On inflation, wealth inequality and welfare in emerging economies

Sunel, Enes

University of Maryland, College Park, Department of Economics

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On Inflation, Wealth Inequality and Welfare in Emerging Economies*

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Enes Sunel†
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Abstract

Evidence shows that globally observed disinflation in the last two decades has been more predominant in emerging economies. This paper undertakes a quantitative investigation of the distributional and welfare consequences of a sharp reduction in inflation in a monetary model of a small open economy with uninsured idiosyncratic earnings risk. Consumers hold non-interest bearing real balances (demand deposits) that economize transactions costs of consumption and internationally-traded risk-free bonds (term deposits) that are useful for consumption smoothing. Bonds are modeled as inflation-indexed to incorporate financial dollarization. Analytical results for deterministic economies show that alternative fiscal responses to inflationary finance create various redistributive wealth effects in addition to wealth-eroding and consumption-distorting effects of inflation. The stochastic model is calibrated to Turkish data and is used to compare stationary equilibria with quarterly inflation rates of 15% (for 1987:1-2003:4) and 2% (for 2004:1-2009:4) under alternative fiscal arrangements. I find that (i) when uniform transfers are endogenous, reducing inflation lowers aggregate welfare by 2.65% in terms of compensating consumption variation. This is because the reduction in the costs of inflation for the poor is less than the decrease in transfers. This also tightens natural debt limits, increases precautionary savings motive and causes the distribution of bonds to be more equitable. When endogenous transfers are proportional to individual-specific inflation tax payments, aggregate welfare increases by 0.5%. This is because proportional transfers do not drive redistributive effects. Welfare gains increase further (1.67%) if wasteful spending is endogenous. The model also generates a cross sectional portfolio consistent with the disaggregated deposits data and the literature.

Keywords: Small open economy, incomplete markets, welfare effects of inflation

JEL Classification: D31, F41, E52

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†University of Maryland; sunel@econ.umd.edu; http://www.econ.umd.edu/~sunel

1 Introduction

Inflation has been declining throughout the world in the last two decades. In Table 1 below, I report the time series average of annual CPI inflation rate for a number industrialized and emerging countries. For each country, two periods, for which inflation has been high and low respectively, are pointed out. Evidence shows that structural changes in inflation has been more predominant in emerging economies (who have a record of high inflation) compared to industrialized countries.[1]

Table 1: Disinflation as a Structural Change

Advanced	**High (Per.)**	**Low (Per.)**	**Emerging**	**High (Per.)**	**Low (Per.)**
Italy	15[a] (73-85)	4 (86-08)	Brazil	135 (60-94)	11 (95-08)
UK	10 (70-91)	3 (92-08)	Argentina	115 (75-94)	6 (95-08)
France	9 (68-85)	2 (86-08)	Peru	71 (74-91)	9 (92-08)
Japan	7 (60-81)	1 (82-08)	Turkey	60 (77-02)	10 (03-08)
U.S.	7 (70-85)	3 (86-08)	Mexico	53 (74-88)	14 (89-08)
Canada	7 (71-91)	2 (92-08)	Bolivia	35 (73-83)	9 (84-08)
Advanced[b]	7 (60-90)	2 (91-08)	Emerg.&Dev.[b]	49 (79-95)	10 (96-08)

[a] Period average of annual CPI inflation rate, %.
[b] These classifications reflect aggregations of the IMF.
Source: International Financial Statistics, the IMF.

There is a growing, fruitful literature on the consequences of inflation in environments with a non-degenerate distribution of households (For examples, see Erosa and Ventura (2002), Akyol (2004), Molico (2006), Doepke and Schneider (2006), Albanesi (2007), Chiu and Molico (2007), and Meh et al. (2008)). In this paper, I quantitatively investigate the distributional and welfare consequences of recent disinflation in emerging economies, which have been unexplored by studies on the effects of inflation in heterogeneous agents frameworks.

The question posed in this paper is motivated by particular financial system characteristics of emerging economies that are key in relation to disinflation: In emerging economies; *(i)* the distribution of financial assets displays substantial inequality and financial assets portfolio is not uniform across people; *(ii)* financial system exhibits a high degree of dollarization that affects the vulnerability financial assets to inflation in a particular way; *(iii)* financial dollarization (FD, hereafter) is systemically more predominant in countries that have an inflationary past and exhibit strong exchange rate pass through.[2]

[1]See the Data Appendix for the methodology of determining the structural break dates and a complete list of countries.

[2]See Section 2 for a detailed documentation of these facts.

This paper develops a monetary model of a small open economy with uninsurable idiosyncratic risk and incomplete markets. The model economy is populated by a continuum of consumers and a government. There is no aggregate uncertainty. Infinitely-lived consumers face idiosyncratic earnings shocks and consume a tradable consumption good. They hold *(i)* non-interest bearing real balances that economize transactions costs of consumption and *(ii)* internationally-traded risk-free bonds that are useful for consumption smoothing under the presence of idiosyncratic earnings shocks. Furthermore, consumers face ad-hoc borrowing constraints, which dampen their ability to smooth consumption.

I assume that there is perfect mobility in capital and goods markets so that the domestic nominal interest rate is determined by a parity condition and the domestic price level is determined by the law of one price. Because of the latter, domestic inflation rate is equal to the depreciation rate of the currency. These assumptions cause bonds to be fully dollarized (inflation-indexed) so that their real return does not depend on domestic inflation. I assume that the *de facto* exchange rate regime is practically a managed float. Therefore monetary authority is able to manipulate the level of the depreciation rate exogenously. Within this framework, for a given depreciation rate of currency, monetary authority prints as much money as the private sector demands.

Empirical literature has documented a positive and strong relationship between fiscal deficits and inflation in emerging (high inflation) economies (e.g. see, Fischer et. al (2002), Catao and Terrones (2005)). To that end, I assume that the government uses seigniorage revenues to finance lump-sum transfers and wasteful spending. In order to explore the mediating role of fiscal policy on the distributional and welfare consequences of inflation, I study fiscal arrangements with *(i)* endogenous uniform transfers; *(ii)* endogenous government spending; *(iii)* endogenous transfers that are proportional to individual specific inflation tax payments. These arrangements are meant to analyze the redistributive role of wealth effects created by fiscal policy.

I calibrate the model to the low inflation period (2004:1-2009:4) of the Turkish economy, which is representative of the disinflation phenomenon and the afore-mentioned financial system characteristics of emerging economies. The main quantitative exercise is to compare stationary equilibria with quarterly inflation rates of 15% (for 1987:1-2003:4) and 2% under alternative fiscal arrangements.

I find that *(i)* when uniform transfers are endogenous, reducing (the quarterly) inflation rate from 15% to 2% lowers aggregate welfare by 2.65% in terms of compensating consumption variation. This is because the inflation tax incidence of the poor is less than transfers so that when inflation is high, lump-sum transfers create positive wealth effects in favor of them. *(ii)* When wasteful spending is endogenous, aggregate welfare increases by 1.67%. This is because wealth effects created by inflationary finance (and favor the poor) are muted when transfers are constant. *(iii)* Finally, when endogenous transfers are proportional to individual-specific inflation tax payments, aggregate welfare increases by 0.5%. The welfare gains in this case are lower than the endogenous spending case because wasteful spending does not decrease when inflation is lower.

The theory developed in this paper is consistent with the findings of the empirical literature that the poor hold a larger fraction of their assets in cash. This is due to the proportional relationship between consumption and money holdings of consumers who are not borrowing constrained and the typical property of incomplete markets models that consumption-to-wealth ratio decreases with wealth.

In this model, welfare of consumers are affected by inflation through the following channels: *(i)* Inflation leads to a wealth eroding due to inflation taxation. *(ii)* Inflation creates a distortion in consumption since it makes real balances (that economize transactions costs) less desirable. In addition to these standard effects, redistributive wealth effects that are driven by alternative fiscal arrangements play various important role in mediating welfare consequences of disinflation.

The impact of disinflation on portfolio choice manifests itself through substitution and wealth effects, where the latter crucially depends on the fiscal response to inflationary finance. Specifically, when endogenous lump-sum transfers are uniform, reduction in transfers driven by disinflation, tightens natural debt limits of the poor and increases their precautionary savings motive. This causes the distribution of bonds to be more equitable. In contrast, when transfers are proportional, such wealth effects are partially neutralized and due to substitution effects, consumers demand less bonds. This reduces the interest income unambiguously, since the real interest-rate is exogenous and constant. In fact, if wealth effects are eliminated completely, disinflation reduces welfare through this channel.

This paper is closely related with the studies of Erosa and Ventura (2002) and Albanesi (2007). Both studies incorporate a costly transaction technology that displays economies of scale so that the poor choose to consume "cash" goods. The current paper differs from the former study by showing that if the redistribution effect is predominant, the poor benefit from inflationary finance while holding a portfolio which is more vulnerable to inflation. Moreover, I analyze the effect of inflation on financial wealth inequality, changing the direction of causality emphasized by the latter study.

I abstract from the redistributive role of inflation among debtors and creditors of local currency denominated nominal contracts. The motivation for doing so derives from the idea that high inflation economies have developed particular methods (such as financial dollarization) to cope with this phenomenon.[3] Iacoviello (2005) argues that such effects are actually important in low inflation (developed) economies.

This paper contributes to the monetary economics literature that incorporates imperfectly insured idiosyncratic risk framework. Imrohoroglu (1992) and Molico (2006) study the precautionary demand for money but abstract from portfolio composition. Imrohoroglu and Prescott (1991), Chatterjee and Corbae (1992), Akyol (2004), Ragot (2009) and Wen (2010) include interest bearing assets but do not model money as an asset that economizes transactions costs. Therefore, inflation acts as a savings tax on households (not as an indirect consumption tax), and most of the welfare effects originate from increased consumption volatility. The recent work by Doepke and Schneider (2006) and Meh et. al (2008) study the welfare effects of an inflation shock that is modeled as a zero sum redistribution of real wealth. Chiu and Molico (2007) explore the welfare cost of inflation in developed economies in a search-theoretic environment with costly liquidity management and find that welfare costs of inflation are smaller than those estimated by representative agent models. Kehoe et al. (1992) analytically find that the optimal inflation rate might be positive if lump-sum transfers are considered. The theoretical contribution of the current paper emerges from its effort of reconciling the monetary model of the small open economy (which has been commonly used to study exchange-rate-based stabilizations) with incomplete markets, uninsured idiosyncratic risk framework. On empirical grounds, the main contribution of this paper is to document the structural change in inflation as a worldwide phenomenon and to explore its implications in emerging economies, using a calibrated model economy.

The rest of the paper is organized as follows. Section 2 reviews key facts regarding financial dollarization and the distribution of financial assets in emerging economies. Section 3 describes the theoretical model. Section 4 shows the workings of the model and defines the stationary recursive equilibrium. Section 5 describes the parameterization of the model and reports our findings. Section 6 includes sensitivity analysis, and finally, Section 7 concludes the paper.

[3] Berument and Guner (1997) and Berument and Gunay (2003) find that nominal deposit and treasury auction rates have provided a good hedge against inflation and currency depreciation during the high inflation period in Turkish economy.

2 Key Facts

In this section, I document some financial system characteristics of emerging economies, which are among the building blocks of the question asked in this paper. In particular, I document *(i)* financial dollarization and *(ii)* properties of the distribution of deposits in emerging economies, from which the motivation of modeling bonds as inflation-indexed and using a heterogeneous agents framework derives, respectively.

2.1 Financial Dollarization in Emerging Economies

Dollarization in emerging economies has been understood as a currency substitution phenomenon. However, as Ize and Levy Yeyati (2003) argue, what is analyzed as "currency substitution" is actually "asset substitution", since the dollarization of interest-bearing financial assets is more predominant.[4] Following this argument, I list key observations from the dollarization literature:

1. The cross-country average of the share of dollarized deposits at the end of 2000 was 35% in all developing economies (Levy Yeyati (2006)).[5]

2. Only countries that have managed to keep inflation below 35% per annum between 1990 and 2005, do not exhibit a high degree of dollarization (i.e., a FX deposit share of more than 50%) between 2000 and 2004 (Honohan (2007)).[6]

3. Theoretically, under perfect pass-through, the real value of dollar assets becomes fixed and this part of the economy fully dollarizes (Ize and Levy Yeyati (2003) and Levy Yeyati (2006)). The data show that, a 10% increase in dollarization is associated with an 8% increase in pass-through (Honohan and Shi (2001)).[7]

The main findings of the dollarization literature are: *(i)* FD is commonly observed in emerging economies; *(ii)* the degree of FD is positively related to inflation; *(iii)* data

[4] For example, in the period 2005:4-2008:4, the average share of foreign currency denominated demand and term deposits (with a maturity more than 6 months) in Turkey are 44% and 72% respectively. Source: Banking Regulation and Supervision Agency.

[5] Dollarization of deposits is coupled with dollarization of loans. The elasticity of dollarized loans with respect to dollarized deposits is 0.73 for 100 emerging, developing and transition economies in the period 1990-2001 (De Nicoló et. al (2003)).

[6] There is a positive relationship between the likelihood of having an inflationary past and the degree of dollarization (Reinhart et. al (2003)). Levy Yeyati (2006) finds that the correlation between average deposit dollarization and inflation rates is 0.50 and FD is stronger in economies with more inflation elastic monetary shocks.

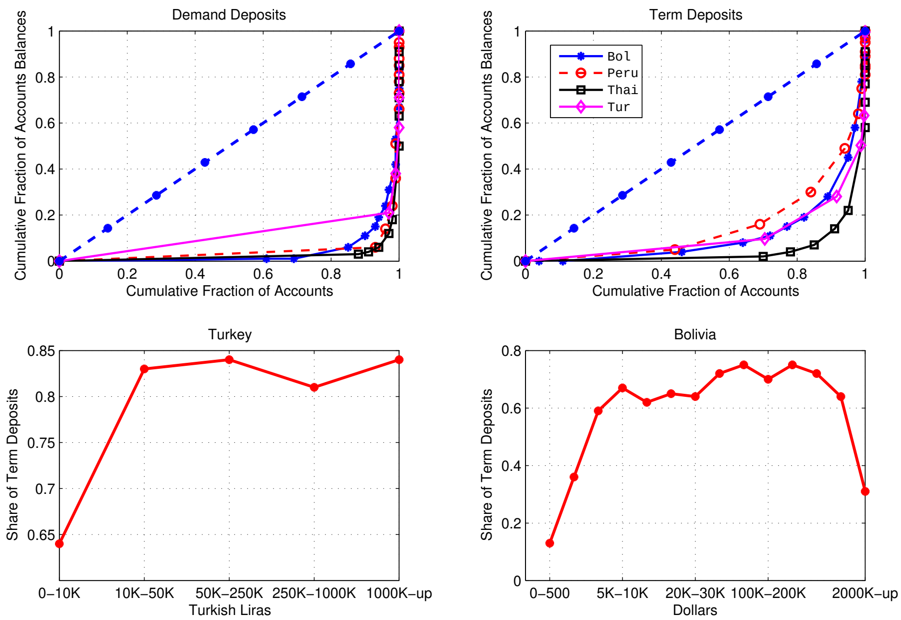
[7] They use quarterly data from over 50 countries for the period 1980-2000. The implied t-statistic from the estimation is equal to 4.5.

support the prediction of the theory that the stronger the pass-through, the stronger FD is. I now present properties of the distribution of deposits in emerging economies.

2.2 Distributions of Demand and Term Deposits

In this section, I document the inequality in deposits positions and portfolio heterogeneity for a selected group of emerging economies. The selection criterion is the availability of the data. The top panels of Figure 1 illustrate Lorenz curves of demand and term deposits for Turkey, Peru, Bolivia and Thailand. As figure clearly shows, demand and term deposits distributions display substantial inequality.[8] Gini coefficients implied by Figure 1 vary

Figure 1: Deposits Distributions and Portfolio Share in Emerging Economies



between 65% and 95%. For Bulgaria, Chile, Georgia and Lithuania, disaggregation into demand and term deposits is not available. Therefore, those countries cannot be included in Figure 1. Gini coefficients for total deposits in those countries vary between 80% and 95%.[9]

Finally, the bottom panels of Figure 1 represent the share of term deposits (which bear more interest than demand deposits) for increasing account sizes. Both for Turkey

[8]Deposits represent an important fraction of the financial system in emerging economies. For example, the average share of deposits in total financial assets for the period 1970-2006 is 61% in the Turkish economy. Source: State Planning Organization.

[9]In the Data Appendix, I report the data sources, describe how Figure 1 is plotted and include Table 9 that reports the data for Turkey. The data for other countries are available from the author upon request.

and Bolivia, this share increases with account size.[10] This suggests that the portfolio of heterogeneous consumers is not uniform across the wealth distribution. This observation is in line with the findings of Mulligan and Sala-i-Martin (2000), Avery et. al (1987) and Easterly and Fischer (2001) that the poor hold a financial portfolio that is more vulnerable to inflation. Consequently, I study a heterogeneous agents framework, which is a natural laboratory to analyze portfolio heterogeneity across the wealth distribution. I now proceed to the next section in which I describe the theoretical framework used to analyze the distributional and welfare implications of disinflation in emerging economies.

3 The Model Economy

I study a monetary model of a small open economy with uninsurable idiosyncratic earnings risk. There is no production. The economy is inhabited by two agents: A continuum of infinitely lived households of total mass 1 and a government. To focus on the implications of a reduction in inflation, I abstract from aggregate uncertainty. Time is discrete. The consolidated government determines fiscal and monetary policy.

3.1 Households

The stochastic process of earnings is independently and identically distributed across consumers and follows a finite state Markov chain with conditional probabilities $p_{\varepsilon'|\varepsilon} = Pr(\varepsilon_{t+1} = \varepsilon' | \varepsilon_t = \varepsilon)$ for ε' and $\varepsilon \in \boldsymbol{E}$ where $\boldsymbol{E}$ is a finite dimensional vector. The invariant distribution of this Markov process is denoted by P.

Households derive utility from consumption. Preferences over flows of a single, tradable consumption good are given by

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t u(c_t) \right] \tag{1}$$

where $0 < \beta < 1$ is the subjective discount factor (which is the same across individuals) and $u(c)$ is a continuous and strictly concave function defined over the flow of consumption. The utility function satisfies the Inada condition, $\lim_{c \to 0^+} u'(c) = \infty$. E is the mathematical expectation operator.

[10]It is puzzling to see that share of term deposits is falling for largest size accounts in the case of Bolivia. This could be because Bolivia experiences "currency substitution" so that even cash is dollarized and is less vulnerable to the depreciation rate of the currency. This feature reduces the asymmetric advantage of the rich in say Bolivia, relative to the advantage of the rich in a less dollarized economy. Yet, possession of zero return, dollarized cash still provides better insurance than negative return, domestic currency.

Households have access to two financial assets: Real balances (demand deposits), m, issued by the monetary authority, and a one-period, risk free bond (term deposits), b, that is internationally traded.[11] The decision of real balances position is made at the beginning of the period. Consumers use real balances during the period to economize transactions costs of consumption and once consumption takes place, they carry over their position in this asset to the next period. Small letters are used to denote real values of individual specific variables. Capital letters denote the aggregate real variables. If inflation from date $t-1$ to date t is π_t, then *real deposits*, a, at time t are defined as $a_t = Rb_t + \frac{m_t}{1+\pi_t}$ where R is the gross real interest rate and b_t, m_t are the beginning of period t positions in bonds and real balances respectively.

The flow budget constraint that consumers face reads:

$$c_t\left[1+S\left(\frac{c_t}{m_{t+1}}\right)\right]+b_{t+1}+m_{t+1}=\varepsilon_t+a_t+\tau_t \tag{2}$$

The left-hand-side of (2) represents total consumption expenditures and asset demands. Following Kimbrough (1986) and Mendoza and Uribe (2000), transactions costs are assumed to be an increasing function S of the consumption velocity of money, $\kappa_t = \frac{c_t}{m_{t+1}}$. The unit transactions costs function is assumed to take the form $S = \phi\kappa^\gamma$, where $\phi > 0$ and $\gamma > 1$.[12] τ_t is a lump-sum transfer made by the government. Since the utility function satisfies the Inada condition, consumption has to be strictly positive ($c_t > 0\ \forall t$). Moreover, for the convex function S to be defined, real balances should be strictly positive as well ($m_t > 0\ \forall t$). I assume that financial markets are underdeveloped in this economy. Therefore consumers face a borrowing constraint so that $b_{t+1} \geq \Omega$ with $\Omega \leq 0$.[13]

There is perfect mobility in capital and goods markets. Therefore, the small open economy assumption ensures that R is taken as given from the international capital markets.[14] Under the law of one price and the assumption of zero foreign inflation rate, the domestic inflation rate, π_t, becomes identical to the depreciation rate of the currency,

[11] From now on, I use real balances (bonds) and demand (term) deposits interchangeably.

[12] As is shown on the left hand side of (2), real balances that are held in the current period, m_{t+1}, economize current transactions and are carried over to the next period.

[13] Even without ad-hoc borrowing constraints, consumers will never borrow more than a "natural debt limit" to ensure nonnegative consumption in each period. This debt limit implies the lower bound $\Psi = \left(\frac{\varepsilon_{\min}+\tau_t-\frac{e}{1+e}m_t}{1-R}\right)$ for b_t and is a variation of the one studied by Aiyagari (1994).

[14] For a given R, I restrict β to satisfy $\beta R < 1$ in order to guarantee the existence of an ergodic distribution of total deposits. For a discussion of this property of incomplete markets models, see Huggett (1993).

e_t.[15]

At any period t, a household is characterized by a double $(a_t, \varepsilon_t) \in \boldsymbol{A} \times \boldsymbol{E}$, where the terms in parentheses denote the real deposits position and earnings level of an individual. If $\mathcal{A}$ denote the Borel sets that are subsets of $\boldsymbol{A}$ and $\mathcal{E}$ denote the set of all subsets of $\boldsymbol{E}$, then $(\boldsymbol{X}, \mathcal{X}) = (\boldsymbol{A} \times \boldsymbol{E}, \mathcal{A} \times \mathcal{E})$ denotes the product space whereas $\boldsymbol{X}$ denotes the state space of this economy. Let $\Gamma(a, \varepsilon)$ be the measure of agents who are in the idiosyncratic state (a, ε).[16] I use real deposits and earnings to indicate the state of an individual for both expositional simplicity and numerical tractability. However, the portfolio choice between real balances and bonds is still explicit in the model, as I describe below.[17]

3.2 Government and Alternative Fiscal Arrangements

Equation (3) describes the budget constraint of the government. As part of the monetary policy, the government issues the currency and announces the depreciation rate of the nominal exchange rate, e_t.[18] Since the focus is on stationary equilibria, $e_t = e \ \forall t$. Aggregate real seigniorage revenues are denoted by $M^s_{t+1} - \frac{M^s_t}{1+e_t}$, where M^s_t is the aggregate real money supply at the beginning of period t.[19] I abstract from international reserves for simplicity.

$$G_t + \tau_t = M^s_{t+1} - \frac{M^s_t}{1 + e_t} \tag{3}$$

The fiscal policy is conducted by making unproductive expenditures, G_t, and remitting transfers, τ_t to households. To explore the distributional role of a reduction in inflation, I study alternative fiscal arrangements in response to the monetary policy described above. In Economy 1 (Economy 2), I assume that the government spending (uniform transfers) is (are) constant, $G_t = G \ \forall t$ ($\tau_t = \tau \ \forall t$), which leaves uniform transfers (spending) as responsive to changes in seigniorage revenues. These two arrangements are meant to capture the redistributive role of uniform transfers. I consider Economy 1 as

[15] Motivated by Section 2.1, bonds are thought to be fully dollarized so that the real interest rate earned on them, R, is independent of the depreciation rate of the currency by the interest parity condition.

[16] I discretize the state space. Real deposits holdings is a member of the grid $\boldsymbol{A} = [a_1 < a_2 < ... < a_n]$. The choices of real balances and bonds that govern the evolution of total deposits are also restricted to be members of the grids $\boldsymbol{M} = [m_1 < m_2 < ... < m_{nm}]$ and $\boldsymbol{B} = [b_1 < b_2 < ... < b_{nb}]$, respectively.

[17] The other option is to consider the triple of real balances, bond holdings and the earnings level as the idiosyncratic state of the consumer.

[18] It is assumed that the government can perfectly manipulate the depreciation rate of the currency, although the *de jure* exchange rate regime is not necessarily pre-determined. To that end, I take the disinflation phenomenon as given.

[19] Money is demand determined, i.e., for a pre-determined depreciation rate, the central bank prints as much money as the economy demands on aggregate.

the benchmark case, since a well-known practice in the literature is to couple monetary creation by lump-sum transfers. Lastly, in Economy 3, I assume again that spending is constant but now model transfers as proportional to individual specific inflation tax payments.[20] In this case, transfers are meant to partially neutralize the wealth effects caused by changes in inflation.[21]

4 Analytical Framework

In this section, I formulate the optimization problem solved by the consumer in the benchmark economy, analyze the workings of the model on the portfolio heterogeneity and welfare, and define the stationary recursive equilibrium.

4.1 The Household's Decision Problem

The dynamic programming problem solved by a household who is in state (a, ε) is:

$$v(a, \varepsilon) = \max_{c,m',b'} \left[u(c) + \beta E \left\{ v \left(Rb' + \frac{m'}{1+e}, \varepsilon' \right) | \varepsilon' \right\} \right] \tag{4}$$

subject to

$$c \left[1 + S \left(\frac{c}{m'} \right) \right] + b' + m' = \varepsilon + a + \tau \tag{5}$$

$$c, m' \geq 0 \text{ and } b' \geq \Omega \tag{6}$$

where $a = Rb + \frac{m}{1+e}$ and $-\Omega$ is an ad-hoc debt limit.

The decision rules of an individual that govern the demand for real money balances, bonds and consumption are time invariant functions $m' = m'(a, \varepsilon)$, $b' = b'(a, \varepsilon)$ and $c = c(a, \varepsilon)$. The optimality conditions that come out of combining the first order conditions of this problem are:

$$\lambda[1 - S'(\kappa)\kappa^2] = \frac{\beta}{1+e} E\{\lambda'\} \tag{7}$$

$$\lambda - \varphi = \beta R E\{\lambda'\} \tag{8}$$

$$c[1 + S(\kappa)] + b' + m' = \varepsilon + a + \tau \tag{9}$$

[20] I assume that the government is not capable of identifying the money holdings of heterogeneous agents in Economies 1 and 2 whereas in Economy 3, it can perfectly track the inflation tax paid by each consumer without consumers having the chance to internalize this redistributive policy.

[21] Wealth effects would be fully neutralized if inflation tax payments and transactions costs are completely rebated in an individual specific manner which requires $G = 0$.

where $\kappa = \frac{c}{m'}$ and $a = Rb + \frac{m}{1+e}$.

The Lagrange multipliers of the budget constraint and the borrowing constraint (λ and φ) are the shadow prices of total (real) deposits and relaxing the borrowing constraint by one unit respectively.[22] Equation (7) is the Euler equation related to real balances decision. The left hand side is the marginal cost of saving in real balances (i.e., foregone marginal utility of consumption net of economized unit transactions costs) whereas the right hand side is the marginal benefit of saving in real balances (i.e., the expected discounted marginal utility of consuming the gross return in the next period). The real return from holding real balances is negative if $e > 0$. Equation (8) is the Euler equation for bonds, which equates the marginal cost of saving in interest-bearing bonds (net of the shadow price of relaxing the borrowing constraint by one unit) to the expected discounted marginal utility of consuming the gross return in the next period. Equation (9) is the flow budget constraint of the household.

4.2 Heterogeneity in Opportunity Cost of Holding Real Balances and Portfolio Composition

Proposition 1. *For a given constant depreciation rate, e, and real interest rate, R, consumption velocity of individuals who do not face a binding borrowing constraint is identical, i.e. $\kappa(a,\varepsilon) = \kappa \; \forall \; (a,\varepsilon)$ if $b'(a,\varepsilon) > \Omega$. Moreover, consumption velocity of borrowing constrained individuals, κ^c is strictly greater than κ and is increasing in $\varphi(a,\varepsilon)$.*
For a proof, see Appendix B.

Proposition 1 elaborates how the effective opportunity cost of holding real balances is determined across different agents. I point out that it is higher for constrained individuals and the more constrained an individual (i.e. the larger $\varphi(a,\varepsilon)$) is, the larger the discrepency. The intuition here is as follows: Consider a borrowing constrained individual who is hit by a negative earnings shock. The only way to dissave for such a consumer is to reduce real balances holdings, m', which results in a higher consumption velocity, $\kappa^c = \frac{c}{m'}$ for a given consumption level. This is costly for such an individual because higher consumption velocity means higher effective price of consumption[23].

The second important implication of Proposition 1 is on the portfolio heterogeneity. In a standard incomplete markets economy with uninsurable idiosyncratic risk, the

[22] Both Lagrange multipliers are functions of idiosyncratic states due to the history dependence implied by incomplete markets.
[23] See the budget constraint in equation (9)

consumption-to-wealth ratio (i.e. $\frac{c(a,\varepsilon)}{a}$ in the current model) typically falls with wealth, since the marginal utility of consumption is higher for the poor.[24] Now, the first part of Proposition 1 (i.e., $\frac{c(a,\varepsilon)}{m'(a,\varepsilon)} = \kappa\ \forall(a,\varepsilon)$ with $b'(a,\varepsilon) > \Omega$) coupled with the afore-mentioned property causes $\frac{d\left(\frac{m'(a,\varepsilon)}{a}\right)}{a} < 0$. As a result, the poor hold a larger fraction of their total deposits in demand deposits, consistent with the bottom panel of Figure 1 and the literature on financial asset portfolio across the wealth distribution.[25]

4.3 Distributional and Welfare Implications of Inflation in Relation to Fiscal and Monetary Interactions

In the current paper, inflation has the following two adverse effects: *(i)* a wealth eroding effect through inflation taxation and *(ii)* distortion in the consumption decision led by changes in the real transactions costs per unit of consumption. These effects can be listed among the classical adverse effects of inflation. However, the particular way that the fiscal authority responds to the monetary authority (which I call fiscal and monetary interactions) might create substantial wealth effects on the private sector.[26] In order to gain intuition on the implications of alternative fiscal policy arrangements, I make a detour here and analyze the deterministic version of the model economy described in Section 3.

4.3.1 A Deterministic Economy with Heterogeneous Households

In this section, I simplify the economy studied in Section 3 by assuming that the economy is now inhabited by a finite number of household types $i \in \{1, ..., I\}$ who are endowed with a time-invariant flow of earnings ε_i. Each cohort i includes a large number of identical households. If the total population is normalized to 1, the measure of each cohort becomes $\mu_i > 0$ with $\sum_i \mu_i = 1$.[27] Here I focus on the welfare implications of the alternative fiscal arrangements within the no-earnings risk framework. The solutions to

[24] This is especially the case when the precautionary savings motive is less predominant, that is, when consumers are sufficiently far away from the natural debt limit.

[25] In generating this result, I do not resort to any economies of scale assumption on the transactions costs function (i.e., average transactions costs $\phi\kappa^{\gamma}$ do not depend on consumption) in contrast with Erosa and Ventura (2002). Note also that the focus is on the "portfolio share" of real balances. Otherwise, it follows again from Proposition 1 that the poor hold less real balances in "absolute terms", because they consume less.

[26] Moreover these wealth effects can be asymmetric due to the heterogeneous agents nature of the model economy studied in this paper.

[27] The problem of a type i consumer looks similar to the problem formulated by equations (4), (5) and (6) with the only difference that the deterministic ε_i is no more a state variable. For the following, I denote economic variables related to type i consumers by an i subscript.

these models are available in Appendix B.

Endogenous Uniform Transfers

From an optimal inflation point of view, the Friedman rule establishes an important theoretical benchmark. In general, the inflation rate that follows the Friedman rule is the one that implies zero non-pecuniary returns from holding real balances.[28]

Assuming CRRA utility and using the closed form solutions for c_i^* and τ^*, the long-run welfare of a type i consumer (W_i) becomes

$$W_i = \frac{\left[\frac{\varepsilon_i+\tau^*-(1-R)\Omega}{(1+\phi\kappa^\gamma)+\frac{e}{1+e}\cdot\frac{1}{\kappa}}\right]^{1-\sigma} - 1}{(1-\beta)(1-\sigma)}. \tag{10}$$

It is crucial to see that the long-run welfare of consumers is affected by *(i)* their "disposable income", $\varepsilon_i + \tau^* - (1-R)\Omega$, *(ii)* the inefficiency brought by transaction costs of consumption $\phi\kappa^\gamma$ and *(iii)* inflation tax paid-per consumption, $\frac{e}{1+e}.\frac{1}{\kappa}$. The second and the third effects denote the classical adverse effects of inflation, i.e., consumption distortion and wealth eroding whereas the first effect denotes the "redistribution" effect introduced by the current paper. Indeed, equation (10) shows that the poor would *benefit* from inflationary finance provided that seigniorage revenues (and therefore lump-sum transfers) increase with inflation. In particular, although the effects *(ii)* and *(iii)* worsen with higher inflation, the incidence of inflation tax and transactions costs would fall short of the aggregate transfers earned by the poor, in *"absolute terms"*.[29] This creates an increase in the disposable income of the poor at the expense of the rich. Consequently, (assuming that the measure of the poor is larger than the rich) the inflation rate that maximizes the aggregate welfare ($\sum_i \mu_i W_i$) would be positive and high.[30]

[28]In the current paper, it is the inflation rate that implies a zero consumption velocity, which would eliminate the inefficiency caused by real transactions costs of consumption. Hence, $e^{Fr} = \beta - 1 < \frac{1}{R} - 1$ by the solution for consumption-velocity, $\kappa = \frac{c_i^*}{m_i^*} = \left[\frac{1}{\gamma\phi}\left(1 - \frac{\beta}{1+e}\right)\right]^{\frac{1}{1+\gamma}}$ and $\beta R < 1$. In this case, opportunity cost of cash is higher than the interest rate, therefore e^{Fr} becomes smaller than the zero nominal interest rate rule, $\frac{1}{R} - 1$.

[29]This is because they consume less (and therefore hold less real balances by constant consumption velocity.)

[30]It is interesting to observe that the third term breaks down the optimality of the Friedman rule, since $\kappa \to 0$ implies that $\frac{e^{Fr}}{1+e^{Fr}}.\frac{1}{\kappa} \to -\infty$, deteriorating consumption. Indeed, as inflation gets closer to the Friedman rule, although the distortions in the economy are eliminated, aggregate welfare would keep falling since it would be inefficient to redistribute resources from the poor to the rich by means of decreasing lump-sum transfers.

Endogenous Government Spending

Long-run welfare of type i individuals can be written as:

$$W_i = \frac{\left[\frac{\varepsilon_i+\tau-(1-R)\Omega}{(1+\phi\kappa^\gamma)+\frac{e}{1+e}\cdot\frac{1}{\kappa}}\right]^{1-\sigma} - 1}{(1-\beta)(1-\sigma)}. \tag{11}$$

This expression is identical with equation (10) except for the crucial difference that redistribution effect is now muted since lump-sum transfers (and disposable income) do not respond to inflation.[31] Therefore, optimality requires the inefficiencies to be eliminated. Yet, the Friedman rule is still suboptimal because it would imply negative government spending, which is not feasible. Consequently, we have a constrained efficiency problem and the aggregate welfare ($\sum_i \mu_i W_i$) is maximized when $G^* = 0$. The closed form solution for G^* enables us to solve for this inflation rate analytically:[32]

$$e^{CE} = \frac{1}{1-\frac{\tau\kappa(1+\phi\kappa^\gamma)}{Y-(1-R)\Omega}} - 1. \tag{12}$$

Endogenous Proportional Transfers

The long-run welfare of type i consumers is

$$W_i = \frac{\left[\frac{\varepsilon_i-G-(1-R)\Omega}{(1+\phi\kappa^\gamma)}\right]^{1-\sigma} - 1}{(1-\beta)(1-\sigma)}. \tag{13}$$

This expression (and consequently the aggregate welfare, $\sum_i \mu_i W_i$) can be maximized only if $\kappa \to 0$, which is achieved when inflation is equal to the Friedman rule level. Therefore, the redistribution effect is completely shut down and changes in inflation taxation are exactly compensated by changes in proportionate transfers.

A Deterministic Economy with a Representative Household

The deterministic version of Economy 1 would be identical to a representative agent economy if each cohort i possesses the same deterministic earnings profile $\varepsilon_i = Y$, where Y is the GDP per-capita of the economy. The long run welfare of the representative household becomes:

$$W = \frac{\left[\frac{Y-G-(1-R)\Omega}{(1+\phi\kappa^\gamma)}\right]^{1-\sigma} - 1}{(1-\beta)(1-\sigma)}. \tag{14}$$

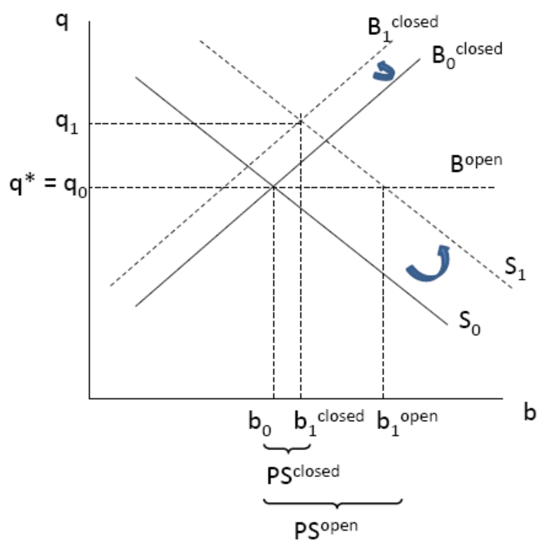
[31] Strictly speaking, redistribution is not absent as long as transfers are positive. But *changes* in the degree of redistribution are fully eliminated.

[32] Notice that e^{CE} depends on τ, which in turn is the equilibrium transfers level in the previous economy for a benchmark inflation rate.

It is clear that the Friedman rule is optimal in this case given that the disposable income of the aggregate economy does not depend on inflation. Furthermore, wealth eroding term does not even show up in the welfare expression since lump-sum transfers exactly match the inflation tax net of government spending.[33]

In summary, introducing heterogeneity to the small open economy model might drive non-trivial departures from the representative agent framework depending on the fiscal and monetary interactions. Moving toward the economy with idiosyncratic uncertainty and incomplete markets brings an additional channel that would affect the disposable

Figure 2: Precautionary Savings in Small Open Economy



income of households. Changes in inflation (which is a relative price between bonds and real balances) would create wealth and substitution effects regarding the portfolio decision. Depending on the relative dominance of these effects, welfare impacts might be strengthened or weakened. Notice also that the small open economy takes the interest rate as given. Therefore, the celebrated precautionary savings (PS, hereafter) outcome of reduction in the equilibrium real interest rate is absent in this model. This will result in large magnitudes of movements in the equilibrium quantity of interest-bearing assets, which in turn affects the disposable income and welfare.[34] This completes the description

[33] As a result, the first-best in this economy would require $G = 0$ and $e = e^{Fr}$.

[34] Figure 2 illustrates this idea by considering an increase in the PS motive. In closed-economy setup, an increase in the PS motive shifts the demand for assets, S_0, (supply of funds, B_0) to the right (left). This results in higher bond price, $q_1 > q_0 = q^*$ (lower interest rate) and an increase in PS of PS^{closed}. However, since the supply of funds, B^{open} is flat in the small open economy, the adjustment in the PS

of the mechanics of my framework and I now proceed to the definition of the stationary recursive equilibrium in the benchmark economy with idiosyncratic uncertainty.

4.4 Stationary Recursive Equilibrium

I assume that conditions that guarantee the existence of unique invariant measure Γ^* are satisfied (see Hugget (1993)). Below is a formal definition of the stationary recursive equilibrium:

Definition 1. *Given a constant level of government expenditures G, the international gross real interest rate R and a constant depreciation rate e, a stationary recursive equilibrium is a time invariant value function v, time invariant policy functions $m' = m'(a, \varepsilon; e)$, $b' = b'(a, \varepsilon; e), c = c(a, \varepsilon; e)$, constant lump-sum transfers τ^* and a stationary distribution Γ, such that: (i) Given τ^*, R, and e; v, $m' = m'(a, \varepsilon; e)$, $b' = b'(a, \varepsilon; e)$ and $c = c(a, \varepsilon; e)$ solve the household's problem (4.1); (ii) Given G, Γ, e and the policy functions of households, τ^* is consistent with the balanced budget of the government; $G + \tau^* = \left(\frac{e}{1+e}\right) M^s$; (iii) Given Γ and the policy functions of households, the aggregate goods market clears (i.e. the national income identity holds), $C + G + (1 - R)B + Tr = Y$ with $C = \sum_{a,\varepsilon} \Gamma(a, \varepsilon)c$, $B = \sum_{a,\varepsilon} \Gamma(a, \varepsilon)b'$, $Y = \sum_{a,\varepsilon} \Gamma(a, \varepsilon)\varepsilon$, and $Tr = \sum_{a,\varepsilon} \Gamma(a, \varepsilon)cS(\frac{c}{m'})$. Money market equilibrium, $M^s = \sum_{a,\varepsilon} \Gamma(a, \varepsilon)m'$ follows from the de facto exchange rate regime; (iv) Given the policy rules for assets and the Markov transition of earnings, $[b'(a, \varepsilon), m'(a, \varepsilon), p_{\varepsilon'|\varepsilon}]$, the distribution of total deposits and earnings satisfies the following fixed point equation: $\Gamma(a', \varepsilon') = \sum_{\varepsilon} \sum_{\{a: a' = Rb'(a,\varepsilon) + \frac{m'(a,\varepsilon)}{1+e}\}} \Gamma(a, \varepsilon)p_{\varepsilon'|\varepsilon}$.*[35]

5 Quantitative Analysis

In this section I study the model's quantitative predictions using a version calibrated to Turkish economy. From a parameterization and calibration perspective, the focus is on the low inflation period 2004:1-2009:4, for which data on aggregates, inequality measures and government transfers are available. The main experiment is to make long-run equilibria comparisons between high ($e = 15\%$ for the period 1987:1-2003:4) and low ($e = 2\%$) inflation economies. Throughout the analysis, I carry over this parameterization

happens much larger, i.e. $PS^{open} > PS^{closed}$. Therefore, individuals might experience sharp variations in their interest income when the PS motive changes.

[35]In Economy 2, G^* closes the equilibrium for a fixed τ. In Economy 3, τ^* in *(i)* is replaced by $\tau^*(a, \varepsilon)$, where the latter is a state-dependent equilibrium transfers schedule. So it should satisfy condition *(ii)* by $\tau^*(a, \varepsilon) = \left(\frac{m'(a,\varepsilon)e}{1+e}\right) - G$ and $\tau^* = \sum_{a,\varepsilon} \Gamma(a, \varepsilon)\tau^*(a, \varepsilon)$.

and calibration to Economies 2 and 3. I now describe the parameterization of Economy 1.

5.1 The Parameterization of the Benchmark Economy

The parameter values that are used in Economy 1 are reported in Table 2 below. $\sigma = 2$ is chosen as the risk aversion parameter of the CRRA utility. The model period is a quarter. R is set to 1.01 to reflect quarterly net real interest rate of 1%. Values for σ and R are in line with the existing literature.

Table 2: Benchmark Parameter Values

Symbol	**Value**	**Description**	**Target**	**Moment**
Fixed				
σ	2.0000	Risk aversion	Literature	*N/A*
R	1.0100	Gross real interest rate	Literature	*N/A*
γ	1.5947	Curv. of the trans. costs function	Int. elas. of M1 demand = -0.3854	*N/A*
G/Y	0.1340	Real gov. spending-to-GDP	Average of 2004:1-2009:4	*N/A*
Jointly Calibrated				
β	0.9170	Discount factor	$M2Y/GDP = 1.415$	1.398
ϕ	0.0005	Multip. trans. costs parameter	$C/M1 = 4.124$	4.076
Ω	-0.0428	Lower bound for bonds	$(M2Y - M1)/M2Y = 0.846$	0.847
ρ	0.9604	Persis. of earnings shocks	$Gini_y = 0.390$	0.393
σ_u	0.1560	Volat. of shocks to log-earnings	$\frac{\sigma_\varepsilon}{\bar{\varepsilon}} = 0.641$	0.641

5.1.1 Simultaneously Chosen Parameters

I choose values for the discount factor (β), multiplicative parameter of the transactions costs function (ϕ), negative of the debt limit (Ω) and persistence and volatility of shocks to log-earnings (ρ,σ_u) simultaneously to match moments from the data.[36] The corresponding moments in order are *(i)* total stock of deposits-to-GDP ratio, *(ii)* aggregate consumption velocity of M1, *(iii)* aggregate portfolio composition, *(iv)* Gini coefficient of disposable income and *(v)* coefficient of variation of earnings.[37] I measure total stock of deposits ($B+M$ in the model) with M2Y, which includes currency in circulation, checkable deposit, term deposits and foreign currency denominated deposits.[38] The aggregate portfolio

[36] I assume that the natural logarithm of the idiosyncratic earnings, ε_t, follows an AR(1) process subject to normally distributed disturbances u_t, with zero mean and constant variance, σ_u^2. Therefore I have

$$\log \varepsilon_{t+1} = (1-\rho)\mu + \rho \log \varepsilon_t + u_t \tag{15}$$

where μ is the mean of the logarithm of the earnings process and ρ is the persistence parameter.

[37] Time series averages over the period 2004:1-2009:4 are used as aggregate targets.

[38] The interest parity condition $(1+i = (1+i^*)(1+e))$ and the law of one price $(1+\pi = (1+\pi^*)(1+e))$ imply that a local currency denominated interest-bearing deposit is equivalent to a dollarized asset in

composition is captured by $\frac{B}{B+M}$ in the model. Finally, disposable income is defined as the summation of earnings, interest income and transfers, i.e., $y = \varepsilon + (R-1)b' + \tau$.

Calibration of above parameters requires the solution of the model. In particular, I use the Simulated Annealing method to find the set of parameters that minimizes the absolute values of deviations of model generated moments from their empirical counterparts. The empirical targets and the model generated moments are reported in Table 2. The solution to these parameters remain in 1.5% error level.

Recall that in Bewley models, $\beta R < 1$ has to hold in order to obtain a well defined ergodic distribution of wealth. Otherwise consumers accumulate an unbounded magnitude of assets to avoid negative consumption in any state of nature.[39] This feature of incomplete-markets models and the objective of matching the empirical ratio of $\frac{M2Y}{GDP} = 1.415$ (Source: Central Bank of Republic of Turkey, CBRT) necessitate using a β lower (0.9170) than the value used in standard quarterly models. Model generated $\frac{M2Y}{GDP}$ ratio is 1.398. The implied βR value in the model is equal to 0.926.

The multiplicative parameter of the transactions costs function ϕ is calibrated to match the quarterly aggregate consumption velocity (measured by the time series average of aggregate consumption-to-M1 ratio) of 4.124 (Source: CBRT). Model generated value, C/M, is 4.076.[40]

I use $\Omega = -0.0428$ (implying a debt-to-lowest earnings ratio of 22%) to target the aggregate portfolio composition (i.e. $\frac{M2Y-M1}{M2Y} = 0.846$, source: CBRT). The model generated aggregate share of interest-bearing deposits, $B/(B+M)$, is 0.847.

The remaining parameters whose determination requires the solution of the equilibrium are the defining features of the stochastic earnings process, i.e., the persistence and volatility (ρ,σ_u) of shocks to log-earnings.[41] The corresponding targets are the Gini coefficient of disposable household income and the coefficient of variation of earnings. Note that the second target is directly affected by both ρ and σ_u. I exploit this property by calibrating σ_u to match the coefficient of variation of earnings exactly for a given ρ.[42] As

rate of return. Consequently, the aggregate portfolio composition $\frac{M2Y-M1}{M2Y}$, can be thought of as an effective dollarization ratio.

[39]For examples, see Aiyagari (1994) and Ljungqvist and Sargent (2004).

[40]Aggregate consumption series that I use includes private investment expenditures added to private consumption. I lump private investment in C as well, since I do not model physical capital accumulation. Following a similar reasoning, I lump public investment in the term G while calibrating it (Source: State Planning Organization, SPO).

[41]Due to lack of panel studies on micro level income dynamics, I resort to calibration of these parameters rather than estimating them from micro data.

[42]In particular, I simply compute $\sigma_u = (1-\rho^2)\frac{\sigma_\varepsilon}{\bar{\varepsilon}}$ where ρ comes from the Simulated Annealing routine and the coefficient of variation of earnings, $\frac{\sigma_\varepsilon}{\bar{\varepsilon}}$, comes from the data. Notice that the variance of the

a result, I find $\sigma_u = 0.1560$ and $\rho = 0.9604$. The target regarding σ_u is taken from the study of Bircan and Tansel (2006), who compute the mean-to-standard deviation ratio of private hourly real wages to be equal to 0.641, which is the average of years 1994 and 2002. On the other hand, the target regarding ρ (Gini coefficient of disposable income of 0.390) is taken from the Household Budget Survey (2004-2005) and Income and Living Conditions Survey (2006-2007) held by the Turkish Statistical Institute (TURKSTAT). The model generated value for this moment is 0.393.

I approximate a normally distributed log-earnings process with a Markov chain, using the double (σ_u, ρ), in Tauchen's (1986) procedure. A spread parameter of 3 is used to capture most of the domain of the normal density. 11 nodes that are located symmetrically around zero are used on the shocks to log-earnings grid.

Consumption and income inequality in Turkish economy for the period 2004-2008 have been relatively stable. Gini coefficients that I compute from the approximate Lorenz curves for income and consumption are 39% and 33% respectively.[43] Surprisingly, consumption inequality is much less than inequality in deposits positions and income. I attribute this phenomenon partly to the existence of informal insurance mechanisms.[44]

5.1.2 Interest Elasticity of Money Demand

I use a standard form for the transactions costs function, $S(\kappa_t) = \phi\kappa_t^\gamma$, which is introduced by Kimbrough (1986), and used by Mendoza and Uribe (2000) to analyze the exchange-rate-based stabilizations in emerging economies. I choose to calibrate the curvature parameter of the transactions costs function, γ, by estimating an aggregate money demand equation since the data on aggregates such as M1, nominal interest rates and consumption are available. The estimated equation is implied by the functional form of S, the optimality condition regarding real balances (i.e. $S'(\kappa_t)\kappa_t^2 = \frac{i}{1+i}$) and the definition of consumption velocity $\kappa_t = \frac{c_t}{m_{t+1}} = [\frac{1}{\gamma\phi}(\frac{i}{1+i})]^{\frac{1}{1+\gamma}}$. In particular, there is a

Markov chain computed via the invariant distribution differs from the variance of the true process due to approximation. To match the target exactly, I account for this difference as well.

[43]The data come from Household Budget Survey (2004-2005), Income and Living Conditions Survey (2006-2007) and Consumption Expenditures Survey conducted by Turkish Statistical Institute.

[44]Recall that I only model earnings, interest and transfers as potential sources of income. Unfortunately, disaggregated data on each potential source of income are not available for Turkish economy. However, Income and Living Conditions Survey (2006-2007) conducted by TURKSTAT shows that these three sources of income indeed captures total income inequality quite well. This is because *(i)* earnings, transfers and interest income that I model add up to 67.57% of the aggregate disposable income; *(ii)* the major type of income which I do not model (i.e., entrepreneurial income, making 24% of total income) is distributed among quintiles similar to the way that earnings and social transfers are distributed. See Tables 10 and 11 in the Data Appendix on income and consumption inequality in Turkey.

log-linear relationship between real balances demand, consumption and the opportunity cost of holding money as follows:

$$\log(m_{t+1}) = \alpha_1 \log(c_t) + \alpha_2 \log\left(\frac{i_t}{1+i_t}\right) + \epsilon_t \tag{16}$$

where m_{t+1} is determined at date t. Note that equations (23) and (25) in Appendix B imply that both constrained and unconstrained individuals are subject to this functional relationship. Yet, since the opportunity cost of holding money is higher for constrained individuals, the second explanatory variable on the right hand side of equation (16) should ideally incorporate this feature. However, since I do not have a measure of the "effective opportunity cost of holding money for constrained individuals" in the data, I use the quarterly nominal deposit interest rates as an explanatory variable for all individuals and estimate a single equation.[45]I use the time series for aggregate consumption and real M1 (deflated by the GDP deflator) in the estimation of equation (16) for the period 1987:1-2009:2. The data source for all these aggregates is CBRT.

I estimate the interest elasticity of real money demand to be equal to α_2 = -0.3854. The standard error of this coefficient is 0.0734, implying significance at 1% error level. The estimation also implies close to unitary elasticity of money demand with respect to consumption: I estimate $\alpha_1 = 0.8788$, with a standard error of 0.0054, again implying significance at 1% error level. The adjusted R^2 of the regression is 68.85%. Since $\alpha_2 = -\frac{1}{1+\gamma}$, I solve for γ to be equal to 1.5947.

5.1.3 Public Sector

Finally, I close the section on the calibration of the baseline economy by mentioning parameters related to the government. I consider the depreciation rate $e = 0.02$ in the baseline economy. This is the average quarterly inflation rate in the period 2004:1-2009:4. I computed the inflation rate from the GDP deflator (Source: CBRT). The time series average of aggregate government spending (final goods consumption plus investment expenditures of the central government) was about 13% of GDP for the same period (Source: CBRT). Therefore I set $G = 0.134Y$.

[45]This issue would be problematic had γ been a parameter of consumer characteristics, such as a taste parameter for real balances in the MIU specification. However, in this framework, consumers have no preference over the way that the transactions are carried on. Therefore, I argue that it is appropriate not to model heterogeneity over γ and use nominal interest rates as the common variable to capture the opportunity cost of holding money. For this matter, I used 1, 3, 6 and 12-month maturity deposit rates. The quarterly time series for nominal interest rates are constructed by adjusting maturities properly and computing weighted average rates by using the share of various (maturity) type-deposits in the whole system.

Note that the government budget constraint in the model is very simplistic. For example, I abstract from public finance elements such as government debt and conventional taxes (such as capital income tax) other than the inflation tax. Therefore I need to take an empirical stance of what the endogenous variable τ represents. Equation (17) below illustrates the budget constraint of consolidated government in general:

$$G_t + Transfers_t + (R-1)B_t^G = Revenues_t + B_{t+1}^G - B_t^G \tag{17}$$

where G_t is government spending, $(R-1)B_t^G$ is debt service, $Transfers$ are pure transfers to households and $Revenues$ are any kind of government revenues (mainly taxes). Now if I rewrite the government budget constraint in the model, I have,

$$G_t + \tau_t = M_{t+1}^s - \frac{M_t^s}{1+e_t} \tag{18}$$

where the right hand side are seigniorage revenues, which do not explicitly show up in the public finance data and τ_t is a lump-sum variable that tends to capture what I do not model in the public side. Since leaving τ_t as a residual is not informative for the matter of accounting pure transfers to households, I decompose it into two parts τ_{1t} and τ_{0t}, where the former represents pure transfers to households (such as social security transfers, direct transfers and transfers to the health and education sectors) and the latter represents any component of equation (17) that is not modeled. The crucial feature of the baseline economy here is that I fix G and τ_{0t} so that they are independent of inflation and let τ_{1t} and $M_{t+1}^s - \frac{M_t^s}{1+e_t}$ respond to inflation.[46] Since pure transfers to households are about 4%, government spending is about 13% and seigniorage revenues are about 1% of GDP in the period 2004:1-2009:4, I set $\tau_{0t} = (M_{t+1} - \frac{M_t}{1+e_t})^{Data} - G^{Data} - \tau_{1t}^{Data} = 0.009Y - 0.134Y - 0.04Y = -0.165Y$ (Source: CBRT).

This closes the discussion of the parameterization and calibration of the benchmark model. The numerical solution method for the computation of the stationary recursive equilibrium is described in the Appendix D. I now proceed to the analysis of the benchmark economy.

5.2 Benchmark Model vs. Data

In this section, I compare the aggregate and distributional variables implied by the calibrated model (Economy 1) with their empirical counterparts. The aggregate statistics that I report in Table 3 are the ratios of the aggregate stock of real balances plus

[46] Economies 2 and 3 obviously deviate from this setup.

bonds ($(B+M)/Y$), consumption (C/Y), trade balance ($(1-R)B/Y$), transactions costs (Tr/Y), lump-sum transfers (the part that respond to inflation, i.e. (τ_1/Y), see Section 5.1.3) and real seigniorage revenues-to-GDP ($(eM/(1+e))/Y$), the aggregate consumption velocity of money (C/M) and the dollarization ratio ($B/(B+M)$). The distributional variables are the Gini coefficients of disposable income, bonds, real balances and consumption, top quintile-to-bottom quintile ratios of income and consumption and mean-to-median ratio of income. The model performs considerably well in terms of matching the ratios of aggregate consumption and transfers-to-GDP although they are not targeted. Aggregate transactions costs are estimated to be 0.4% of GDP.

Table 3: Benchmark Model, $e = 2\%$

Aggregates	*DATA*	*E1*	**Distributional Variables**	*DATA*	*E1*
$(B+M)/Y^a$	1.415	1.398	$Gini_y$	0.390	0.393
C/Y	0.878	0.874	$Gini_b$	0.781	0.623
TB/Y	-0.012	-0.012	$Gini_m$	0.775	0.388
Tr/Y	N/A	0.004	$Gini_c$	0.324	0.379
C/M	4.124	4.076	$({}^{Top20}/{}_{Bottom20})_y$	9.146	8.885
SE/Y	0.009	0.004	$({}^{Mean}/{}_{Median})_y$	1.350	1.275
τ_1/Y	0.040	0.035	$({}^{Top20}/{}_{Bottom20})_c$	5.984	8.476
$B/(B+M)$	0.846	0.847	Frac. of Constrained	N/A	0.058

[a] Y denotes the GDP of the economy.

In Figure 3, I compare model generated (straight plots) Lorenz curves for disposable income, bonds, real balances and consumption and the portfolio share of bonds with their empirical counterparts (dashed plots). Consistent with the lower panel of Table 3, the model does well in replicating the inequality patterns of income and consumption, partially underestimates inequality in bond positions and considerably fails in capturing inequality in real balances holdings. The Gini coefficient of real balances is larger than that of consumption because of the existence of borrowing constraints, however, since only 5.8% of the population is borrowing constrained, the distribution of real balances is slightly decoupled from that of consumption.[47] I now discuss the implications of the main experiment of comparing high and low inflation stationary equilibria under alternative fiscal arrangements. The portfolio plot in the bottom-right panel is plotted in a comparable way to the one plotted in the bottom-left panel of Figure 1. The model is able to replicate the concave shape of share of bonds as individuals become richer.

[47] Yet, this finding proves that the distributions of consumption and cash holdings might be decoupled in an environment that exhibits a transaction technology, which creates a strong relationship between cash holdings and consumption.

Figure 3: Lorenz Curves and Portfolio in the Benchmark Economy, e=2%

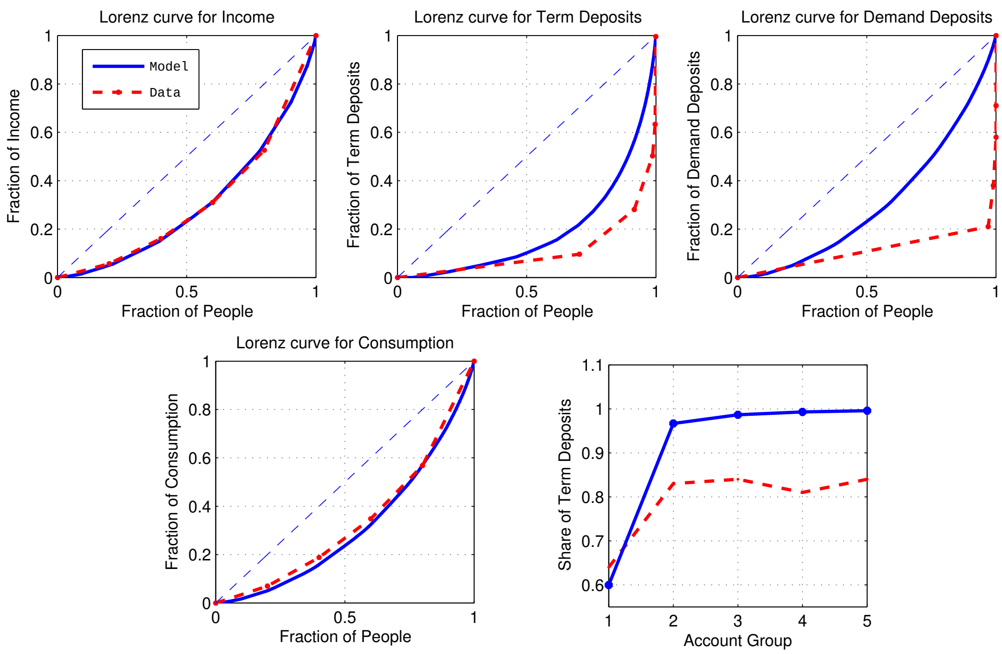


Table 4: Aggregate Implications of Disinflation

	Uniform τ		**Endogenous G**		**Proportionate τ**	
Aggregates	$e = 15\%$	$e = 2\%$	$e = 15\%$	$e = 2\%$	$e = 15\%$	$e = 2\%$
$(B+M)/Y$	1.239	1.398	1.376	1.398	1.542	1.490
C/Y	0.866	0.874	0.857	0.874	0.870	0.875
TB/Y	-0.011	-0.012	-0.013	-0.012	-0.014	-0.013
Tr/Y	0.011	0.004	0.010	0.004	0.010	0.004
C/M	7.492	4.076	7.435	4.076	7.382	4.060
SE/Y	0.015	0.004	0.015	0.004	0.015	0.004
τ_1/Y	0.046	0.035	0.035*	0.035	0.046	0.035
$B/(B+M)$	0.907	0.847	0.916	0.847	0.924	0.855

*$G/Y = 14.5\%$ in Economy 2 when $e = 15\%$.

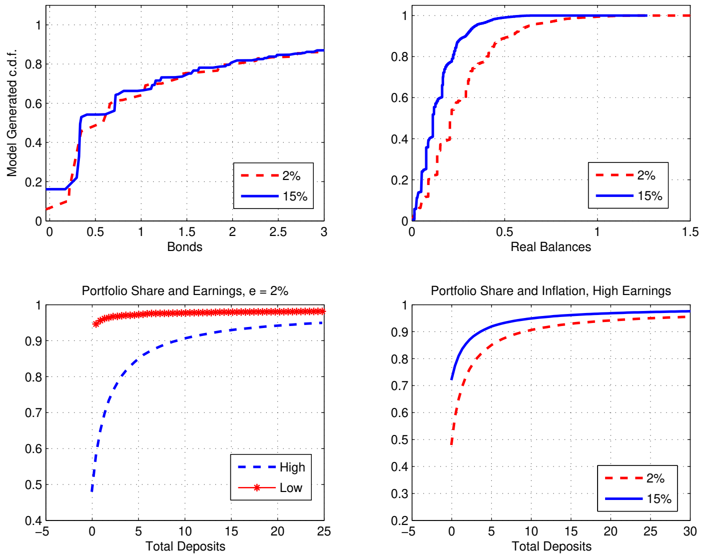
5.3 Aggregate Implications of Disinflation

Table 4 shows that under all fiscal arrangements, the ratios Tr/Y, $\frac{Me}{1+e}/Y$ and C/M decrease when inflation reduces. Reduction in inflation dominates the increase in aggregate real balances demand causing seigniorage revenues (inflationary finance) to diminish. Transfers decrease in Economies 1 and 3, whereas government spending decreases in Economy 2. The model is consistent with the observations of the dollarization literature that a reduction in inflation lowers the degree of dollarization, $B/(B+M)$. In Economy 3, aggregate bonds decrease (causing trade deficit to fall) in contrast with Economies 1 and 2. I discuss this difference below, in regards to distributional implications.

5.4 Distributional Implications of Disinflation

In the top panels of Figure 4 below, I plot the model generated cumulative distribution functions (c.d.f.) of term and demand deposits for permanent depreciation rates of 2 (dashed plot) and 15 (straight plot) percent.[48] The top-right panel shows that c.d.f. of

Figure 4: Disinflation, Portfolio and Asset Distributions (Benchmark)



demand deposits in the low inflation economy first order stochastically dominates that in high inflation economy. This is because wealth and substitution effects work in the same direction for real balances demand: A reduction in inflation creates *(i)* a positive *wealth* effect that induces consumers to demand more of both assets and *(ii)* a substitution effect driven by a reduction in the relative price of real balances in terms bonds that induces an individual to demand more (less) real balances (bonds). Therefore, whether rich or poor, consumers increase their real balances demand when inflation is lower whereas this is not the case for bonds since the dominance of wealth and substitution effects displays heterogeneity across the wealth distribution.[49]

The bottom panels of Figure 4 illustrate the asset portfolio of households as functions of total deposits-earnings (a, ε) and total deposits-depreciation rate (a, e) doubles.

[48] For visual clarity, I restrict the plot on the top-left panel to display a subset of the range of the c.d.f.

[49] Hence the absence of first order stochastic dominance between c.d.f.s of bonds in high and low inflation economies.

Portfolio is defined as $\frac{b'}{b'+m'}$ at the individual level. The increasing, concave shape is in line with the empirical facts documented by the literature that the poor hold a larger fraction of their portfolio in non-interest bearing assets and the facts documented in this paper.[50]The bottom-left panel shows that earnings-poor individuals hold a portfolio which is more biased towards bonds because of the increased PS motive of the poor. The bottom-right panel illustrates that the share of bonds shifts down when inflation is reduced. Yet, a lower portfolio share of bonds does not mean that the *'absolute value'* of the bond position of a particular consumer is decreasing. Indeed, the bond position of an individual may *rise* if the wealth effect dominates the substitution effect.[51]

Table 5 presents the distributional implications of reduction in inflation under alternative fiscal arrangements. Rows 1-4 report the Gini coefficients of income, consump-

Table 5: Distributional Implications of Disinflation

	Uniform τ		**Endogenous G**		**Proportionate τ**	
Aggregates	$e = 15\%$	$e = 2\%$	$e = 15\%$	$e = 2\%$	$e = 15\%$	$e = 2\%$
$Gini_y$	0.389	0.393	0.393	0.393	0.393	0.394
$Gini_b$	0.653	0.623	0.619	0.623	0.587	0.604
$Gini_m$	0.393	0.388	0.388	0.388	0.381	0.384
$Gini_c$	0.376	0.379	0.379	0.379	0.379	0.380
$(^{Top20}/_{Bottom20})_y$	8.564	8.885	8.892	8.885	8.911	8.985
$(^{Top20}/_{Bottom20})_c$	8.141	8.476	8.452	8.476	8.570	8.616
$(^{Median}/_{Median})_y$	1.272	1.275	1.271	1.275	1.275	1.277
$(^{Mean}/_{Median})_c$	1.273	1.226	1.275	1.226	1.258	1.249
Frac. of Constrained	0.161	0.058	0.101	0.058	0.047	0.032
Portf. of the 1^{st} Percentile	0.093	0.570	0.564	0.570	0.766	0.647

tion, bonds and real balances and rows 5-8 show the mean-to-median and top quintile-to-bottom quintile ratios of income and consumption. These statistics establish that the distribution of income, real balances and consumption are almost intact when inflation is reduced irrespective of the particular fiscal arrangement. On the other hand, when inflation is reduced, Gini coefficient of bonds decreases by 3% in Economy 1, stays almost intact in Economy 2 and increases by 2% in Economy 3.

The difference between alternative fiscal arrangements can be explained by the variations in the equilibrium precautionary savings (PS) motive across Economies 1, 2 and 3. Rows 9 and 10 in Table 5 report the fraction of population that hit the debt limit, and

[50]See section 4.2 for the discussion of the mechanism that generates this phenomenon in the model.

[51]Since the PS motive will be strong for consumers who are affected by wealth effects the most, at the heart of the analysis is the relative dominance of these effects.

portfolio share of the poorest total deposits percentile respectively.[52] In Economies 1 and 2, there is an inverse relationship between these statistics: If the PS motive for the poor is strong, then the portfolio share of bonds increases and therefore, a smaller fraction of population hits the debt limit.[53]

Observing the definition of the natural debt limit, $-\Psi = \left(\frac{\varepsilon_{\min}+\tau-\frac{e}{1+e}m_t}{R-1}\right)$, is useful here. In Economy 1, uniform transfers reduce substantially when inflation is low, therefore, the natural debt limit becomes much tighter. As a result, the portfolio share of the poor surges to 57% from 10% causing the fraction of constrained to decrease from 16% to 6%.[54]In Economy 2, transfers do not depend on inflation. Therefore when inflation is high (15%), consumers are willing to borrow less compared to Economy 1 (10% of the population hits the debt limit). The portfolio of the poor does not change substantially as well. On the other hand, in Economy 3, since transfers are proportional to inflation tax payments net of government spending, natural debt limits are much tighter compared to Economies 1 and 2.[55]This causes the fraction of constrained to be lower compared to the other economies. In Economy 3, $\frac{d\left(\tau(a,\varepsilon)-\frac{m'(a,\varepsilon)e}{1+e}\right)}{de} = 0$, so that natural debt limits are not affected by changes in inflation.[56] Since wealth effects are partially neutralized in this economy, the poor buffer more assets to make up for the insurance not provided by transfers. When inflation is reduced, the substitution effect drives a reduction in bonds position (so that the fraction of borrowing constrained reduces to 3.2%) as well as a decrease in the share of bonds for the poor (from 76% when inflation is high to 65% when inflation is low). This also explains the reduction in the aggregate bond position in Economy 3 caused by disinflation (see the first and third rows of Table 4). This closes the distributional implications of disinflation and I now analyze the welfare consequences.

[52]Portfolio of the 1^{st} percentile is computed as

$$\frac{\sum_{a,\varepsilon}\Gamma(a,\varepsilon;e)b'(a,\varepsilon;e)}{\sum_{a,\varepsilon}\Gamma(a,\varepsilon;e)b'(a,\varepsilon;e)+\sum_{a,\varepsilon}\Gamma(a,\varepsilon;e)m'(a,\varepsilon;e)} \text{ where } a:\Phi(a;e)=0.01 \text{ with } \Phi(.) \text{ being the c.d.f. of } a.$$

[53]For a given stochastic process of idiosyncratic earnings, a *decrease* in the measure of borrowing constrained represents an *increase* in the equilibrium PS motive in the economy, since it points out the desire to avoid hitting debt limits.

[54]This is also the reason of a more equitable distribution of bonds when inflation is lower. See Gini coefficients for bonds in row 2.

[55]Natural debt limits are more relaxed in Economy 2 compared to Economy 3, because transfers earned by the poor are much larger in the former.

[56]For the poor, $\frac{d\left(\tau-\frac{m'(a,\varepsilon)e}{1+e}\right)}{de} > 0$ in Economy 1.

5.5 Welfare Implications of Disinflation

Welfare consequences of inflation depend crucially on fiscal and monetary interactions as is illustrated in section 4.3. Before analyzing models with uncertainty, to warm up, first I develop a measure of aggregate welfare. Following Mendoza et al. (2007), welfare effects are computed as the proportional increase in consumption in the 15% inflation stationary equilibrium, η, that would make an individual consumer indifferent about remaining in the 15% inflation rate economy versus shifting to an economy with the inflation level of 2%. Since I do not study surprise changes in inflation, I abstract from the effects of transitional dynamics on welfare. For each agent i who is in state (a, ε), $\eta(a, \varepsilon)$ solves

$$E_0 \sum_{t=0}^{\infty} \beta^t u(c_t^{i,15\%}(1 + \eta(a, \varepsilon))) = E_0 \sum_{t=0}^{\infty} \beta^t u(c_t^{i,2\%}) \tag{19}$$

where $\{c_t^{i,15\%}\}_{t=0}^{\infty}$ is the infinite sequence of consumption of agent i in state (a, ε) in the high inflation economy and $\{c_t^{i,2\%}\}_{t=0}^{\infty}$ is the corresponding sequence of consumption in the low inflation economy.[57]

Once I establish the consumption equivalent of welfare gains on the individual level, as a natural next step, I need to do an aggregation to achieve a normative assessment regarding the economy as a whole. The practice is to fix the wealth distribution of the high inflation economy, $\Gamma^{15\%}(a, \varepsilon)$ and use it to compute a weighted average of the welfare gains in terms of compensating consumption variation. Hence, the consumption equivalent of the aggregate welfare gain from changing the inflation rate to 2% can be written as

$$W^{2\%} = \sum_{a,\varepsilon} \Gamma^{15\%}(a, \varepsilon) \eta(a, \varepsilon) \tag{21}$$

Table 6 below presents the welfare implications of reducing inflation (from 15% to 2%) in model economies. The first row denotes the aggregate welfare gain (as defined above) of waking up in the low inflation stationary equilibrium. Rows 2, 3 and 4 include the disaggregation of this measure into the average gains of the poorest quintile, 50^{th} percentile and the top percentile (ordered according to total deposit positions). Row 5

[57] Given the particular functional form for the utility function and the notation so far, $\eta(a, \varepsilon)$ also solves

$$[(1-\beta)(1-\sigma)v^{15\%}(a, \varepsilon) + 1](1 + \eta(a, \varepsilon))^{1-\sigma} = [(1-\beta)(1-\sigma)v^{2\%}(a, \varepsilon) + 1] \tag{20}$$

where $v^{15\%}(a, \varepsilon)$ is the equilibrium value function in the high inflation economy and $v^{2\%}(a, \varepsilon)$ is the value in the low inflation economy.

Table 6: Welfare Consequences of Reducing Inflation to 2% from 15%

Welfare Gains[a]	**Uniform** τ_1	**Endogenous** G	**Proportionate** τ_1
Aggregate	-2.643	1.675	0.500
Bottom 20%	-6.195[b]	1.205	0.143
Median	-2.562	1.720	0.526
Top 1%	0.806[b]	1.856	0.600
Deterministic	-0.700	1.726	0.513

[a]Welfare gains are computed percentage change in terms of compensating consumption variation.
[b]Average welfare gains of percentiles ordered according to total deposits positions.
[c]'Deterministic' refers to the aggregate welfare effects in economies studied in section 4.3.

shows the welfare gains in the deterministic cases that I study in Section 4.

When transfers are uniform, (Economy 1), the rich benefit (welfare gain of 0.8% in terms of compensating consumption variation (ccv, hereafter) from disinflation at the expense of the poor (welfare loss of 6.2%). This is because disinflation causes the poor to lose redistributive transfers that are mainly financed by inflation tax payments of the rich. Since the welfare loss of the poor is disproportionately large, the aggregate economy incurs a welfare loss of 2.6%.

If wasteful government spending responds to monetary policy, (Economy 2), welfare gains schedule observed in Economy 1 shifts up because transfers are not reduced following a contraction in the inflationary finance. Since the redistribution channel is absent in this economy, the poor do not incur a welfare loss anymore. Yet, their welfare gain (1.20% in terms of ccv) falls short of the rich (1.85%) because the reduction in inefficiencies caused by inflation taxation and transactions costs are mainly utilized by the rich, who consume and hold real balances more. Aggregate welfare increases by 1.67% in terms of ccv when inflation is reduced to 2% in Economy 2.

When transfers are individual specific (i.e. $\tau(a,\varepsilon) = \frac{m'(a,\varepsilon)e}{1+e} - G$), fiscal policy does not cause any redistribution among heterogeneous agents. As a result, reducing inflation in Economy 3 creates welfare gains mainly due to reduced transactions costs. However, welfare gains are much lower compared to Economy 2. This is mainly due to the absence of positive wealth affects created by a reduction in government spending in Economy 2. A second reason is that when wealth effects are not strong and real interest rate is constant, reduction in inflation causes consumers to earn unambiguously lower interest income (see the discussion in Section 4.3.).[58]

[58]In the Sensitivity Analysis section, I show that disinflation is welfare reducing when there are no wealth effects.

In contrast with Economies 2 and 3, in Economy 1, aggregate welfare loss (2.65%) is much larger when there is idiosyncratic uncertainty as opposed to when there is no risk (0.70%). This is because reduction in inflationary finance (and transfers) tightens the natural debt limits substantially, which is only a feature of the stochastic economy. Economies 2 and 3 do not display this fundamental difference since transfers are fixed in the former and natural debt limits do not change with inflation at all in the latter.

In summary, I argue that welfare consequences of disinflation depend crucially on the particular fiscal arrangement. The main results are, *(i)* if the transfers system is redistributive, inflationary finance might be good for the poor at the expense of the rich. *(ii)* Inflationary finance causes substantial welfare losses if it is directed to government consumption and *(iii)* if agents' financial wealth and their transfers income are positively related, then inflationary finance is again costly in terms of welfare.[59]This closes the welfare analysis and I now explore the sensitivity of the findings in this paper to parameter values and alternative fiscal arrangements.

6 Sensitivity Analysis

In this section I perform sensitivity analysis on two dimensions. First, I explore the role of changing calibrated parameters one at a time on main findings (rows 2-17 of Table 7) related to distributional and welfare consequences of reducing inflation from 15% to 2%. Second, I tweak the transfers policy of the fiscal authority by considering variations that might induce qualitatively and quantitatively different wealth effects (rows 18-21). I report equilibrium lump-sum transfers-to-GDP ratios in columns 1-2, Gini coefficients of asset holdings and fraction of borrowing constrained in columns 3-8 and disaggregated/aggregate welfare gains in columns 9-11.

Discount Factor and Real Interest Rate (β, R): In Bewley-style economies, a higher βR implies stronger PS incentive of households. Second row of Table 7 shows that a higher (lower) β reduces (increases) the measure of borrowing constrained individuals. As a result, a lower (higher) Gini coefficient for bonds is obtained. When the fraction of borrowing constrained is high, the model generates more inequality in real balances distribution. Increasing (decreasing) real return of bonds, R has similar implications to that of β because the higher R, the stronger the asset buffering motive of individuals is. Equilibrium transfers-to-GDP ratios and welfare implications are quite similar to those

[59]This is supported by the data for the Turkish economy as I discuss in Section 5.1.1.

in the benchmark parameterization.

Risk Aversion (σ): Using a σ of 3 instead of 2 makes consumers more risk averse. Therefore, regardless of the inflation rate, no one hits the debt limit. In this case, the distribution of bonds become significantly more equitable. Welfare implications are very similar to those in the benchmark economy. In the case of log utility, $\sigma = 1$, welfare losses of the poor reduce substantially because consumers continue to borrow (fraction of constrained is about 55-60%) since their risk aversion is lower compared to the benchmark case.

Parameters of the transactions costs function(γ, ϕ): Gini coefficients of assets distribution and transfers-to-GDP ratios are very similar to those in benchmark parameterization when I increase γ from 1.5947 to 1.9. When the transactions function has more curvature, fraction of constrained reduces. This increases the welfare gain of the rich because they consume more, which makes them incur more transactions costs. On the other, hand when the curvature is lower, $\gamma = 1.1$, the fraction of borrowing constrained rises since the rise in the effective price of consumption becomes limited. When ϕ is increased, seigniorage revenues and transfers do not decrease much and therefore welfare loss of the poor becomes smaller. Moreover, the PS incentive increases a lot (measure of consumers who hit the debt limit decreases to 5% from about 20%) causing the interest income of consumers to decrease.

Lower bound of bonds (Ω): The distributional and welfare results are almost the same as in the benchmark parameterization when I increase or decrease the lower bound for bonds.

Parameters of the earnings process (ρ, σ_u): The PS motive is lower and consumers are able to borrow more when shocks are less volatile and persistent (ρ, σ_u, lower). Therefore, the welfare gain schedule for the whole economy shifts down when earnings shocks are less severe. As expected, when shocks are more volatile and persistent, nobody hits the debt limit and the distribution of bonds become substantially more equitable.

Alternative fiscal arrangements: Row 18 and 19 keep the baseline calibration but include transactions costs to uniform transfers and set $G = 0$ respectively. The welfare results show that adding transactions costs amplifies the redistributive effects. Setting $G = 0$ on the other hand (which is the case for rows 19-22) reduces welfare changes substantially. The reason is that when $G = 0$, transfers are already high. Therefore the effect of redistribution is lower when transfers increase with inflation. Row 20 shows the proportionate transfers case with $G = 0$. In that case, there is no redistribution via trans-

Table 7: Sensitivity Analysis

	τ_1/Y		$Gini_b$		$Gini_m$		**Fraction of Constrained**		**Aggregate[a] Welfare Gain**	**Gain of Bottom 20%**	**Gain of Top 1%**
	15%	2%	15%	2%	15%	2%	15%	2%			
Benchmark[b]	0.046	0.035	0.653	0.623	0.393	0.388	0.161	0.058	-2.643	-6.195	0.806
$\beta = 0.93$	0.046	0.035	0.619	0.599	0.372	0.372	0.081	0.035	-2.470	-4.887	0.815
$\beta = 0.89$	0.046	0.035	0.659	0.666	0.425	0.437	0.325	0.201	-2.719	-5.578	0.807
$R = 1.020$	0.046	0.035	0.623	0.600	0.382	0.380	0.094	0.040	-2.483	-5.084	0.916
$R = 1.005$	0.046	0.033	0.675	0.646	0.400	0.394	0.208	0.080	-2.653	-6.639	0.788
$\sigma = 3$	0.047	0.035	0.473	0.451	0.342	0.344	0.003	0.002	-2.967	-7.639	0.751
$\sigma = 1$	0.045	0.034	0.664	0.708	0.453	0.487	0.606	0.555	-1.055	-0.568	1.104
$\gamma = 1.9$	0.045	0.036	0.645	0.638	0.384	0.385	0.118	0.046	-3.100	-6.089	0.975
$\gamma = 1.1$	0.039	0.033	0.662	0.621	0.399	0.394	0.207	0.096	-1.623	-3.801	0.488
$\phi = 0.0010$	0.039	0.037	0.658	0.641	0.396	0.387	0.197	0.052	-1.969	-4.505	-0.213
$\phi = 0.0001$	0.041	0.033	0.658	0.620	0.396	0.391	0.197	0.096	-1.849	-4.380	0.410
$\Omega = -0.02$	0.046	0.035	0.655	0.623	0.393	0.387	0.162	0.058	-2.629	-6.163	0.807
$\Omega = -0.06$	0.041	0.035	0.653	0.622	0.393	0.387	0.161	0.055	-2.653	-6.224	0.805
$\sigma_u = 0.17$	0.047	0.033	0.546	0.372	0.398	0.398	0.005	0.000	-22.885	-69.983	0.057
$\sigma_u = 0.13$	0.046	0.035	0.658	0.662	0.365	0.384	0.325	0.211	-0.980	-1.392	0.867
$\rho = 0.97$	0.047	0.035	0.299	0.251	0.431	0.433	0.000	0.000	-12.322	-32.906	0.545
$\rho = 0.94$	0.046	0.035	0.664	0.665	0.331	0.348	0.260	0.190	-0.824	-1.619	0.786
$\tau^* = \frac{Me}{1+e} + Tr - G$[c]	0.057	0.040	0.678	0.643	0.397	0.394	0.202	0.098	-4.485	-9.376	0.207
$\tau^* = \frac{Me}{1+e}$	0.017	0.004	0.732	0.754	0.378	0.399	0.310	0.220	-0.725	-1.203	0.952
$\tau^*(a,\varepsilon) = \frac{m'(a,\varepsilon)e}{1+e}$	0.017	0.004	0.700	0.747	0.374	0.394	0.244	0.203	0.329	-0.020	0.577
$\tau^*(a,\varepsilon) = \frac{m'(a,\varepsilon)e}{1+e} + c(a,\varepsilon)\phi\left(\frac{c(a,\varepsilon)}{m'(a,\varepsilon)}\right)^\gamma$	0.030	0.011	0.733	0.784	0.379	0.418	0.299	0.280	-0.236	-0.229	-0.119

[a] Welfare gains of reducing inflation rate from 15% to 2% in terms of compensating consumption variation.
[b] Implications of disinflation for the benchmark parameterization of the model. See Table 2 for parameter values.
[c] This row and the following three rows consider alternative fiscal arrangements that are different than the ones considered in Economies 1,2 and 3.

fers so that welfare losses of the poor become negligible. The last row of Table 7 is especially important because it corresponds to the case with no wealth effects from reducing inflation. In particular, all costs of inflation are rebated in an individual specific way and $G = 0$. Although the welfare impacts are quite low, disinflation is welfare reducing. This is because since all wealth effects are shut down, by the presence of substitution effect, consumers decrease their bond demand when inflation is lower. This unambiguously reduces their interest income, implying a reduction in their welfare. In the deterministic case with no wealth effects, inflation does not affect welfare at all. But the last row of Table 7 shows that introducing idiosyncratic uncertainty with incomplete markets is enough to find that disinflation is reducing welfare in this framework.

7 Conclusion

This paper investigates the distributional and welfare implications of disinflation in a small open economy. The motivation of the analysis derives from financial system characteristics of emerging economies. In particular, the inflationary past of emerging economies caused the financial system in these economies to evolve in a particular way. Moreover, the distribution of financial assets display substantial inequality.

The analysis in this paper shows that apart from the classical adverse effects of inflation, the way that fiscal authority responds to monetary policy might create various wealth effects. The main policy conclusion is that unless the transfers system is of redistributive nature, inflationary finance reduces welfare. Another interpretation of this result is that if emerging economies are to experience inflationary episodes in the future, they are better direct the inflationary finance to social transfers of redistributive nature.

Empirical literature has shown that fiscal deficits and inflation are positively related in (high inflation) developing economies. Normative findings of this paper suggest that it is important to identify whether the co-movement between the two are driven by wasteful government spending or transfers of uniform nature. Another important extension is to analyze the transitional dynamics implications of disinflation in a calibrated economy. Gradual adjustment in the aggregate money supply along the transition might cause volatility in transfers which would definitely affect the welfare results.

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Appendix A: Proof of Proposition 1

The Lagrange multiplier on the borrowing constraint (φ) will be equal to zero for unconstrained individuals. Therefore one can combine equations (7) and (8) to obtain the following:

$$\left(\frac{1}{1+e}\right)\left(\frac{1}{1-S'(\kappa)\kappa^2}\right) = R \tag{22}$$

which can also be rewritten as

$$S'(\kappa)\kappa^2 = \frac{i}{1+i} \tag{23}$$

by using the definition of the nominal interest rate, $1+i=(1+e)R$ under the absence of aggregate uncertainty. Given that $S(\kappa) = \phi\kappa^\gamma$ is a strictly convex and increasing function of κ, equation (23) implies a unique solution for the consumption velocity as, $\kappa = [\frac{1}{\gamma\phi}(\frac{i}{1+i})]^{\frac{1}{1+\gamma}}$. Clearly, κ does not depend on any idiosyncratic variable. On the other hand, for borrowing constrained individuals, we have $\varphi(a,\varepsilon) > 0$. Now, equations (7) and (8) imply that

$$\frac{\beta E\{\lambda'\}}{\lambda} = (1+e)[1-S'(\kappa^c)\kappa^{c2}] = \frac{1}{R}\Big[1-\frac{\varphi}{\lambda}\Big]. \tag{24}$$

The first equality follows from equation (7) and the second equality follows from equation (8) after dividing the whole equation by $R\lambda$. It is straightforward to show that the definition of nominal interest rate and rearranging terms imply

$$S'(\kappa^c)\kappa^{c2} = \frac{i+\frac{\varphi}{\lambda}}{1+i} \tag{25}$$

The proof can be completed by imposing the functional form of $S(.)$ again and solving for the consumption velocity of a constrained individual as, $\kappa^c = \Big[\frac{1}{\gamma\phi}\Big(\frac{i+\frac{\varphi}{\lambda}}{1+i}\Big)\Big]^{\frac{1}{1+\gamma}}$. Since $\varphi > 0$ and $\lambda > 0\ \forall\ (a,\varepsilon)$, $\kappa^c > \kappa\ \forall\ (a,\varepsilon)$. Furthermore, $\gamma, \phi, \lambda, i > 0$ implies that κ^c is increasing in φ.[60]

[60]Equations (23) and (25) are the consumption-money optimality conditions that illustrate the marginal benefit-opportunity cost trade off regarding the real balances holding decision for unconstrained and constrained individuals respectively.

Appendix B: Solutions of Deterministic Economies

Economy 1; A Deterministic Economy with Heterogeneous Households and Endogenous Uniform Transfers. The steady state equilibrium is characterized by a time-invariant profile for endogenous real variables, $\lambda_{it} = \lambda_i^*$, $\varphi_{it} = \varphi_i^*$, $c_{it} = c_i^*$, $M_t^s = \sum_i \mu_i m_{it} = \sum_i \mu_i m_i^* = m^*$, $b_{it} = b_i^*$, $\tau_t = \tau^*$ $\forall\ i, t$ and the system of equations (26)-(31) evaluated at these constant values:

$$u'(c_i^*) = \lambda_i^* \left[1 + \phi(1+\gamma)\left(\frac{c_i^*}{m_i^*}\right)^{1+\gamma}\right] \tag{26}$$

$$\left[1 - \phi\gamma\left(\frac{c_i^*}{m_i^*}\right)^{1+\gamma}\right] = \frac{\beta}{1+e} \tag{27}$$

$$\lambda_i^*(1 - \beta R) = \varphi_i^* \tag{28}$$

$$c_i^*\left[1 + \phi\left(\frac{c_i^*}{m_i^*}\right)^{\gamma}\right] + b_i^* + m_i^* = \varepsilon_i + R b_i^* + \frac{m_i^*}{1+e} + \tau^* \tag{29}$$

$$b_i^* \geq \Omega \tag{30}$$

$$G + \tau^* = \sum_i \mu_i m_i^* \frac{e}{1+e} \tag{31}$$

which is a system of $(5\times I)+1$ conditions and $(5\times I)+1$ unknowns: $(c_i^*, m_i^*, b_i^*, \tau^*, \varphi_i^*, \lambda_i^*)$.[61] It is possible to find a closed-form solution to this system. If I assume that $\beta R < 1$, then, since $\lambda_i^* > 0$, equation (28) implies that the borrowing constraint is binding (i.e., $\varphi_i^* > 0$). Therefore, by equation (30), $b_i^* = \Omega$ that is, consumers role over a constant interest payment of $(1 - R)\Omega$. It is straightforward to show that equation (27) implies a consumer type independent-consumption velocity, which can be denoted by[62]

$$\kappa = \frac{c_i^*}{m_i^*} = \left[\frac{1}{\gamma\phi}\left(1 - \frac{\beta}{1+e}\right)\right]^{\frac{1}{1+\gamma}}. \tag{32}$$

The budget constraint, (29), $b_i^* = \Omega$ and equation (32) yields,

$$m_i^* = \frac{\varepsilon_i + \tau^* - (1-R)\Omega}{\kappa(1 + \phi\kappa^{\gamma}) + \frac{e}{1+e}} \tag{33}$$

[61]Note that if equation (29) is aggregated with $\sum_i \mu_i m_i^* = M^*$, $\sum_i \mu_i c_i^* = C^*$, $\sum_i \mu_i b_i^* = B^*$,$\sum_i \mu_i \varepsilon_i^* = Y^*$ and substituted in equation (31), the resource constraint, $C + Tr + G + (1-R) = Y$, where $Tr = \sum_i \mu_i c_i \phi(\frac{c_i}{m_i})^{\gamma}$ obtains.

[62]Consumption velocity is increasing in the inflation rate by $\frac{d\kappa}{de} = \frac{\beta}{(1+\gamma)\kappa^{\frac{\gamma}{1+\gamma}}\phi\gamma(1+e)^2} > 0$, given that $\beta, \gamma, \kappa, \phi > 0$.

Aggregating this equation and using the government budget constraint implies,

$$(G+\tau^*)\frac{1+e}{e} = m^* = \sum_i \mu_i \left[\frac{\varepsilon_i + \tau^* - (1-R)\Omega}{\kappa(1+\phi\kappa^\gamma)+\frac{e}{1+e}}\right] = \frac{Y+\tau^*-(1-R)\Omega}{\kappa(1+\phi\kappa^\gamma)+\frac{e}{1+e}} \tag{34}$$

which delivers equilibrium transfers as $\tau^* = \frac{({}^{e}/_{1+e})[Y-G-(1-R)\Omega]}{\kappa(1+\phi\kappa^\gamma)} - G$. Finally, plugging this solution in equation (33) yields,

$$m_i^* = \frac{\varepsilon_i - G - (1-R)\Omega + \frac{({}^{e}/_{1+e})[Y-G-(1-R)\Omega]}{\kappa(1+\phi\kappa^\gamma)}}{\kappa(1+\phi\kappa^\gamma)+\frac{e}{1+e}}. \tag{35}$$

as the closed-form solution for real balances. Now by equation (32), $c_i^* = m_i^*\kappa$. [63]

Economy 2; A Deterministic Economy with Heterogeneous Households and Endogenous Government Expenditures. In this economy, the stationary equilibrium conditions (26)-(31) would again follow with the only difference that the endogenous unknowns are now $(c_i^*, m_i^*, b_i^*, G^*, \varphi_i^*, \lambda_i^*)$ whereas τ is just a parameter. Straightforward calculations deliver that equation (33) is replaced by

$$m_i^* = \frac{\varepsilon_i + \tau - (1-R)\Omega}{\kappa(1+\phi\kappa^\gamma)+\frac{e}{1+e}}. \tag{36}$$

which is now a closed-form solution since τ is a known parameter. Equilibrium conditions and aggregation implies that $G^* = \frac{({}^{e}/_{1+e})[Y+\tau-(1-R)\Omega]}{\kappa(1+\phi\kappa^\gamma)+\frac{e}{1+e}} - \tau$. The rest of the system can be solved in a straightforward way.

Economy 3; A Deterministic Economy with Heterogeneous Households and Proportional Transfers. In this economy, transfers received by type i consumers equal $\tau_i(a_i) = \frac{m_i e}{1+e} - G$ so that any change in the inflation tax paid by consumer i is reflected to transfers. Stationary equilibrium conditions (26)-(31) of the benchmark economy follow with the modification that the budget constraint, (29), includes type-specific transfers τ_i and instead of the government budget constraint, (31), we write $\tau_i = \frac{m_i e}{1+e} - G$ as I additional equilibrium conditions.[64] Therefore, the equation system is composed of $6 \times I$ unknowns, $(c_i^*, m_i^*, b_i^*, \tau_i^*, \varphi_i^*, \lambda_i^*)$ and $6 \times I$ equations. These conditions would yield,[65]

$$m_i^* = \frac{\varepsilon_i - G - (1-R)\Omega}{\kappa(1+\phi\kappa^\gamma)}. \tag{37}$$

[63] If $\beta R = 1$, equation (19) implies that $\varphi_i^* = 0$ and therefore, equilibrium bond position is determined by the initial conditions, $b_i^* = b_{i0}$ which is given. Note that $b_{i0} \geq \Omega$ should hold in this case. Therefore, all closed form solutions hold except for the difference that Ω is replaced by b_{i0}.

[64] The aggregation of these transfers imply the government budget constraint.

[65] $\varepsilon_i - G - (1-R)\Omega \geq 0\ \forall i$ should hold for the real balances and consumption to be non-negative.

Appendix C: Numerical Solution Algorithm

Economy 1: I solve the household optimization problem formulated in section **4.1** by value function iteration on a discretized space for real deposits and idiosyncratic earnings. I use separate grids for real balances and bonds choices. The grids that I use for total deposits, earnings, bonds (in $[\Omega,40]$) and real balances (in $[0.001,5]$) have 100, 11, 3200 and 400 nodes respectively. When $b' > \Omega$, by Proposition 1, consumption can be computed for given states and the bond choice. On the other hand when, $b' = \Omega$, the consumer budget constraint becomes non-linear in consumption and real balances choice needs to be handled separately.[66]For each pair of real balances and bonds choice, I keep track of the law of motion of real deposits and linearly interpolate the next iteration's value by using this law of motion. Once I find the decision rules, I solve for the stationary distribution of total deposits by employing standard methods, aggregate over heterogeneous agents by the help of the stationary distribution and compute public surplus ($\frac{Me}{1+e} - G - \tau$) from the government budget constraint.

The solution algorithm that I implement to compute the stationary recursive equilibrium is as follows:

- Pin down two lump-sum transfers levels (τ^1 and τ^2) for which the above-mentioned solution of the private sector implies public surplus ($\frac{Me}{1+e} - G - \tau^1 > 0$) and public deficit ($\frac{Me}{1+e} - G - \tau^2 < 0$) respectively,

- Initialize lump-sum transfers by setting $\tau_0 = \frac{(\tau^1+\tau^2)}{2}$. If there is public surplus, update lump-sum transfers in order to bring them closer to the public deficit-generating transfers level (i.e. $\tau_1 = \frac{(\tau_0+\tau^2)}{2}$) and set $\tau^1 = \tau_0$. If there is public deficit, update lump-sum transfers in order to bring them closer to the public surplus-generating transfers level (i.e. $\tau_1 = \frac{(\tau_0+\tau^1)}{2}$) and set $\tau^2 = \tau_0$).

- Repeat step 2 until the absolute value of the public surplus is smaller than a tolerance level.[67]

Economy 2: The numerical solution algorithm of Economy 2 involves fixing τ and iterating on G by using an algorithm in the spirit of the above-mentioned steps.

[66]I exploit this property of the model by solving the non-linear budget constraint only when the borrowing constraint binds. I achieve this by implementing Newton's univariate method for solving the roots of non-linear equations.
[67]I used 10^{-6} as the tolerance value.

Economy 3: The solution of Economy 3 involves initiating a state-dependent matrix of lump-sum transfers $\tau^0(a,\varepsilon) = \tau_1^0(a,\varepsilon) + \tau_0$ (instead of a uniform value) and solving the problem of the private sector by respecting this transfers schedule.[68] Once the private sector problem is solved and aggregation is made, the transfers schedule is updated following the rule,

$$\tau_1^1(a,\varepsilon) = \omega\tau_1^0(a,\varepsilon) + (1-\omega)\Big(\frac{m'(a,\varepsilon)e}{1+e} - G - \tau_0\Big) \tag{38}$$

where ω is a number between 0 and 1 and $m'(a,\varepsilon)$ is the policy for real balances of an agent who is in state (a,ε).[69] Once I find $\tau^1(a,\varepsilon) = \tau_1^1(a,\varepsilon) + \tau_0$, I use it as the new candidate transfers schedule and repeat the above steps until the whole transfers schedule converges (i.e. $sup||\tau^0(a,\varepsilon) - \tau^1(a,\varepsilon)|| < 10^{-4}$) and the implied public surplus is less than a tolerance level.

Appendix D: Data

Structural Change in Inflation: In general, inflation has followed a low-high-low time profile in the periods (1960-1975), (1975-1995) and (1995-2008) around the world. In Table 8, I report a complete list of developing and industrialized countries for which the annual CPI inflation data for the period 1989-2008 are available from the International Financial Statistics, published by the IMF. Observing this general pattern, I regress the time series of inflation for each country on a constant and perform the Chow test that incorporates two structural break dates one around the-1970s and another around the-mid 1990s. If a country displays a high-low profile, I use only one structural break point. If for a country, there is not a pattern at all, I just compute averages for the aforementioned periods. For each country, I search over alternative break dates and choose the ones that imply the highest F-statistic in the Chow test. Since I focus on disinflation, I only include the period averages for which inflation has been high and low historically. Countries are listed in descending order according to their inflation rates in the first period. Among 134 countries listed in Table 8, 104 of them pass the structural break test (at 99% significance level). Countries that did not pass the test are marked by an asterisk.

[68] Notice that total transfers still have the lump-sum component τ_0 which tends to capture the taxes that are not modeled.

[69] I set $\omega = 0.75$. The second term on the right hand side of equation (41) might change in accordance with what the government rebates back to households.

Deposits Distributions: Data in Table 9 are used to plot the parts of Figure 1 that are related to the Turkish economy. Columns denote account groups that are classified by the sizes of accounts. Rows on the other hand (from 1 to 4), report shares of account balances and shares of number of accounts for each account group. The last row of the table reports the share of term deposits within each account group.

The data sources for deposits are: Autoridad de Supervision del Sistema Financiero (Bolivia), Bulgarian National Bank, Superintendencia de Bancos e Instituciones Financieras (Chile), National Bank of Georgia, Bank of Lithuania, Central Reserve Bank of Peru, Bank of Thailand and Banking Regulation and Supervision Agency (Turkey). It should be noted that the data are on the number of accounts, not depositors. Therefore, if an individual possesses multiple accounts with small balances, then inequality in the distribution of these deposits would be understated. Second, depending on the country specific institutional arrangements, demand deposits might be dollarized or effectively pay interest that is closely related to the inflation rate, missing the vulnerability of cash to inflation. Considering that the existing Gini coefficients are already too high, I believe that the first caveat is not that important. The second issue is difficult to address since the currency composition data are not available in the disaggregated level.

Income and Consumption Inequality: Tables 10 and 11 include data on income-consumption inequality and the distribution of income earned by various sources among quintiles that are ordered according to the disposable income.

Table 8: Disinflation as a Worldwide Phenomenon

Country	**High (Per.)**	**Low (Per.)**	**Country**	**High (Per.)**	**Low (Per.)**
Brazil	135[a] (60-94)	11 (95-08)	Gambia*	14 (75-94)	6 (95-08)
Argentina	115 (75-94)	6 (95-08)	Myanmar*	14 (75-94)	25 (95-08)
Uganda	106 (60-88)	12 (89-08)	Egypt	14 (72-95)	6 (96-08)
Zambia	104 (60-93)	25 (94-08)	Guatemala	14 (73-90)	10 (91-08)
Indonesia	96 (60-69)	13 (70-08)	Cote D.	14 (72-79)	5 (80-08)
Israel	91 (77-86)	8 (87-08)	Swaziland	14 (73-94)	8 (95-08)
Sierra Leo.	75 (81-91)	18 (92-08)	Algeria	14 (75-94)	6 (95-08)
Peru	71 (74-91)	9 (92-08)	Honduras	14 (79-97)	9 (98-08)
Congo, Dem.	69 (75-97)	18 (98-08)	Spain	13 (71-87)	4 (88-08)
Ghana	66 (74-83)	24 (84-08)	Gabon	13 (73-81)	4 (82-08)
Uruguay	63 (75-94)	13 (95-08)	Samoa	13 (71-86)	5 (87-08)
Turkey	60 (77-02)	10 (03-08)	South Af.	12 (71-95)	6 (96-08)
Sudan	60 (78-96)	13 (97-08)	New Zealand	12 (70-86)	3 (87-08)
Mexico	53 (74-88)	14 (89-08)	Trinidad & T.	12 (72-93)	6 (94-08)
Guinea-B.	51 (60-96)	7 (97-08)	Barbados	12 (60-83)	3 (84-08)
Venezuela	51 (87-97)	22 (98-08)	Ireland	12 (67-86)	3 (87-08)
Emerg.&Dev.	49 (79-95)	10 (96-08)	Haiti*	12 (75-94)	17 (95-08)
Mozambique	46 (60-94)	16 (95-08)	Papua N.G.	12 (60-03)	9 (04-08)
Ecuador	42 (82-00)	10 (01-08)	Botswana	115 (60-93)	6 (94-08)
Nigeria	41 (87-95)	13 (96-08)	Sri Lanka*	11 (75-94)	11 (95-08)
Suriname	38 (86-00)	16 (01-08)	St. Lucia	11 (60-80)	4 (81-08)
Poland	37 (81-96)	5 (97-08)	Solomon I.*	11 (75-94)	10 (95-08)
Iceland	36 (71-88)	6 (89-08)	Thailand	11 (72-82)	4 (83-08)
Bolivia	35 (73-83)	9 (84-08)	Dominica	11 (60-81)	3 (82-08)
Chile	29 (74-90)	7 (91-08)	Pakistan	10 (73-97)	7 (98-08)
Dom. Rep.	28 (83-90)	13 (91-08)	Neth. Ant.	10 (72-81)	3 (82-08)
Tanzania	25 (74-95)	9 (96-08)	Burundi*	10 (75-94)	14 (95-08)
Colombia	24 (72-94)	11 (95-08)	UK	10 (70-91)	3 (92-08)
Jamaica	23 (73-96)	10 (97-08)	Tonga*	10 (60-94)	7 (95-08)
Lao P.D.R.*	22 (75-94)	27 (95-08)	Bhutan	10 (60-98)	5 (99-08)
Nicaragua	22 (60-93)	10 (94-08)	Ethiopia*	10 (75-94)	8 (95-08)
Costa Rica	21 (72-82)	15 (83-08)	Nepal*	10 (75-94)	6 (95-08)
Congo, Rep.	21 (94-98)	3 (99-08)	Senegal	9 (60-85)	3 (86-08)
Saudi Arab.	20 (72-77)	1 (78-08)	Australia	9 (71-90)	3 (91-08)
Hungary	20 (86-98)	7 (99-08)	Denmark	9 (71-85)	3 (86-08)
Iran, I.R.	18 (71-95)	17 (96-08)	Rwanda*	9 (75-94)	7 (95-08)
Malawi*	18 (74-94)	24 (95-08)	Niger	9 (60-82)	2 (83-08)
Paraguay	18 (72-95)	9 (96-08)	Cameroon*	9 (75-94)	3 (95-08)
Portugal	18 (71-91)	4 (92-08)	Fiji	9 (60-87)	4 (88-08)
Madagascar	17 (74-96)	10 (97-08)	Morocco	9 (71-86)	3 (87-08)
Syrian A.R.	17 (73-94)	4 (95-08)	France	9 (68-85)	2 (86-08)
Maldives	17 (60-93)	3 (94-08)	Libya*	8 (75-94)	1 (95-08)
Philippines	17 (70-85)	7 (86-08)	Sweden	8 (70-91)	2 (92-08)
Mauritius	17 (72-80)	7 (81-08)	Vanuatu	8 (60-88)	3 (89-08)
Seychelles	16 (60-80)	4 (81-08)	Jordan*	8 (75-94)	4 (95-08)
World	16 (75-94)	6 (95-08)	China, H.K.	8 (60-97)	0 (98-08)
Grenada	16 (60-83)	3 (84-08)	Norway	8 (70-91)	2 (92-08)
Zimbabwe*	16 (74-94)	53 (95-08)	India*	8 (75-94)	6 (95-08)
Kenya	16 (73-93)	11 (95-08)	China, M.*	8 (75-94)	2 (95-08)
Greece	16 (71-97)	3 (98-08)	Panama	8 (72-80)	2 (81-08)
Italy	15 (73-85)	4 (86-08)	Togo*	8 (75-94)	4 (95-08)
Korea	15 (60-82)	4 (83-08)	Finland	8 (60-90)	2 (91-08)
Bahrain,K.	15 (73-80)	1 (81-08)	Cyprus	7 (71-85)	3 (86-08)
El Salvador	15 (71-95)	4 (96-08)	Advanced	7 (60-90)	2 (91-08)

Table 8 continued

Country	High (Per.)	Low (Per.)	Country	High (Per.)	Low (Per.)
Mauritania*	7 (75-94)	6 (95-08)	Bangladesh*	6 (75-94)	6 (95-08)
Japan	7 (60-81)	1 (82-08)	Malaysia	6 (70-82)	3 (83-08)
Malta	7 (71-82)	2 (83-08)	Belgium	5 (60-85)	2 (86-08)
Singapore	7 (71-82)	2 (83-08)	Chad*	5 (75-94)	4 (95-08)
U.S.	7 (70-85)	3 (86-08)	Austria	4 (60-92)	2 (93-08)
Burkina F.*	7 (75-94)	3 (95-08)	Aruba*	4 (75-94)	4 (95-08)
Canada	7 (71-91)	2 (92-08)	St. Kitts &N.*	4 (75-94)	4 (95-08)
St. Vincent	7 (60-91)	3 (92-08)	Switzerland	4 (60-93)	1 (94-08)
Luxembourg	7 (71-85)	2 (86-08)	Cent Af.*	4 (75-94)	4 (95-08)
Cape Verde	7 (60-97)	3 (98-08)	Belize*	4 (75-94)	2 (95-08)
Tunisia	7 (60-94)	3 (95-08)	Kuwait*	3 (75-94)	3 (95-08)
Bahamas	6 (60-92)	2 (93-09)	Qatar*	3 (75-94)	6 (95-08)
Netherlands	6 (60-84)	2 (85-08)	Equatorial G.*	1 (75-94)	6 (95-08)

Table 9: Summary Statistics on the Distribution of Deposits in Turkey

Turkey (2002-2008)	Account Sizes up to 10K[a]	10K-50K	50K-250K	250K-1,000K	1,000K and up
Share of DD[b] Bal.	21.11[c]	17.13	19.32	13.02	29.41
Share of DD # of Acc.	97.34	1.97	0.59	0.08	0.02
Share of TD[d] Bal.	9.66	18.53	22.30	13.07	36.43
Share of TD # of Acc.	70.45	21.16	7.12	0.96	0.30
Share of TD in group	64.03	82.72	83.54	81.29	84.13

[a]In Turkish Liras, [b]Demand deposits.
[c]In percentage terms, the average over the period, [d]Term deposits.

Table 10: Income and Consumption Inequality in Turkey, 2004-2008

	1^{st} Quintile	2^{nd} Quintile	3^{rd} Quintile	4^{th} Quintile	5^{th} Quintile
Household Income					
Avg. of 2004-2007	5.26[a]	10.03	14.86	21.75	48.1
Consumption					
Avg. of 2004-2008	7.09	11.95	16.28	22.23	42.45

[a]Percentage share of quintiles in total household income and consumption.
Household Budget Survey (2004-2005), Income and Living Conditions Survey (2006-2007) and Consumption Expenditures Survey conducted by TURKSTAT.

Table 11: Inequality and Income Types, 2006-2007

Avg. of 2006-2007 Types of Income	Aggregate Share of Types	Share of Quintiles Within Type 1^{st}	2^{nd}	3^{rd}	4^{th}	5^{th}
Total	100	4.47[a]	9.17	14.19	21.26	50.89
Wage and Salary*	40.29	2.63	8.59	14.42	22.95	51.41
Casual	3.84	26.79	26.75	20.89	17.07	8.50
Entrepreneurial	23.72	4.89	8.80	11.49	16.46	58.36
Rental	3.58	1.89	3.70	6.68	16.00	71.74
Asset*	6.54	2.44	6.55	11.58	19.55	59.87
Social Tran.*	17.98	3.44	8.53	17.75	26.34	43.93
Inter-h.hold Tran.*	2.77	11.45	13.79	15.94	19.30	39.52
Other	1.3	5.30	9.45	17.12	25.07	43.06

[a]Percentage share of the relevant income quintile. Quintiles are always ordered according to total income.
Source: Income and Living Conditions Survey (2006-2007)