaked.

10 Although there are infinitely many ways to characterize inequality, for our purposes here what is relevant is the ratio of mean to median income.

needed to finance the transfer payment, then the median voter may prefer a *very* high inflation rate.[11]

It is also worth noting one other feature of this model. We focus on the case where $\Phi^m > 1$, since this characterizes most empirical distributions of income or wealth. That is, most empirical distributions of income or wealth exhibit substantial right skewness (large numbers of relatively poor people, small numbers of very rich people). In this model, this characteristic of the income distribution results in lump-sum government transfers, which cause inflation. On the other hand, if $\Phi^m < 1$, then our model would predict *deflation,* which is financed by lump-sum *taxation.*

Given the above analysis, one might wonder why there is not a stronger relationship in the data between inflation and inequality. In the model, we have assumed for simplicity that there is only one policy instrument and one policy mechanism, which permits agents to acquire resources and influence relative prices through the political process. In practice, of course, there is a large number of such instruments and mechanisms. That is, through the political process in actual economies governments design and implement very complex tax codes, institute a plethora of trade barriers and subsidies, spend and transfer trillions of dollars, design and regulate financial markets, and so on. All of these activities have distortional and redistributive effects on economies. It is not surprising that, as we look across countries with different degrees of inequality, we see vastly different political, fiscal, judicial, and legal structures. This is what we would expect if we accept that agents' voting preferences were going to influence the policy-making mechanism.

The model described above is sufficiently stylized that it provides a closed-form decision rule and a value function that is easy to characterize. However, the implications are much more general. Inequality in income and holdings of nominally denominated assets leads poorer agents to try to extract resources from their counterparts, and inflation is the mechanism that generates this transfer of resources. There are many other environments in which this type of transfer of resources, from rich to poor agents, would take place and would be accompanied by inflation. For example, we could permit agents to invest in capital through a financial intermediary, and there could be a reserve-requirement, in the form of fiat currency, imposed on these deposits. If agents could then vote on the size of this inflation tax, it would be straightforward to show that, again, increased inequality would lead to inflation. The analysis would be much less straightforward and would not give rise to any easily characterizable decision rule or value function.

11 It should be noted that because of the simple nature of the model, the inflation tax acts as an *intragenerational* transfer, and there are no intergenerational transfers. In a more complicated environment, say, where agents live for more than two periods, then the median voter might be someone who has existed in the economy for several periods and will continue to live for several more periods. There would then be transfers both between and within generations. Characterizing the preferences of such a median voter would be much more difficult in this instance.

4. Central bank independence

The model presented above has implications for the issue of central bank independence. Obviously, if the central bank for this model economy were completely detached from any political pressure and instead given the sole mission of achieving price stability, there is nothing standing in the way of this objective, since it could be accomplished simply by not letting the money stock grow at all. Of course, if the central bank in the economy above were given such a mandate, it would drastically restrict the options available to the fiscal authorities in terms of their ability to make transfer payments, but that is another issue.

Thus, the analysis above suggests that a high degree of wealth or income inequality, *together with certain institutional arrangements*, is an important factor in generating high rates of inflation. That is, it is not merely inequality alone that determines inflation. Presumably, a secure governing authority that is quite oblivious to the characteristics of the individual agents would not feel compelled to react to increased inequality with higher money supply growth. Our statistical analysis earlier showed that the relationship between inflation and inequality that characterizes democracies is much weaker in non-democracies. This begs the question of how democracies with independent central banks fare.

To address this question we extended our earlier statistical analysis to take account of the degree of independence of a country's central bank. We used the measures of central bank independence constructed by Cukierman, Webb, and Neyapti (1992), which build on the earlier measures of central bank independence developed by Bade and Parkin (1992), Alesina (1988) and Grilli, Masciandaro, and Tabellini (1991). The latter groups of authors focus on legal independence in determining how independent a central bank is. Cukierman, Webb, and Neyapti also construct more subjective or informal measures of independence that examine, for example, how frequently central bank governors are replaced. The primary shortcoming of measures of independence based on laws is that laws are inevitably incomplete because they cannot delineate the bounds of authority between a nation's central bank and central political authorities under all possible states of the world. Furthermore, even in cases where the law is quite explicit, actual practice may deviate from it along significant dimensions. For example, in Argentina the term of office of the governor of the central bank is four years, but traditionally governors offer to resign whenever there is a change in government or the finance minister resigns. As a result, between 1950 and 1989 the average term in office of the governor of the Argentine central bank was about one year.[12]

To see whether the degree of independence of a country's central bank influenced the relationship between inequality and inflation outcomes we simply repeated the simple regression in table 1, adding as explanatory variables Cukierman,

12 This has been changed with the introduction of a new Central Bank Charter for Argentina in 1992.

TABLE 2a
Inflation, inequality and central bank independence

Intercept	Gini	Top 20% – Bottom 20%	Central bank independence	Turnover	*N*	$\overline{R}^2$
All countries						
1.393***	0.029**		−1.051		79	0.10
(0.41)	(0.012)		(0.655)			
1.079***	0.020**			1.203*	81	0.14
(0.379)	(0.010)			(0.722)		
1.190**		0.032***	−0.881		68	0.13
(0.479)		(0.012)	(0.726)			
0.825**		0.026***		1.218	68	0.17
(0.402)		(0.010)		(0.843)		
1.448***	0.020**		−1.119*	1.263*	79	0.16
(0.393)	(0.009)		(0.611)	(0.705)		
1.179**		0.025**	−0.923	1.270	68	0.18
(0.478)		(0.010)	(0.691)	(0.827)		

NOTES: See table 1, notes and source.

Webb, and Neyapti's measure of legal central bank independence and their measure of the frequency with which central bank governors are replaced. The results of this exercise are reported in table 2a and table 2b. The first point to note is that, when we look across all countries, inequality is still significantly positively correlated with inflation even after we account for the degree of central bank independence. The measure of central bank independence is negatively correlated with inflation (confirming what many other authors have found), but the relationship is rarely significant in a statistical sense. Note, however, that the *t*-statistic is greater than one in all cases, indicating that the measure of central bank independence does contribute to our ability to explain cross-country differences in inflation. By contrast, the measure of frequency of turnover of central bank governors has some predictive power and is statistically significant at the 10 per cent level in two of the regressions. It also has the expected positive sign.

When we break the sample into democratic and non-democratic countries, we find somewhat more interesting results. We find that for democracies, both the measure of central bank independence and the measure of turnover of central bank governors have much less significance in explaining inflation than do the measures of inequality. We are able to account for as much as 12 per cent of the cross-country differences in inflation rates simply by looking at the degree of income inequality in a country and the extent to which the central bank is free from political interference. In most cases, however, the *t*-statistic on the central bank independence variable is greater than one, confirming that the measure of legal independence adds to our ability to account for cross-country differences in inflation rates in democracies. Note that for the non-democracies, the inclusion of the measure of inequality is generally of no significance in explaining inflation. Furthermore, while

TABLE 2b
Inflation, inequality, and central bank independence

Intercept	Gini	Top 20% – Bottom 20%	Central bank independence	Turnover	N	$\overline{R}^2$
Democracies						
1.261**	0.030**		−0.762		50	0.083
(0.536)	(0.014)		(0.611)			
1.127**	0.022*			0.609	50	0.082
(0.439)	(0.013)			(0.758)		
0.932		0.036**	−0.571		44	0.118
(0.703)		(0.017)	(0.696)			
1.397***	0.023*		−0.853	0.686	50	0.089
(0.485)	(0.012)		(0.568)	(0.738)		
0.741		0.033**		0.363	44	0.114
(0.522)		(0.014)		(0.908)		
1.013		0.032**	−0.657	0.446	44	0.106
(0.64)		(0.015)	(0.648)	(0.887)		
Non-democracies						
1.710**	0.030		−2.264		29	0.033
(0.643)	(0.022)		(1.943)			
0.873	0.021			2.087*	31	0.171
(0.728)	(0.016)			(1.175)		
1.641***		0.037	−3.489		24	0.049
(0.617)		(0.023)	(3.119)			
0.624		0.024		2.276*	26	0.212
(0.732)		(0.015)		(1.226)		
1.240*	0.024		−1.649	2.081*	29	0.164
(0.749)	(0.017)		(1.573)	(1.141)		
0.904		0.031*	−2.177	2.277*	24	0.201
(0.789)		(0.016)	(2.461)	(1.165)		

NOTES: See table 1, notes and source.

the measure of legal central bank independence is of little significance, the measure of turnover is statistically significant at the 10 per cent level.

These results are corroborated by the work of Beetsma and van der Ploeg (1996), who find a positive relationship between inequality and inflation for democracies, but not for non-democracies. However, they employ a different measure of inequality than ours, look at a smaller sample of countries and do not look at the additional statistical significance of central bank independence.[13]

13 Deininger and Squire (1996) give a rather exhaustive list of measures of inequality for various countries at various dates. They acknowledge that some of this data are more reliable than is other data. Some of our observations reflect data in the 1990s, which makes this data more recent than those measures used by Alesina and Rodrik (1994) or Beetsma and van der Ploeg (1996).

5. Conclusion

We have shown that economies with high levels of income inequality also tend to have higher average levels of inflation. This correlation is particularly evident in democratic nations. In this paper we have suggested that the relationship between these two variables is causal and, furthermore, that the direction of causation is from inequality to inflation. We also presented evidence that suggests that this causal mechanism is operative only under certain institutional arrangements in a democracy, specifically in the absence of an independent central bank. Arguably, the causal mechanism suggested here is more plausible than the reverse argument, since the inflation rate is ultimately determined by policies, and these policies are determined by some institutional structure. In democratic societies, policy outcomes are determined through the interaction of voters' preferences with the institutional structure.

It is interesting that the statistical findings are so different for the democracies and the non-democracies. One reason might be that in non-democracies, inequality in income is not reflected in the policies, or policy-making institutions, as it would be in other countries. That is, in non-democratic countries, there are alternative mechanisms for people with unequal incomes to alter the political outcomes and the allocation of resources. Similarly, these countries can have quite different policy-making institutions, and these institutions can be quite difficult to characterize. Even in countries that would appear to have institutionalized independent central banks, it is possible to circumvent this arrangement.[14] In general, we would expect that in countries with certain institutions – such as multiple political parties and regular elections – the wants and desires of a majority of the voters should carry more weight than in those countries that do not have these institutions.

One might criticize the model described above because rich individuals do not typically hold a large amount of their wealth in the form of money. This is only a simplification made to facilitate the exposition and is not critical. What is important is that rich agents would be more harmed by inflation in some absolute sense than poorer agents would be. It is not hard to see why this would be the case. In the United States richer agents hold billions of dollars in dollar-denominated assets, especially through pension and mutual funds. Higher inflation certainly hurts these individuals directly.[15] Furthermore, it is widely believed that inflation lowers the real price of capital – and hence its rate of return – through the erosion of the real value of tax depreciation allowances, which are denominated in nominal terms.

14 Even in Britain, which is not usually thought of as having a very independent central bank, the new Labour government quickly adopted policies that were designed to make this institution more autonomous. If it is possible for elected politicians to give such power, however, it should be also be possible for it to be taken away.

15 Of course, in many developed countries richer individuals choose to hold nominally denominated assets because the inflation rate is low, and they lobby for a low inflation rate to protect this investment.

This effect primarily hurts more wealthy individuals, since they hold title to most of this capital.

Data appendix

As noted in the text our data come from three different sources. The inflation data are taken from the IMF publication *International Financial Statistics*, various issues. The measures of income inequality are from Deininger and Squire (1996). The two measures of central bank independence that we use are taken from Cukierman, Webb, and Neyapti (1992). We have observations on all variables for the following countries for the time periods indicated.

Australia (D)		1970s	1980s	Korea	1960s	1970s	1980s
Bangladesh	1960s	1970s	1980s	Malaysia (D)		1970s	1980s
Brazil	1960s	1970s	1980s	Mexico	1960s	1970s	1980s
Canada (D)	1960s	1970s	1980s	Nepal			1980s
Chile (D)		1970s	1980s	Netherlands (D)		1970s	1980s
Columbia (D)		1970s	1980s	New Zealand (D)		1970s	1980s
Costa Rica (D)	1960s	1970s	1980s	Norway (D)	1960s	1970s	1980s
Denmark (D)			1980s	Pakistan		1970s	1980s
Egypt	1960s	1970s	1980s	Panama		1970s	1980s
El Salvador			1980s	Philippines	1960s	1970s	1980s
Fiji			1980s	Sierra Leone		1970s	
Finland (D)		1970s	1980s	Singapore		1970s	1980s
France (D)	1960s	1970s	1980s	Spain (D)	1960s	1970s	1980s
Germany (D)	1960s	1970s	1980s	Sri Lanka (D)	1960s	1970s	1980s
Greece (D)		1970s	1980s	Sweden (D)		1970s	1980s
Honduras		1970s		Taiwan	1960s	1970s	1980s
Hong Kong		1970s	1980s	Thailand	1960s	1970s	1980s
India (D)	1960s	1970s	1980s	Trinidad and Tobago	1960s	1970s	1980s
Indonesia		1970s	1980s	Tunisia			1980s
Iran		1970s	1980s	Turkey (D)		1970s	
Jamaica (D)	1960s	1970s	1980s	UK (D)	1960s	1970s	1980s
Japan (D)	1960s	1970s	1980s	US (D)	1960s	1970s	1980s

We denote democracies by (D), following the classification in Alesina and Rodrik (1994). A diskette containing all of the data and programs is available from the authors on request.

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