

WP/98/7

INTERNATIONAL MONETARY FUND

African Department

**Income Inequality: Does Inflation Matter?**

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January 1998

**Abstract**

This paper contributes to the income inequality literature that is based on the traditional Kuznets model. Price stability, financial deepening, level of development, state employment, and fiscal redistribution are found to enhance income equality in a given country. While the effect of price stability is uniform for all levels of GDP per capita, the effect of financial deepening is found to increase with the level of development. Moreover, tight monetary policies do not seem to have any austere effects; low inflation reinforces, rather than counteracts, the income-equalizing effect of fiscal redistribution.

JEL Classification Numbers: D31, O15, E31, C21

Keywords: Income distribution, inflation, Kuznets hypothesis

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<sup>1</sup>The work on this paper was started when the author was with the Monetary and Exchange Affairs Department. Branko Milanovic kindly shared his original database with the author. During the process of writing, many helpful comments were provided by William E. Alexander, Eliana Cardoso, David T. Coe, Charles Enoch, John Green, Anne-Marie Gulde, Ernesto Hernández-Catá, Lamin Leigh, Branko Milanovic, Anthony Pellechio, Thomas Walter, and Holger Wolf; however, the author remains responsible for any remaining errors. Kiran Sastry provided excellent research assistance.

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## SUMMARY

The distribution of income in a country is traditionally assumed to shift from relative equality to inequality and back to greater equality as the country develops. Based on this reasoning, the so-called Kuznets hypothesis postulates a nonlinear relationship between a measure of income distribution and the level of economic development. However, empirical multicountry studies of income distribution have documented significant residuals in Kuznets-type models even after corrections have been made for explicit redistribution policies, employment by the state, regional development, the age profile of the population, and other factors.

Following Milanovic, and using his original data, this paper augments the Kuznets hypothesis of income inequality by incorporating inflation and financial deepening (with the latter defined as the ratio of broad money, M2, to GDP). Using a cross-country database containing 75 countries, we find that past inflation affects current levels of income inequality as measured by Gini coefficients, and that these results are robust even after controlling for fiscal redistribution. The positive impact of price stability on income distribution is nonlinear: the reduction in inflation from hyperinflationary levels significantly lowers income inequality, while further reduction toward a very low level of inflation seems to bring about negligible additional gains in the Gini coefficient. At the same time, price stability boosts money demand and helps preserve the real value of fiscal transfers. Price stabilization therefore seems to offer a "free lunch": there are no medium- or long-term income inequality costs of disinflation, only benefits.

## I. INTRODUCTION

The distribution of income in a country is traditionally assumed to shift from relative equality to inequality and back to greater equality as the country develops. Intuitively, inequality will rise as some people move away from prevailing traditional activities, which yield a low marginal product, into more productive ventures. At some point, the marginal product of all economic activities converges and income differences narrow. Based on this reasoning, the so-called Kuznets hypothesis (Kuznets, 1955) postulates a nonlinear relationship between a measure of income distribution and the level of economic development. Income distribution is also a concern of policy makers: government policies can, by design, change income distribution to some degree through taxes, transfers, public sector employment, and other policy instruments.

Empirical multicountry studies of income distribution have documented significant residuals in Kuznets-type models even after corrections have been made for explicit redistribution policies, employment by the state, regional development, the age profile of the population, and other factors.<sup>2</sup> The presence of country-specific contributions to income inequality, or "fixed effects," can account for as much as 50 percent of the variation in the income distribution measure.

It is surprising that inflation, as opposed to the above-mentioned variables, has been largely omitted in cross-country empirical research. Besides Bulir and Gulde (1995), the only exceptions are papers by Adelman and Fuwa (1992) and Sarel (1997). By way of comparison, time-series models, following the pioneering work by Schultz (1969) and Blinder and Esaki (1978), have found inflation to contribute to cyclical changes in income distribution in 12 developed and emerging economies. A link between inflation and income distribution was also established by microeconomic studies employing U.S. household data, see Minarik (1979).

Why has inflation been omitted in most cross-country studies of income distribution? As noted by previous researchers, no comprehensive alternative to the simple Kuznets hypothesis has been suggested. So far, most authors have either estimated the simple Kuznets hypothesis or resorted to ad hoc augmentation of the original model. The latter approach is exemplified by Milanovic (1994, p.3), who argues that "income distribution is determined (1) by factors that are in the short run, from the point of view of policy makers or society as a whole, "given," and (2) by social (or public policy) choice." While the former set of factors

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<sup>2</sup>Contributions to the empirical literature were surveyed in Bulir and Gulde (1995). Practically no single-country study supports the simplest version of the Kuznets hypothesis. See Ram (1991) for a detailed analysis for the U.S. and Deininger and Squire (1996b) for analyses of several other countries.

comprises income per capita and the regional heterogeneity of a country,<sup>3</sup> the latter includes the percentage of workers employed in the state sector and government transfers as a percent of GDP.

Following Milanovic, and using his original data, this paper further augments the Kuznets hypothesis of income inequality by incorporating inflation and financial deepening (as measured by the M2-GDP ratio). Using a cross-country database containing 75 countries (Table 1), we find that past inflation affects current levels of income inequality as measured by Gini coefficients, and that these results are robust even after controlling for fiscal redistribution. The positive impact of price stability on income distribution is nonlinear: the reduction in inflation from hyperinflation levels significantly lowers income inequality, while further reduction toward a very low level of inflation seems to bring about negligible gains in the Gini coefficient. At the same time, price stability boosts money demand and helps to preserve the real value of fiscal transfers. Both factors have a significant second-order impact on inequality reduction.

Moreover, when inflation is included, our results seem to contradict the traditional critique that the Kuznets model depends on the inclusion of Latin American countries.<sup>4</sup> Specifically, inclusion of a dummy for Latin America (or for any other region) does not lead to a breakdown of the Kuznets hypothesis, as in Deininger and Squire (1996b). This result suggests that inflation might be one of the “missing” variables in Kuznets-type models. It is not a coincidence that high-inequality countries, such as many in South America, have generally suffered from hyperinflation and consequent low monetization, and that low-inequality Asian countries have had lower-than-average inflation rates.

The paper is structured as follows: in Section II, we formulate simple representative agent models whose incomes exhibit different inflation sensitivities. The empirical assessment of the direct and indirect effects of inflation and financial deepening on income distribution is presented in Sections III and IV, respectively. In Section V, we summarize our findings and draw some conclusions.

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<sup>3</sup>The list of “given” factors potentially determining income distribution is, of course, longer (see Deininger and Squire (1996a) or Vanhoudt (1997)). Over time, education (investment in human capital) can lower income inequality. However, this measure is usually found correlated with income per capita. A skewed age profile of a country's population affects income distribution, as younger cohorts tend to have lower earned and unearned incomes. Similarly, inequality in a society comprising mainly one-person households will likely be higher than inequality in a society where households contain multiple wage earners.

<sup>4</sup>See, for example, Campano and Salvatore (1988). In general, we find the critique based on a simple regression of income distribution on per capita income overly simplistic; as shown by Milanovic, the level of development is a reversible factor of inequality.

Table 1. Factors Affecting Income Distribution

	Country <sup>1</sup>	Year of Gini Observation	Gini Coefficient	GDP per Capita <sup>2</sup>	Social Transfers <sup>3</sup>	State Employment <sup>4</sup>	Inflation <sup>5</sup>	M2-GDP Ratio <sup>6</sup>	Private Credit-GDP Ratio <sup>6</sup>
1	Tanzania	1988	59.0	567	1.9	6.0	32.6	0.30	0.02
2	Madagascar	1980	48.9	670	3.2	3.1	9.4	0.25	0.18
3	Bangladesh	1983	35.0	700	1.1	4.2	13.2	0.22	0.10
4	Zambia	1973	57.0	868	6.9	13.2	4.5	0.31	0.12
5	India	1976	40.0	870	1.8	6.0	10.0	0.27	0.15
6	Ghana	1989	36.7	991	4.7	12.4	26.3	0.15	0.04
7	Kenya	1983	57.3	1,014	5.6	7.5	13.1	0.29	0.21
8	Sierra Leone	1976	49.0	1,031	1.8	1.3	12.5	0.17	0.07
9	Nigeria	1974	60.0	1,033	1.0	3.3	10.3	0.14	0.07
10	Senegal	1970	51.3	1,248	6.1	3.4	2.3	0.23	0.15
11	Zimbabwe	1970	50.1	1,371	12.2	15.2	1.9	0.14	0.16
12	Côte d'Ivoire	1985	54.0	1,434	7.3	11.3	5.6	0.28	0.39
13	Bolivia	1989	52.5	1,487	6.8	18.3	2,414.3	0.16	0.11
14	Honduras	1989	59.1	1,491	1.1	9.6	4.9	0.31	0.25
15	Pakistan	1984	38.3	1,790	1.6	2.8	8.4	0.42	0.25
16	Indonesia	1977	51.0	1,822	2.4	5.1	24.3	0.16	0.18
17	Egypt	1975	43.0	1,935	7.7	19.3	6.0	0.47	0.15
18	Swaziland	1974	57.0	2,113	5.9	7.5	7.5	0.29	0.20
19	Sri Lanka	1985	43.0	2,120	4.6	23.3	12.2	0.31	0.20
20	Philippines	1987	45.5	2,168	2.8	11.8	17.6	0.27	0.22
21	Morocco	1980	53.3	2,376	6.3	5.0	9.7	0.42	0.18
22	Guatemala	1989	59.5	2,431	3.3	5.8	18.0	0.24	0.15
23	China	1988	38.2	2,472	12.0	20.4	10.2	0.68	0.76
24	Jamaica	1975	44.5	2,628	5.5	11.0	14.6	0.33	0.27
25	Algeria	1989	39.9	2,662	8.6	50.8	9.1	0.84	0.59
26	Jordan	1986	39.7	2,684	5.4	22.2	3.8	0.93	0.58
27	Ecuador	1987	44.5	2,810	6.8	23.7	32.0	0.20	0.23
28	Peru	1981	57.0	3,084	3.4	14.8	59.4	0.20	0.08
29	Thailand	1989	47.8	3,282	4.3	6.2	3.2	0.63	0.49
30	Iran	1984	42.9	3,558	7.9	26.9	19.2	0.53	0.23
31	Panama	1989	56.5	3,794	13.2	17.3	0.5	0.37	0.55
32	Colombia	1987	51.6	3,807	2.0	10.7	20.4	0.21	0.15
33	Turkey	1987	43.8	3,904	7.3	13.6	39.6	0.32	0.23
34	Poland	1989	26.0	4,189	17.5	70.4	71.5	0.48	0.04
35	Gabon	1977	63.0	4,210	2.3	8.4	16.2	0.18	0.16
36	Costa Rica	1989	46.0	4,317	12.2	16.9	16.2	0.41	0.17
37	Argentina	1989	47.6	4,363	7.6	15.2	863.3	0.22	0.23
38	Romania	1991	25.7	4,597	11.7	95.2	47.9	0.53	0.10
39	Brazil	1989	63.3	4,621	5.5	11.7	514.2	0.39	0.21
40	Chile	1987	48.2	4,719	19.1	9.2	23.4	0.40	0.68
41	Yugoslavia	1989	37.9	4,857	13.1	78.9	343.4	0.71	0.57
42	South Africa	1980	57.0	4,936	8.9	13.2	11.9	0.37	0.28
43	Malaysia	1989	48.4	5,070	8.0	8.4	1.3	0.68	0.65
44	Mexico	1984	50.6	5,323	5.6	21.4	56.1	0.29	0.13
45	Venezuela	1989	44.1	5,648	5.6	19.3	33.0	0.34	0.27
46	South Korea	1982	35.7	5,682	2.9	9.3	18.0	0.34	0.40
47	Uruguay	1989	42.4	5,787	10.5	21.4	71.0	0.50	0.44
48	Hungary	1989	23.1	5,924	19.9	93.9	10.7	0.44	0.12
49	Portugal	1974	38.1	5,984	17.1	14.2	11.9	1.03	0.88
50	Greece	1986	39.9	6,436	16.7	10.7	20.4	0.64	0.31
51	Ireland	1987	34.6	7,022	25.1	19.6	6.3	0.39	0.25
52	Czechoslovakia	1988	19.5	7,421	21.3	98.8	0.8	0.68	0.06
53	Spain	1988	31.5	8,253	18.1	13.7	7.8	0.73	0.64
54	Cyprus	1985	35.7	8,434	8.8	12.2	6.6	0.68	0.53
55	Singapore	1988	41.0	10,417	18.3	10.4	0.7	0.84	0.88
56	Israel	1979	33.3	10,864	22.1	27.1	46.8	0.30	0.55
57	Bahamas	1989	42.8	11,004	1.2	18.6	5.1	0.37	0.32
58	New Zealand	1986	30.0	11,308	19.6	24.7	11.7	0.30	0.21
59	Austria	1989	24.9	12,353	27.9	37.9	2.2	0.88	0.66
60	Netherlands	1983	32.1	12,684	31.1	15.0	5.2	0.72	0.66
61	Italy	1990	31.3	13,001	24.4	20.9	5.7	0.62	0.36
62	Belgium	1983	27.4	13,005	30.3	22.5	7.0	0.47	0.29
63	United Kingdom	1979	28.1	13,060	19.8	22.8	15.7	0.33	0.28
64	France	1981	30.7	13,584	31.0	21.2	11.2	0.75	0.69
65	Denmark	1989	28.0	13,607	33.3	29.4	4.3	0.61	0.53
66	Japan	1985	35.0	13,645	17.5	9.5	2.8	0.95	0.93
67	Norway	1979	26.9	13,819	27.1	24.8	8.6	0.58	0.37
68	Finland	1985	20.2	13,980	22.0	28.7	8.6	0.47	0.56
69	Hong Kong	1981	48.5	14,014	2.9	7.9	10.3	0.68	0.85
70	Australia	1982	31.6	14,529	17.1	29.3	9.6	0.40	0.29
71	Germany	1981	27.8	14,621	25.7	22.3	4.4	0.55	2.17
72	Sweden	1981	22.9	14,941	32.2	36.2	10.9	0.58	0.42
73	Canada	1981	32.0	17,681	21.5	24.1	9.7	0.48	0.45
74	Switzerland	1982	35.5	17,763	14.9	10.4	4.2	1.11	1.17
75	United States	1979	34.4	19,851	17.7	15.8	8.1	0.63	0.65
	Full sample average		41.7	6,317	11.8	20.5	69.6	0.45	0.38
	Excluding hyperinflationary countries		41.2	6,456	12.0	19.9	15.3	0.46	0.38

Source: Milanovic (1994), and IMF, *International Financial Statistics*.<sup>1</sup> Ranked in ascending order by GDP per capita.<sup>2</sup> In 1988 US dollars; the same year as the observation of the Gini coefficient.<sup>3</sup> In percent of GDP; the same year as the observation of the Gini coefficient.<sup>4</sup> In percent of total labor force; the same year as the observation of the Gini coefficient.<sup>5</sup> Five-year average preceding the year of the Gini coefficient.<sup>6</sup> Three-year average preceding the year of the Gini coefficient.

## II. INFLATION AS A FACTOR AFFECTING INCOME DISTRIBUTION

Economic theory has identified various costs of inflation, as well as actions that can be taken to avoid those costs.<sup>5</sup> For example, optimizing holdings of domestic currency can prevent losses associated with expected inflation. Similarly, investing in inflation-indexed bonds or negotiating inflation-adjusted employment contracts helps protect against unexpected inflation. However, protecting against inflation uncertainty may be difficult, or the transaction cost of doing so may be too high.

For the sake of simplicity, assume that the economy is inhabited by two types of workers: "outsiders," who accept nominal contracts, and "insiders," who accept inflation-adjusted wage contracts.<sup>6</sup> Let us start with an outsider worker. She receives a wage, which is a product of her wage rate and hours worked, and also holds and trades in a noninterest bearing asset, that is, currency. If inflation is positive, the value of this asset declines. The worker has to allocate her wage and nonwage income between current consumption and the holdings of the nominal asset.

How does inflation affect the outsider worker's behavior? First, the amount of labor supplied by the worker is affected by the change in the price level: inflation shifts the labor supply schedule inward, lowering the amount of hours worked and, eventually, total earnings. (This outcome assumes, of course, a horizontal labor demand schedule and an upward-sloping labor supply schedule in the usual labor-wage space.) The worker responds to losses associated with the so-called shoe leather cost—the cost of being locked into nominal contracts—and the cost of protracted wage negotiations. In each of those cases, both expected and unexpected inflation "distracts" the worker from working and forces her to engage in time-consuming activities to minimize her inflation-induced income losses (see Braun (1994), Fischer (1993), and King and Wolman (1996)).<sup>7</sup>

There is also a second type of costs, affecting outsider workers: inflation reduces the value of a nominal asset held by workers. Irrespective of time spent by the worker, the losses stemming from negative real returns can be avoided only if inflation is fully anticipated and if

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<sup>5</sup>Naturally, we will not consider all costs discussed in the literature. See Driffill, Mizon, and Ulph (1990) for a review.

<sup>6</sup>A formal derivation of the model is contained in the Appendix.

<sup>7</sup>King and Wolman (1996) estimate that annual inflation of 12 percent would result in a loss of six more hours per quarter than would inflation of 5 percent. By way of comparison, a price stability would result in a gain of seven hours per quarter.

the holding of currency can drop to zero.<sup>8</sup> The latter is clearly an unsustainable assumption in a cash-in-advance economy.

It is thus straightforward to show that inflation reduces outsiders workers' resources available for consumption both through limiting the amount of hours worked and through a loss in the asset principal. However, a more interesting question is: What does this framework say about relative incomes of workers whose earnings have different inflation sensitivity? To answer this question, we will introduce an "insider" worker.

Let us assume that another worker (the insider worker) holds other assets than currency and is employed under a different wage regime than the worker discussed earlier (outsider). For example, she might receive most of her compensation in stock options or inflation-adjusted nonwage benefits, the market value of which is uncorrelated with inflation. Alternatively, she might be employed in a unionized sector with indexed wages (through a cost of living adjustment or a similar mechanism). Therefore, she faces little or no inflation distraction, and her marginal product of labor is unchanged. It is reasonable to assume that these compensation characteristics exclude wage earners at the bottom of the income scale, who are generally much less protected from cyclical real-wage fluctuations.<sup>9</sup>

Return on assets owned by a wealthy insider might be also better protected from inflation. She might buy assets, returns on which (i) are uncorrelated or weakly correlated with inflation or (ii) grow faster than inflation. The conditions that must hold if temporary financial investments of periodic income are to be advantageous are quite severe and might exclude low-income households from those activities.<sup>10</sup> The severity of those conditions declines with the level of development of financial markets in the country.

The effects of inflation can be summarized as follows. First, workers whose earnings streams are protected against price level changes (insiders) would increase their incomes relative to the first, unprotected group (outsiders), and the pretransfer income distribution

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<sup>8</sup>Quadrini and Ríos-Rull (1997) discuss a similar issue (earning uncertainty) in the context of the dynastic model of income and wealth distribution.

<sup>9</sup>Between 1981 and 1996, for example, the U.S. federal minimum wage was raised only once, and its value in 1996 dollars declined from about US\$6 per hour in 1981 to the current level of US\$4.25 per hour.

<sup>10</sup>For example, Goodhart (1989) shows that, with an annual interest rate of 6 percent and fixed cost per transaction of US\$2, it would require a monthly salary of about US\$1,600 in order for it to be economical for the agent to purchase and resell any temporary assets.



would widen. Second, in absolute terms, incomes of both groups would fall.<sup>11</sup> Third, while government policies can prevent outsiders from falling into poverty by, say, taxing the rich and making transfers to the poor, those policies are likely to be insufficient to narrow the inflation-generated income distribution gap, as the number of transfers-receiving outsiders is larger than the number of the taxed rich. Therefore, one would expect the effects of fiscal equalization measures to be weakly correlated with inflation-generated changes in income inequality.

### III. CROSS-COUNTRY EMPIRICAL EVIDENCE

In this section, we will test the hypothesis that a part of the variation in income distribution among countries can be explained by previous inflation in those countries.

#### A. The Data and the Original Milanovic Results

The original sample, which was compiled by Milanovic (1994), consists of 80 countries ranked by GDP per capita in ascending order; it was used to test his so-called Augmented Kuznets Hypothesis. Gini observations (one per country) range over a period of 22 years (1970-91), a result of the scarcity of consistent Gini observations. Moreover, these observations had to be paired with almost equally scarce state employment and transfers data.<sup>12</sup> We have narrowed the Milanovic sample to 75 countries for which we could collect the appropriate inflation and financial data from the *International Financial Statistics (IFS)*. Countries are ranked by their GDP per capita in ascending order (the poorest country is Tanzania, the richest is the United States).

Milanovic tested the hypothesis according to which government policies can significantly change income distribution: "inequality in richer societies does not decrease because of economic factors, but because societies *choose* less inequality," (p.33). His preferred variables, the so-called social choice factors, included the percentage of all employed who work in the state sector (inclusive of government administration), the

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<sup>11</sup>In the short term, the indexation scheme can overcompensate insiders for inflation, as shown by Brandolini and Sestito (1994) on the example of Italy's *scala mobile*. It can be argued, however, that this policy is not sustainable because it would lead to changes in the labor-capital ratio.

<sup>12</sup>Hypothetically, this lack of data might create interpretation problems. For example, did the first oil shock affect the countries' income distribution? Are there secular cycles in income distribution across countries? Even though very little is known about these effects, they are likely to be correlated with variables already contained in the regressions, most notably with income, inflation, and transfers.

percentage share of cash and in-kind social transfers in the country's GDP, and a dummy for Asian countries.

While the Kuznets hypothesis held in Milanovic's results, the effect of social choice variables was substantial and rose with the level of income per capita. For example, state employment and transfers lowered the Gini coefficient three times more on average in countries with GDP per capita between US\$6,000 and US\$10,000 than in countries with GDP per capita below US\$1,500 (see Table 5 in Milanovic (1994)). On average, social choice variables reduced the Gini coefficient from 54 Gini points to 41 Gini points, that is, by one-fourth.

### **B. New Hypotheses**

While Milanovic was mainly concerned with fiscal and quasi-fiscal channels of redistribution, either through explicit transfers or through broadly defined state sector employment, we add inflation and financial deepening (defining the latter as the ratio of M2 to GDP and of credit to the private sector to GDP, respectively) to the list of explanatory variables. We expect the impact of inflation on income distribution to be stronger at higher inflation rates. In principle, the impact of inflation should be independent of the level of development and of the level of fiscal redistribution. In addition, we expect that, in countries with deeper financial markets, individuals benefit from better access to capital, an effect reinforced by low inflation.<sup>13</sup>

Our sample and regression estimates differ in two ways from the original Milanovic results. First, inflation and financial data are not available for 5 out of the 80 countries in his sample. However, restricting the number of observations to 75 changes neither the level of statistical significance nor the size of the regression coefficients in Milanovic's results. Coefficients of determination and standard errors of regression are only marginally worse. Second, owing to multicollinearity, we exclude two explanatory variables from Milanovic's preferred equation: the ratio of average incomes between the richest and the poorest region within a country, and a dummy for Asian countries. This exclusion—like the change in the number of observations—changes neither the significance of individual parameters of the remaining variables nor the overall results. A correlation matrix of variables is presented in Table 2.

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<sup>13</sup>See De Gregorio (1993) for the effect of credit markets on human capital accumulation, growth, and income distribution.

Table 2. Estimated Correlation Matrix of Variables

	Gini <sup>1</sup>	GDP	State Employ- ment	Transfers	Inflation				M2-GDP Ratio
					Hyper- inflation	High	Low	Very low	
GDP <sup>2</sup>	-0.63								
State employment <sup>3</sup>	-0.57	0.28							
Transfers <sup>4</sup>	-0.73	0.74	0.38						
Hyperinflation <sup>5</sup>	0.18	-0.05	0.12	-0.09					
High inflation <sup>6</sup>	-0.05	0.05	0.27	-0.02	-0.07				
Low inflation <sup>7</sup>	-0.02	-0.11	-0.22	-0.08	-0.31	-0.42			
Very low inflation <sup>8</sup>	-0.04	0.13	0.00	0.17	-0.13	-0.17	-0.70		
M2-GDP ratio <sup>9</sup>	-0.49	0.57	0.26	0.50	-0.09	-0.11	-0.20	0.36	
Private credit- GDP ratio <sup>10</sup>	-0.31	0.54	-0.06	0.43	-0.07	-0.15	-0.21	0.39	0.65

Source: Calculations based on Table 1.

<sup>1</sup> Gini coefficient of disposable income (for Organization for Economic Cooperation and Development members and socialist economies) and Gini coefficient of gross income for African, Asian, and Latin American countries. The year of the Gini coefficient observation for each country is the same as that of the other variables.

<sup>2</sup> The country's GDP per capita in thousands of 1988 U.S. dollars.

<sup>3</sup> The percentage share of workers in the state sector (including government administration) in total employment.

<sup>4</sup> The percentage share of cash and in-kind social transfers in the country's GDP.

<sup>5</sup> Dummy variable: 1 if five-year average annual inflation more than 300 percent; zero otherwise.

<sup>6</sup> Dummy variable: 1 if five-year average annual inflation more than 40 percent but less than 300 percent; zero otherwise.

<sup>7</sup> Dummy variable: 1 if five-year average annual inflation more than 5 percent but less than 40 percent; zero otherwise.

<sup>8</sup> Dummy variable: 1 if five-year average annual inflation less than 5 percent; zero otherwise.

<sup>9</sup> Three-year average of M2-GDP ratio (financial deepening measure).

<sup>10</sup> Three-year average of private credit-GDP ratio (financial deepening measure).

There is little reason to assume that changes in inflation and financial deepening can cause a major swing in a country's income distribution rapidly. If this were so, we would observe much larger annual swings in income distribution because inflation, especially, is prone to cyclical fluctuations.<sup>14</sup> More likely, the full effects of inflation and financial deepening take time to feed through the system. Thus, one should look at cumulative or average changes preceding the period of observation of the income inequality indicator. Interestingly, a country ranking by average inflation (or by financial deepening) changes little whether three-, five-, or seven-year averages are used. We use a five-year average for inflation based on goodness-of-fit criteria; the three-year average used for financial deepening is dictated by the availability of broad money series for some countries.

The regression equation, with the Gini coefficient as the dependent variable, includes a constant, a quadratic expression for GDP per capita to capture the nonlinearity of the Kuznets hypothesis, state employment, transfers as a percentage of GDP, four measures of inflation, and two measures of financial deepening (M2 and private sector credit as percentages of GDP). Income inequality is assumed to initially rise with development (as proxied by GDP per capita) but to decline in higher stages of development; therefore, the expected signs of  $Y$  and  $Y^2$  are positive and negative, respectively. State employment and fiscal transfers are expected to lower inequality and have negative expected signs.<sup>15</sup> Inflation should unambiguously increase inequality. Finally, as both financial deepening variables are expected to lower income inequality, the expected sign is negative.

The literature suggests that most macroeconomic effects of inflation are nonlinear.<sup>16</sup> Therefore, adding average inflation rates to the Kuznets model yields statistically insignificant results even when various nonlinear transformations of inflation are used, similarly to results in Sarel (1997). To correct for nonlinearity, we distinguish several levels of inflation: hyperinflation (more than 300 percent annually for four countries, with a mean of 1,034 percent), high inflation (between 41 percent and 300 percent annually for seven countries, with a mean of 56 percent), low inflation (between 5 percent and 40 percent annually for 47 countries, with a mean 14 percent), and very low inflation (less than 5 percent annually for 17 countries, with a mean of 3 percent). While the 40 percent breakpoint is taken from Bruno (1995)<sup>17</sup> and hyperinflationary countries are distinguished mechanically, the breakpoint between low and very low inflation is

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<sup>14</sup>Nevertheless, several countries have pronounced cyclical or countercyclical patterns of inequality. Cyclical patterns of inequality have been observed in Brazil (Cardoso, 1993) and Greece (Livada, 1992), while countercyclical patterns have been observed in Italy (Brandolini and Sestito, 1994) and the United States (Blinder and Esaki, 1978).

<sup>15</sup>See Milanovic (1994) for discussion of a possible confusion in determining the signs.

<sup>16</sup>See, for example, Bruno (1995), Barro (1996), and Sarel (1996).

<sup>17</sup>It was successfully tested against 30 percent and 50 percent breakpoints.

chosen heuristically. Although we have experimented with several breakpoints for very low inflation (from 2 percent to 7 percent), none of them is clearly superior to the 5 percent breakpoint. The equation is estimated for both three and four inflation steady states, with the former omitting the distinction between low and very low inflation.

We select intercept dummies as the best transformation of the inflation variable. In principle, one can regress Gini coefficients either on intercept dummies (the inflation variable is 1 if the actual average is within its specified bounds and zero otherwise) or on slope dummies (actual inflation multiplied by its dummy value). While the first approach presents an average impact of a particular level of inflation on income distribution, the second approach shows how much income distribution changes owing to a 1 percent change in inflation. Slope dummies have lower estimates of residual sums of squares and higher  $R^2$ , however, because of higher multicollinearity, usually one or more parameter estimates are either statistically insignificant or the overall improvement in fit is marginal. Including both dummies leads to statistically insignificant estimates.

### **C. Overview of Results**

The empirical results, summarized in Table 3, are divided into two parts: the estimated parameters of the Augmented Kuznets Hypothesis, as proposed by Milanovic, are reported in the shaded area; the estimated parameters of the newly added variables are reported in the nonshaded area. The inclusion of the new explanatory variables only marginally affects the estimated parameters of the Augmented Kuznets Hypothesis, and most of the regressions' variation vis-à-vis the new variables is captured by changes in the statistically insignificant intercept. As in the Milanovic regressions, the inverted U-shaped income distribution profile seems to hold.

The results lend additional support to the Kuznets hypothesis because previously unexplained regional differences can be attributed to past inflation developments. For example, the high inequality in middle-income Latin American countries (with an average Gini coefficient of 50.6 compared with the sample average of 41.7) can be viewed as a consequence of the comparatively high inflation rates and low monetization. Excluding countries in hyperinflation, the five-year Latin American inflation rate is 27 percent and the regional ratio of M2 to GDP is only 0.31 (compared with the sample averages of 14 percent and 0.45, respectively). By way of comparison, the low inequality in middle-income Asian countries (with an average Gini coefficient of 42.1) can be rationalized by the low inflation rates and high monetization of the economy (10 percent and 0.50, respectively).

Table 3. The Kuznets Hypothesis, Inflation, and Financial Deepening  
(Sample of 75 countries, using ordinary least squares, heteroscedastic-consistent standard errors)

Eq	Constant	$Y$	$Y^2$	State Employment	Transfers	Hyper- inflation	High Inflation	Low Inflation	Very Low Inflation	M2-GDP Ratio	Private Credit GDP Ratio	Adj. $R^2$	Standard Errors of Regression	RSS	LM Test
1a	-97.080 (0.21)	39.800 (0.04)	-2.608 (0.00)	-0.223 (0.00)	-0.416 (0.00)							0.71	6.449	n.a.	...
1	-111.584 (1.42)	43.326 (2.30)	-2.814 (2.53)	-0.230 (8.21)	-0.421 (3.96)							0.674	6.450	2912	...
2	-96.304 (1.23)	39.455 (2.10)	-2.579 (2.32)	-0.242 (11.09)	-0.397 (3.78)	7.815 (2.66)						0.694	6.247	2692	2
3	-82.468 (1.02)	38.062 (1.97)	-2.497 (2.18)	-0.249 (10.87)	-0.388 (3.64)		-6.673 (2.08)	-8.105 (2.67)				0.691	6.280	2682	5
4	-113.417 (1.42)	43.686 (2.28)	-2.804 (2.48)	-0.225 (7.79)	-0.405 (3.72)					-4.846 (1.61)		0.676	6.429	2852	20
5	-98.403 (1.23)	39.897 (2.09)	-2.578 (2.28)	-0.238 (10.85)	-0.385 (3.62)	7.546 (2.41)				-4.163 (1.40)		0.694	6.241	2648	3
6	-87.135 (1.05)	39.043 (1.98)	-2.530 (2.17)	-0.242 (10.82)	-0.380 (3.52)		-6.887 (2.04)	-7.736 (2.39)		-3.893 (1.23)		0.690	6.283	2645	8
7	-82.861 (1.02)	38.306 (1.97)	-2.521 (2.17)	-0.248 (10.88)	-0.394 (3.62)		-5.892 (1.79)	-8.825 (2.87)	-5.959 (1.84)			0.697	6.190	2567	4
8	-92.500 (1.10)	40.374 (2.01)	-2.597 (2.18)	-0.239 (10.44)	-0.391 (3.44)		-6.946 (1.98)	-8.383 (2.47)	-4.614 (1.30)	-6.590 (1.89)		0.704	6.142	2489	3
9	-110.216 (1.39)	42.893 (2.26)	-2.776 (2.47)	-0.234 (7.79)	-0.415 (3.88)						-1.000 (0.94)	0.677	6.486	2902	63

Notes: (1a) is the original Milanovic equation with 80 observations; values in parentheses are the complements of the level of confidence with which the null hypothesis is rejected. For example, 0.21 in the first column indicates that the hypothesis of the first parameter being equal to zero can be rejected at the 21 percent confidence level.

The variables for the Augmented Kuznets hypothesis are presented in the shaded area. Absolute value of  $t$ -statistics in brackets, except equation (1a). The 1 percent and 5 percent critical values for the  $t$ -statistics are 2.38 and 1.67, respectively; Adj.  $R^2$  is coefficient of determination adjusted for the number of variables, and RSS is a residual sum of squares. The Lagrange multiplier (LM) test is the probability of rejecting the null hypothesis that the parameters of the new explanatory variables (in the nonshaded area) are jointly equal to zero. For example, in equation 2, a value of 2 means that the null hypothesis can be rejected at approximately the 2 percent confidence level.

Taking into account the persistent heteroscedasticity, we reestimated the standard errors using the White heteroscedastic-consistent standard errors procedure. No spatial autocorrelation was observed and, therefore, we do not report the results of autocorrelation tests. The overall fit is quite robust, and the estimated coefficients are stable, as documented by the recursive least-squares coefficients (Figure 1).<sup>18</sup> However, as can be seen in Table 3, all of the newly included variables are statistically different from zero at the 5 percent significance level in only five equations. This is an unfortunate but inescapable effect of multicollinearity of variables: the standard errors of parameters rise when mutually correlated explanatory variables are added to the regression (the M2-GDP ratio and very low inflation, the M2-GDP ratio and transfers, state employment and low inflation, etc.).

#### **D. Effects of Inflation and Financial Deepening on Income Inequality**

What is the impact of the newly added variables? Higher inflation increases income inequality, and the impact is strongest in hyperinflation countries. The largest improvement in income distribution, compared with the hyperinflationary subsample, is in the group of low-inflation countries (5-40 percent annually). Although countries with very low inflation (below 5 percent annually) seem to benefit less directly from the price stability than the low-inflation countries, the former have deeper financial markets (higher ratios of M2 to GDP). In countries with deep financial markets, better access to capital improves income inequality. There is, however, one difference between the potential impacts of low inflation and financial deepening. Unlike price stability, which is independent of the level of development, financial deepening is correlated with GDP per capita.

The results can be summarized as follows. First, hyperinflation dramatically worsens income distribution: the four hyperinflationary countries face an increase of 8 points in the Gini coefficient over the average of 50 Gini points for the rest of the sample (see Table 3, equation 2). Second, countries with either high or low inflation have Gini coefficients that are lower by 7 or 8 Gini points, respectively, than countries with hyperinflation (Table 3, equation (3)).<sup>19</sup> Third, deepening financial markets (increasing the M2-GDP ratio by its one standard deviation) lowers the Gini coefficient by roughly 1 point, (Table 3, equations (4-6)).

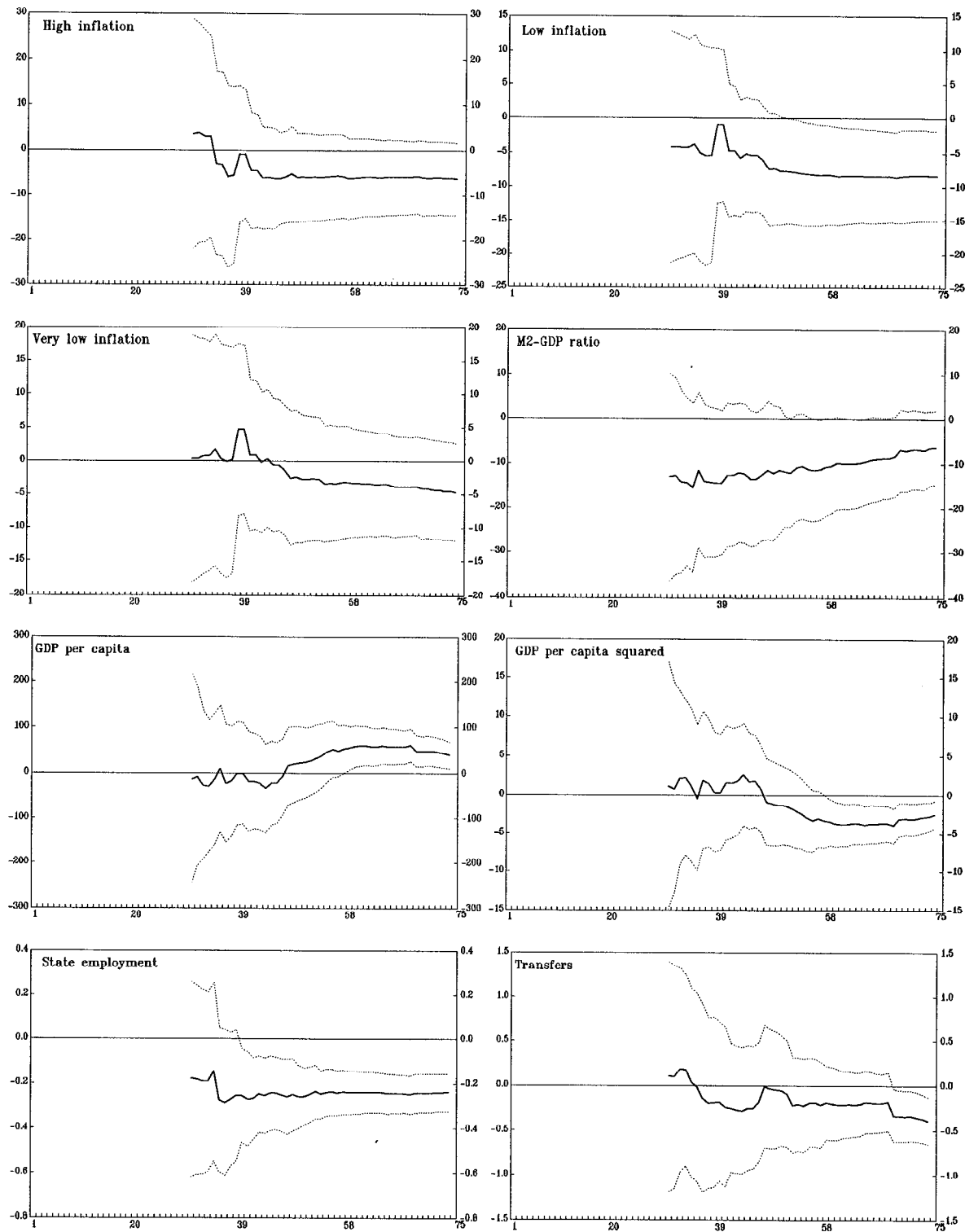
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<sup>18</sup>The 5 percent standard error bands in the recursive regression are computed from the simple ordinary least squares (OLS) and are not heteroscedastic consistent. As such, they are likely to overestimate the true standard errors.

<sup>19</sup>In equations (3) and (6) of Table 3 only three levels of inflation are distinguished: hyperinflation (dummy is 1 if inflation is over 300 percent annually; zero otherwise); high inflation (dummy is 1 if inflation is over 40 percent annually and below 300 percent; zero otherwise); and low inflation (dummy is 1 if inflation is less than 40 percent; zero otherwise). Since the last variable includes also the countries with very low inflation, its mean is only 11 percent compared with a mean of 14 percent for low-inflation countries when all four inflation states are distinguished.

Figure 1

# Stability of the Augmented Kuznets Model Recursive OLS Coefficients and Their 2 Standard Error Bands 1/



Source: Calculations based on Equation 8 in Table 3.

1/ Ordinary least squares overestimate the true standard errors because of heteroscedasticity of residuals.



Equation (7) of Table 3 adds another variable to equation (3): countries with very low inflation (defined above). The results reveal further nonlinear effects of inflation on income distribution. While the improvements in high and low inflation compared with hyperinflation remain stable at 6 and 9 Gini points, respectively, very low inflation implies only a modest gain in income distribution, roughly equal to the gain of high inflation (6 Gini points). The gain for countries with very low inflation becomes even smaller (5 Gini points) when financial deepening is taken into account (see Table 3, equation 8) for the full-model estimate.<sup>20</sup> However, the decline in the parameter of very low inflation is almost fully offset by the parameter of the M2-GDP ratio: the average financial depth increases from 0.42 in countries with low inflation to 0.61 in countries with very low inflation.<sup>21</sup> So, the additional gain for countries with very low inflation compared with low-inflation and high-inflation countries is 1.2 and 1.6 Gini points, respectively. The ratio of private credit to GDP contributes only marginally to the explanatory power of the model because of strong multicollinearity.

On inspection, however, the estimated dummies for the various levels of inflation have similar values, especially those for high and low inflation.<sup>22</sup> Therefore, the question is: Are the differences in the estimated inflation coefficients statistically significant? To answer this question, we perform two tests. First, the recursive ordinary least squares (OLS) estimation shows an acceptable stability of parameters, as the standard errors are high, but stable (Figure 1). Second, we calculate the Wald tests for all pairs of inflation parameters (Table 4). The null hypothesis of identical values of parameters can be rejected at about the 10 percent significance level for all combinations except high inflation/low inflation and high inflation/very low inflation. Hence, we conclude that the estimated parameters of inflation can be used for further analysis—with the obvious caveats.

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<sup>20</sup>One could speculate that the fiscal restraints needed to subdue inflation over a longer period have a detrimental effect on fiscal transfers, especially in poorer countries. This result is not, however, confirmed by the data: countries with lower inflation have higher transfers, not vice versa (see below).

<sup>21</sup>The average financial depth is 0.36 in high-inflation countries and 0.37 in hyperinflation countries. The latter number is, however, biased upward by Yugoslavia's high M2-GDP ratio (0.71). The average of the three remaining countries (Argentina, Bolivia, and Brazil) is only 0.25.

<sup>22</sup>Inflation dummies and financial deepening are jointly significant at the 5 percent significance level (see the Lagrange multiplier test in Table 3).

Table 4. Statistical Significance of the Differences Between Inflation Coefficients  
(In percent)

	Hyperinflation	High Inflation	Low Inflation
High inflation	9		
Low inflation	1	43	
Very low inflation	10	83	11

Source: Calculations based on equation (8) in Table 3.

Note: A Wald test for the null hypothesis of  $\alpha - \beta = 0$ , where  $\alpha$  and  $\beta$  are parameters of two inflation coefficients. For example, a value of 9 in the second column of the first row means that the null hypothesis of the parameter of hyperinflation being identical to the parameter of high inflation can be rejected at the 9 percent significance level.

#### E. How Important Are the Newly Added Variables for Income Inequality?

The next question is threefold. First, what is the importance of inflation and financial deepening, compared with the Milanovic social choice factors? Second, does the impact of inflation and financial deepening depend on the level of development? Third, does the impact of inflation and financial deepening depend on the location of the country? Using a simple comparative static analysis, we aim to show that the effect of inflation is as strong as that of the social choice variables and that the benefits of low inflation and high financial deepening are evenly spread across income levels.

Inflation and financial deepening clearly exert a strong impact on income distribution, but how exactly is the impact distributed across the levels of development? Using the estimated coefficients from equation (8) of Table 3, we separate the effects of income variables, Milanovic social choice variables, and our inflation and monetary deepening variables on income distribution. Those effects are smoothed and plotted against GDP per capita (Figure 2).<sup>23</sup> First, taking into account an intercept and the Kuznets factors only<sup>24</sup> (solid line) overestimates the actual income inequality, as shown by the empty squares. Second,

<sup>23</sup>In this approach, we use comparative static analysis which has an apparent disadvantage: omitting a variable from the regression will change all point estimates. However, the results in Table 3 show that the only parameter reacting strongly to variable additions is the intercept.

<sup>24</sup>Social choice variables, inflation, and the M2-GDP ratio are set equal to zero.

including the social choice variables shifts the Kuznets curve downward and pivots it at the intercept (short-dashed line).<sup>25</sup> Finally, inflation and financial deepening shift the Kuznets line further downward (chained line and long-dashed line, respectively). The narrowing effects on income distribution of lower inflation and financial deepening seem independent of the level of development: while the effect of inflation is stronger in lower-income countries, the effect of financial deepening is more pronounced in higher-income countries.

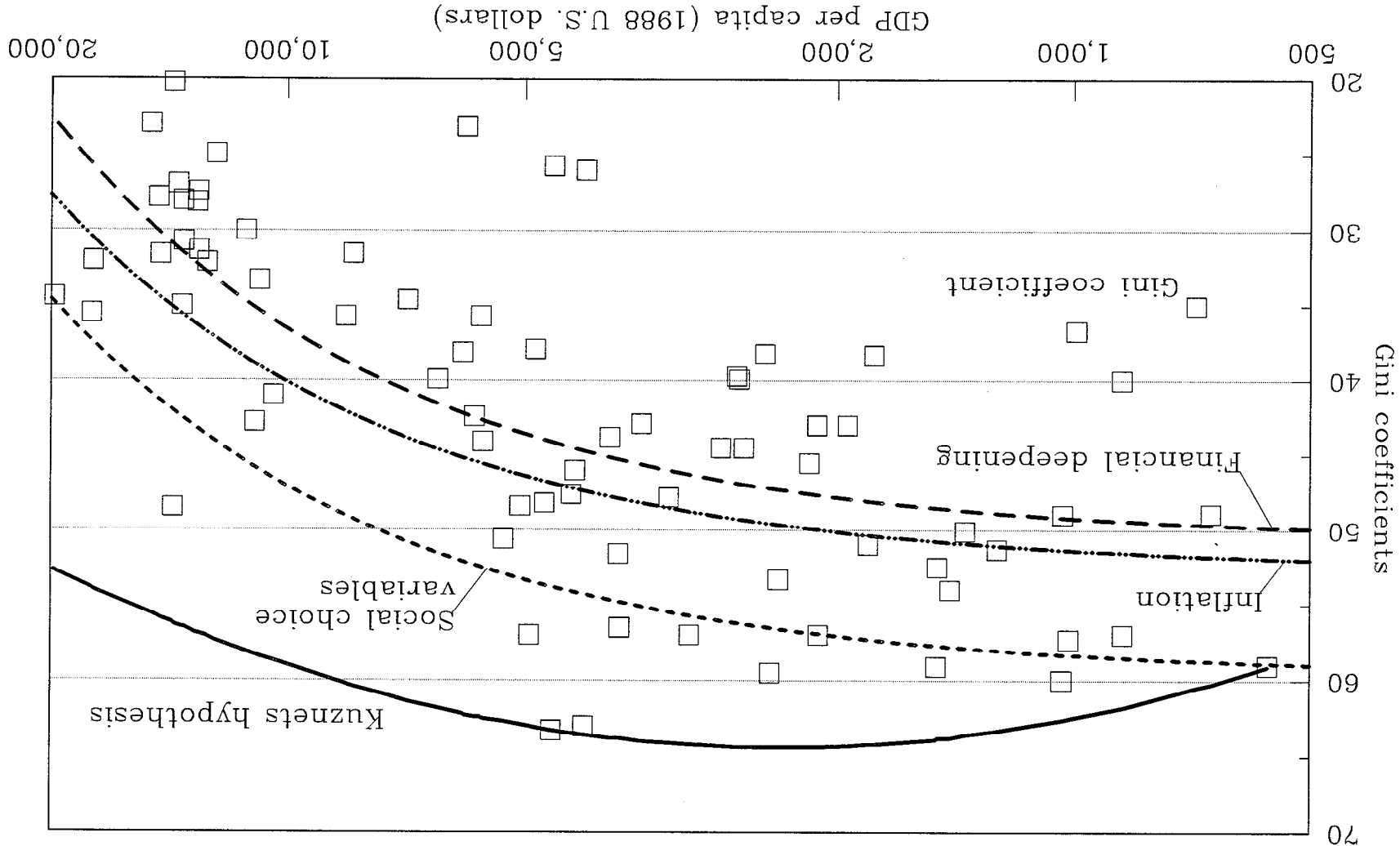
The average effect of the additional variables (and unexplained errors) is about 20 Gini points (see Table 5). The average effect of inflation and financial deepening is stable, at about 10 Gini points, and it increases only slightly with income per capita. In addition, the combined effect can be further divided into the effect of inflation (7 Gini points) and the effect of financial deepening (3 Gini points). In contrast to Milanovic, the gap between the Kuznets hypothesis and the actual Ginis owing to social choice variables widens earlier, at about US\$4,501-6,000 per capita. As before, the impact of social choice variables is strongest in the high-income countries. On average, however, their effect is smaller in absolute terms and also marginally smaller than the aggregated effect of the newly added variables. As predicted, the correlation between the effects of social choice variables and inflation on income distribution is zero (-0.03).

Further insights can be obtained from an analysis of the relative impact of inflation and financial deepening at different levels of development (Table 5). Low-income countries (from US\$1,501-3,000 per capita) benefit both from low inflation and a relatively high M2-GDP ratio, which improve their theoretical income distribution by 11 Gini points, or by almost double the amount generated by the social choice variables. Economies in the two upper brackets of income per capita (US\$6,001-10,000 and more than US\$10,000 per capita, respectively) gain because of households' better access to financial markets. The poorest countries (with incomes of less than US\$1,500 per capita) appear to gain little from the combination of very low inflation and thin financial markets. However, the combined effects of inflation and financial deepening are more than twice as strong as those of social choice variables at this level of development. Middle-income countries (US\$3,001-6,000 per capita) also gain little; this can be attributed mostly to their larger proportion of high-inflation countries.

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<sup>25</sup>Inflation and financial deepening (M2-GDP ratio) are set equal to zero.

Figure 2  
Gini Coefficients and the Augmented Kuznets Hypotheses



Source: Table 1 and Equation 8 in Table 3.

Table 5. Impact of Selected Variables on Income Distribution at Different Income Levels  
(Simple unweighted averages, in Gini points)

Per Capita GDP (in U.S. dollars)	Actual Gini	Kuznets Hypothesis <sup>1</sup>	Total Effect of Additional Variables <sup>2</sup>	Partial Effects							
				Social choice <sup>3</sup>	Inflation and financial deepening					Unexplained part of Gini	
					Total <sup>4</sup>	Inflation <sup>5</sup>					M2-GDP ratio
						Total	Very low	Low	High		
Less than 1,500	50.7	62.3	-11.6	-3.7	-8.2	-6.7	-1.3	-5.4	0.0	-1.5	0.3
1,501-3,000	46.0	64.4	-18.4	-6.0	-10.9	-8.1	-0.4	-7.7	0.0	-2.8	-1.5
3,001-4,500	48.2	63.8	-15.6	-7.8	-8.7	-6.4	-0.9	-3.4	-2.1	-2.3	1.0
4,501-6,000	42.9	62.8	-19.9	-12.1	-9.6	-6.3	-0.4	-4.2	-1.7	-3.3	1.8
6,001-10,000	31.4	61.2	-29.8	-16.5	-11.4	-7.4	-1.2	-6.3	0.0	-4.0	-1.9
Over 10,000	31.8	56.6	-24.8	-13.4	-10.9	-6.9	-1.7	-5.0	-0.3	-4.0	-0.4
Average	41.7	61.2	-19.5	-9.5	-9.9	-6.9	-1.0	-5.3	-0.6	-3.0	0.0

Source: Calculations based on Equation 8 in Table 3.

<sup>1</sup> Income variables and an intercept. All other parameters set equal to zero.

<sup>2</sup> The difference between the actual Gini coefficients and predictions from the simple Kuznets hypothesis.

<sup>3</sup> State employment as percentage of total employment and transfers as percentage of GDP.

<sup>4</sup> Inflation and financial deepening. For definitions of variables see the text.

<sup>5</sup> Relative to hyperinflationary countries.

We can also disentangle a part of the nonlinear effect of inflation, namely, the failure of very low inflation to improve the Gini coefficient much more than low inflation. Part of the positive effect of price stability is captured by the coefficient of the M2-GDP ratio, as countries with very low inflation benefit from deeper financial markets.<sup>26</sup>

While lowering income inequality through the social choice variables is likely to be costly and may be open only to middle- or higher-income countries, substantial income equality gains can be obtained through low inflation at any stage of development. In fact, only with income per capita of more than US\$4,500 can a country expect the effects of social choice variables to outweigh the combined effects of low inflation and financial deepening.

The effects of the newly introduced variables are even more eye-opening when countries are sorted regionally (Table 6). Clearly, the less-developed regions have more to gain from price stability than the members of the Organization for Economic Cooperation and Development (OECD). Only in Europe (the OECD countries are almost the same subsample), owing to massive transfers, and in Eastern Europe, because of the state employment, is the effect of the social choice variables stronger than that of inflation and financial deepening! By way of comparison, the combined effect of inflation and financial deepening in Africa and Asia, is double that of the social choice variables. Inflation has an impact of more than 7 Gini points everywhere except the Latin American and Eastern European regions. Similarly, the main beneficiaries from monetization are the European countries.

Do the results confirm the special status of certain regions? Only two regions, Africa and Asia, have relatively large unexplained residuals. Africa's inequality is higher than the estimated value, Asia's inequality is lower; still, these residuals seem to be far too small to conclude that the Kuznets hypothesis is a result of a few regionally concentrated countries.

#### **IV. SECOND-ORDER EFFECTS OF PRICE STABILITY**

The observed multicollinearity of variables and the nonlinearity of inflation raise the question of common links among explanatory variables. Specifically, are inflation and financial deepening substitutes for, or complements of, the Kuznets and Milanovic variables? If they are complements, how strong are the second-order effects of inflation on income distribution through the social choice variables? Our results indicate that inflation and financial deepening are complements of the traditional variables, and they seem to explain as much as 1 additional Gini point.

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<sup>26</sup>One should not also forget that low-inflation countries—and their per capita incomes—tend to grow faster than other countries (Bruno, 1995 and Sarel, 1996). Despite a marginally wider income distribution, the overall outcome can be Pareto improving, as the total pie to be divided is bigger.

Table 6. Impact of Selected Variables on Income Distribution in Different Regions

(Simple unweighted averages, in Gini points)

	Per capita GDP (in U.S. dollars)	Number of Countries	Actual Gini	Kuznets Hypothesis <sup>1</sup>	Total Effect of Additional Variables <sup>2</sup>	Partial Effects				Unexplained part of Gini
						Social choice <sup>3</sup>	Inflation and financial deepening			
							Total <sup>4</sup>	Inflation <sup>5</sup>	M2-GDP ratio	
Africa	1,832	17	51.5	63.0	-11.4	-5.1	-9.7	-7.5	-2.2	3.4
Asia	4,829	14	42.2	62.1	-19.9	-5.1	-10.6	-7.3	-3.3	-4.3
Latin America	4,207	16	50.6	63.3	-12.6	-6.3	-7.9	-5.8	-2.0	1.6
Europe <sup>6</sup>	11,075	20	30.9	58.4	-27.5	-14.5	-11.3	-7.2	-4.0	-1.7
Eastern Europe	5,700	4	26.6	62.4	-35.9	-28.4	-8.9	-5.0	-3.9	1.4
Developed countries <sup>7</sup>	12,911	22	30.6	57.1	-26.5	-14.3	-11.4	-7.3	-4.1	-0.8

Source: Calculations based on Equation 8 in Table 3.

<sup>1</sup> Income variables and an intercept. All other parameters set equal to zero.<sup>2</sup> The difference between the actual Gini coefficients and predictions from the simple Kuznets hypothesis.<sup>3</sup> State employment as percentage of total employment and transfers as percentage of GDP.<sup>4</sup> Inflation and financial deepening. For definitions of variables see the text.<sup>5</sup> Relative to hyperinflationary countries.<sup>6</sup> Excluding Eastern European countries.<sup>7</sup> Organization for Economic Cooperation and Development.

### A. Inflation and Financial Deepening

What are the quantitative impacts of inflation on financial deepening when the level of development has been controlled for? Initially, we observed a negative correlation between inflation and financial deepening and a positive correlation between the level of development and financial deepening, (see Table 2).<sup>27</sup> Hence, we estimated a simple OLS regression:

$$M2/GDP = -0.515 - 0.044 \text{ Inflation} + 0.129 Y, \quad (2)$$

(2.62) (2.95) (5.79)

$$R^2 = 0.401 \quad SE = 0.180 \quad RSS = 2.35$$

where  $M2/GDP$  and  $Y$  were defined in Table 1, and *Inflation* is the log of the five-year average inflation, SE is the standard error of regression and RSS is the residual sum of squares. The estimated model exhibits no sign of heteroscedasticity in the residuals, and the equation passes the usual stability tests.

The regression results support the hypothesis that even a poor, low-inflation country can deepen its financial sector and, hence, improve its income distribution through the second-order impact of inflation on financial deepening. For example, lowering medium-term inflation by its standard deviation increases  $M2/GDP$  by almost 0.1 percentage point and, other things being equal, lowers income inequality by an additional 0.3-0.4 Gini point.<sup>28</sup> Of course, the effect of financial deepening is more pronounced in richer countries because  $M2/GDP$  is strongly correlated with the level of development (0.57), as agents in richer countries demand larger money balances for transaction purposes (see Figure 2 and Table 4). Indeed, the contribution to equality through financial deepening is negligible for the poorest 10 countries.

### B. Inflation and Transfers

What are the quantitative impacts of inflation on fiscal transfers when the level of development (income per capita) and state employment have been controlled for? While inflation should lower transfers,<sup>29</sup> both controls carry expected positive signs. The control for the level of development asserts that richer countries have more money to spend. We interpret

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<sup>27</sup>Money demand functions include income and inflation with positive and negative expected signs, respectively (see Cagan, 1956 and Laidler, 1985).

<sup>28</sup>High- and low-inflation countries have much larger standard deviations of inflation than does the whole sample or countries with very low inflation; hence, we most likely underestimate the actual improvement in inequality.

<sup>29</sup>As the inflation rate rises, the real tax revenue—the source of transfers—falls. The reason for the so-called Tanzi-Olivera effect is the lags in both the calculation and payment of taxes.



the control for state employment as a measure of the government's statism: the state that employs more people as an income-levelling policy is likely to try to affect income distribution also by other instruments at its disposal, such as transfers. The measure of state employment does not show much correlation with any of the explanatory variables except transfers (Table 2).

As a first step, we estimate a full-sample OLS regression in a semilogarithmic form with heteroscedastic-consistent standard errors:

$$\text{Transfers/GDP} = -40.195 - 1.009 \text{ Inflation} + 6.293 Y + 0.094 \text{ State employment} \quad (2)$$

(6.56) (2.58) (7.83) (3.30)

$$R^2 = 0.598 \quad SE = 5.922 \quad RSS = 2490.2$$

where *Transfers/GDP* denotes the percentage share of cash and in-kind social transfers in the country's GDP and *State employment* is the broadly defined employment by state agencies as percentage of all employed.

Overall, equation (2) does not support the hypothesis that stabilization (anti-inflation) policies worsen medium-term income inequality because of the cutting of social expenditures to balance the budget.<sup>30</sup> Even if such cuts are made initially, the medium-term impact of low inflation runs in the opposite direction: On average, countries with hyperinflation, high-inflation, low-inflation, and very low inflation steady states have transfers of 8.3 percent, 11.1 percent, 11.2 percent, and 14.6 percent of GDP, respectively. The estimated negative unitary elasticity of transfers on inflation implies that lowering inflation by its one standard deviation increases *transfers/GDP* by 1.5 percentage points. Other things being equal, the second-order impact of low inflation on inequality through higher transfers is estimated to be on the order of 1/2 of 1 Gini point.

To test whether the impact of the above explanatory variables on transfers is uniform across different income levels, we mechanically divide the sample into three subsamples and estimate the equation for each subsample (see Table 7). In addition, to gauge more precisely the responsiveness of transfers to our variables, we estimate the equation using the rolling least squares procedure with a window of 35 observations (see the right panel of Figure 3).<sup>31</sup>

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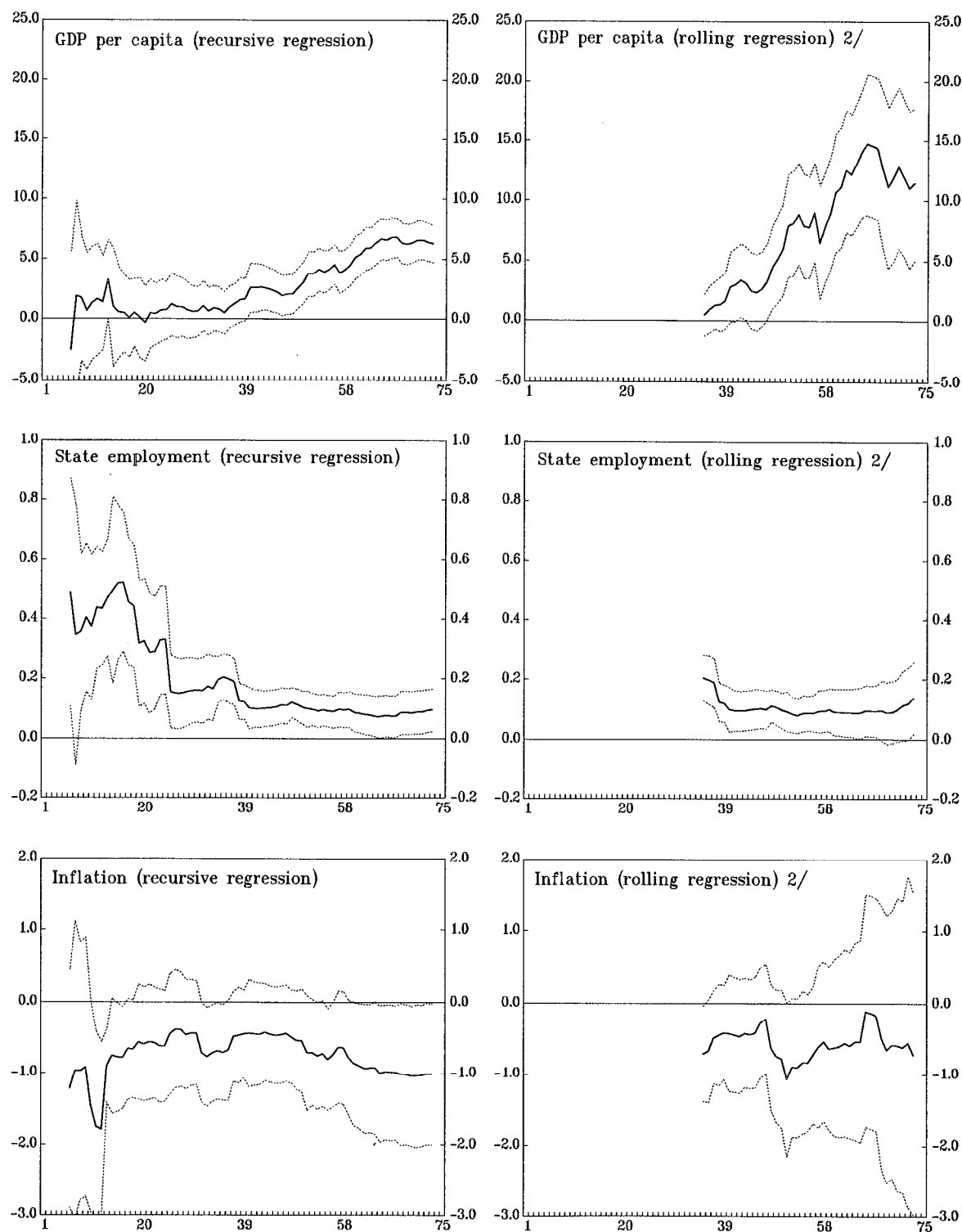
<sup>30</sup>See, for example, Adelman and Fuwa (1992) and Cardoso (1992) for this view. Anyway, such a causality would be difficult to capture even in a pooled sample—governments often run unsustainable fiscal policies for prolonged periods of time.

<sup>31</sup>Rolling regressions allow the estimation of the coefficients of a regression over successive rolling portions of the sample. By setting the size of the window at 35, estimates should have the usual asymptotic properties.

Figure 3

# Determination of Fiscal Transfers

## Recursive and Rolling OLS Coefficients and Their 2 Standard Error Bands 1/



Source: Calculations based on estimated equations in Table 7.

1/ Ordinary least squares overestimate the true standard errors because of heteroscedasticity of residuals.

2/ With a window size of 35.

Table 7. Determinants of Transfers at Different Income Levels  
(Three samples of 25 countries each, using heteroscedastic-consistent standard errors)

Explanatory Variables	"Low Income" Countries 1 to 25	"Middle Income" Countries 26 to 50	"High Income" Countries 51 to 75
Constant	-4.269 (0.63)	-67.581 (2.48)	-45.420 (0.79)
<i>Y</i>	1.177 (1.28)	9.141 (2.71)	6.508 (1.09)
<i>State employment</i>	0.155 (2.22)	0.097 (3.12)	0.166 (1.67)
<i>Inflation</i>	-0.447 (1.05)	-0.721 (2.25)	0.706 (0.69)
$R^2$	0.378	0.419	0.115
SE	2.684	4.442	8.377
RSS	151.3	414.4	1473.6

Note: Countries are ranked in ascending order by their GDP per capita, as in Table 1. The last (twenty-fifth) country in the first subsample, Algeria, has a GDP per capita of US\$2,662; the last (fiftieth) country in the second subsample, Greece, has a GDP per capita of US\$6,436; the last (seventy-fifth) country in the third subsample, the United States, has a GDP per capita of US\$19,851.

The results of both tests suggest serious parameter instability; this is, however, both intuitive and consistent with the literature. In fact, stable parameters across the different levels of development would be hard to justify. For example, the public choice literature explains why richer societies are prone to redistribute significantly more of its wealth through explicit schemes (fiscal transfers) than through implicit redistribution (say, through state employment) as in poorer societies, (see Mueller (1989)). Similarly, the way in which inflation erodes the real value of fiscal transfers depends not only on indexation mechanisms but also on the character of transfers, both of which are likely to be affected by the level of development.

On the one hand, the level of statism, as measured by state employment, seems to have an overriding impact on the level of transfers in the group of low-income countries (Table 7). On the other hand, the level of transfers in the high-income subsample might be income driven (as measured by  $Y$ ), although the particular level of transfers is determined independently of the theoretical factors. The lack of statistically significant variables in the high-income equation in Table 7 can be, however, attributed to an inappropriately small subsample (25 observations).<sup>32</sup>

The inflation sensitivity of transfers is highest and statistically significant at the 5 percent level only for the group of middle-income countries: Lowering inflation by its one standard deviation implies a 1.2 percentage points increase in the transfers-to-GDP ratio. The inflation sensitivity of transfers is lower and statistically insignificant for the group of low-income countries, while in the group of high-income countries it has the wrong sign and is insignificant.

## V. CONCLUSIONS AND POLICY IMPLICATIONS

This paper offers a contribution to the income inequality literature within the traditional Kuznets model. Price stability and financial deepening—in addition to the level of development and fiscal redistribution—are found to improve income equality. While the impact of price stability is uniform for all levels of GDP per capita, the impact of the financial variables increases with the level of development. Moreover, the income-equalizing effect of fiscal redistribution seems to be reinforced by low inflation, rather than being an instrument chosen to correct for the austere effects of tight monetary policies.

The results also document the relative effect of inflation and financial deepening on income distribution. The introduction of the new variables leaves the effect of both the Kuznets and the Milanovic (1994) variables intact. In line with the cost-of-inflation literature, the negative impact is most pronounced during hyperinflation. Effects of price stabilization on income distribution are nonlinear—countries with inflation below 5 percent a year seem to benefit less than countries with inflation between 6 percent and 40 percent. However, the low-inflation countries tend to have deeper financial markets, in which individuals benefit indirectly from better access to capital.

What are the policy implications? In the author's view, price stabilization offers a free lunch: there are no medium- or long-term income inequality costs of disinflation, only benefits. The improvement in income distribution from a hyperinflationary to a high-inflation steady state is substantial, and the benefits of moving from high to low inflation are tangible. It might even pay off to move toward price stability because the smaller direct effects can be

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<sup>32</sup>Using a rolling regression window with 35 observations shows both per capita income and state employment to be statistically significant.

compensated by second-order effects of low inflation, as expectations of future price stability drive up not only money demand (the M2-GDP ratio) but also real resources available for transfers.

Our results are difficult to compare with alternative research, because very few cross-country studies have included inflation as an explanatory variable for income inequality. It remains to be seen if our results can be confirmed in a large cross-country or pooled sample, or in a sample with different definitions of income distribution.

### A Model

The general equilibrium model features an infinite number of periods and a single consumption good. Each worker receives a wage stream ( $y_t$ ), which is a product of the wage rate and hours worked, and consumes  $c_t$  (real) units of the good in each period. The worker also trades in one nominal asset, that is, currency,  $w_t$ , which returns  $(1-\pi_{t+1})$  in period  $t+1$ , where  $\pi$  is inflation. If  $\pi$  is positive, the value of savings in terms of the consumption goods declines. In each period, the worker must allocate her wage and nonwage income between consumption and the future holdings of the nominal asset. Therefore, she faces the usual budget constraint:

$$y_t + (1-\pi_t)w_{t-1} = c_t + w_t. \quad (\text{A1})$$

From the budget constraint, it follows that the worker has two sources of income: wage income and the nominal asset. For simplicity, assume that the worker is endowed with a stock of nondepreciating human capital ( $\bar{h}$ ) that does not require further investment in education. The worker is paid her marginal product ( $m$ ), which also defines the usual demand schedule for labor.<sup>33</sup>

$$L^d \equiv \text{wage rate} = m(\bar{h}) \quad (\text{A2})$$

The amount of labor supplied is affected by the change in the price level:  $L_s = l(\pi, \dots)$ .<sup>34</sup> First, inflation shifts the labor supply schedule inward, lowering the amount of hours worked and, eventually, also the worker's total earnings ( $\partial y/\partial \pi < 0$ ) as the worker responds to inflation-induced losses. Second, inflation reduces the value of a nominal asset ( $w$ ) held by the workers. The loss stemming from negative real returns can be avoided only if inflation is fully anticipated and if the holding of  $w$  can drop to or below zero.

Because of these costs, inflation unambiguously reduces resources available for consumption both by limiting the amount of hours worked and by generating a loss in the asset principal,

$$c_t = y_t(\bar{h}, \pi_t) + (1-\pi_t)w_{t-1} - w_t, \quad (\text{A3})$$

as both terms in  $\partial c/\partial \pi$  are negative.

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<sup>33</sup>See, for example, Blanchard and Fischer (1989).

<sup>34</sup>One can consider a more extreme version of the model, in which wealth enters directly the wage function,  $\text{wage}_t = m(\bar{h}(w_{t-1}(\pi_{t-1})))$ . Past wealth is needed to buy health, education, or social status in a broad sense of the word (club membership, travel, reputable housing and schooling, etc). These "attributes of success" would then raise her marginal product of labor.

The worker chooses  $c_t$  and  $w_t$  in each period to maximize the expected utility function

$$\max E_t \int_0^{\infty} \beta^j u(c_{t+j}) dt, \quad (\text{A4})$$

subject to the above budget constraint, where  $E_t$  denotes the worker's expectation at the beginning of period  $t$  and  $\beta^t = 1/(1+r)$  denotes her subjective discount factor.

The solution to the worker's problem requires that

$$\partial m(\pi^*)/\partial \pi_t = -w_{t-1} \quad (\text{A5})$$

and

$$E_t \beta^{t+1} \partial u_{t+1}(c^*)/\partial c_{t+1} = E_t \beta^t (1-\pi_t) \partial u_t(c^*)/\partial c_t \quad (\text{A6})$$

in each period  $t = 0, 1, 2, \dots$

Equation (A5) shows that, under uncertainty, the loss of wage income owing to higher inflation must be compensated by higher wealth in  $t-1$  to keep the worker's utility unchanged. Equation (A6) then states that marginal utility of consumption declines with inflation. Because both  $(1-\pi)$  and  $u'(c_{t+1})/u'(c_t)$  cannot be predicted with the available information set, consumption follows a random walk.<sup>35</sup>

Moreover, one can confirm that inflation lowers wealth:

$$\frac{\partial w}{\partial \pi} = -\frac{-\beta^t \lambda_t + \lambda_t \frac{\partial^2 y}{\partial \pi^2}}{-\beta^{t+1} \lambda_{t+1}} < 0 \quad (\text{A7})$$

as the change in the value of the asset is negative.

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<sup>35</sup>Employing a simple logarithmic utility function,  $u_t = \ln(c_t)$ , equation (A6) can be rearranged to yield the random walk property:

$$c_{t+1} = \phi c_t + \varepsilon_t,$$

where  $\phi = 1/[\beta(1-\pi_t)]$  and  $\varepsilon_t$  is an error term.

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