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Income Inequality and Macroeconomic Fluctuations

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Abstract
We document a relationship between income inequality and variability in aggregate consumption growth. In high-income countries, greater income inequality is associated with more volatility in consumption growth, whereas in lower-income countries, higher levels of income inequality are associated with less volatility. We present weaker evidence that variability in real GDP growth is also related to income inequality in the same way. Our results suggest that the level of financial development may help to explain why the distribution of income affects the short-run variability of consumption and output differently in high-income countries than in low-income countries.

Keywords: Income Inequality, Economic Fluctuations, Business Cycles

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1. Introduction

Changes in the income distribution in the United States as well as other industrialized countries since the late-1970s have drawn considerable attention both in the popular press and in the academic literature. While newspaper accounts have focused on the political ramifications of growing inequality, the academic literature has taken up two issues. First, there is an active debate regarding the underlying source of the inequality, and, second, an intensifying debate about the long-run consequences of income inequality.¹ This paper is an attempt to examine whether inequality is associated with the short-run volatility of consumption and output growth as well.

Using cross-country panel data, we demonstrate that greater income inequality is associated with less consumption and output variability in the subsequent period when per capita income is low. When per capita income is high, however, greater income inequality is followed by more consumption and output variability. As a preliminary step in explaining our finding, we also explore the relationship between macroeconomic fluctuations, income inequality and financial development. Our results suggest that financial development and availability of credit—both of which are generally associated with higher levels of per capita income—may help to explain why the distribution of income affects the short-run variability of consumption and output differently in high-income countries than in low-income ones.

This paper is related to recent work that has examined the effect of income inequality on economic performance in the long-run. Theoretical studies such as Galor and Zeira (1993), Benabou (1996), and Durlauf (1994) have shown how the distribution of income can affect long-run growth through its effect on the accumulation of human capital. These studies have been complemented by Persson and Tabellini (1994) who show empirically that inequality is harmful for growth in democracies and suggest that income distribution affects voting outcomes, with more unequal distributions resulting in more growth-reducing redistributive policies. In addition, Perotti (1996) provides some empirical evidence that restricted access to credit by the poor, political instability, and the education/fertility decision are potential channels through which income distribution affects long-run growth. More recently, Partridge (1997) and Forbes (2000) have

¹See Levy and Murnane (1992) for a survey of proposed explanations for earnings inequality in the United States. Some recent work on inequality and long-run growth is discussed below.
also added to this debate. Using data from the U.S. states, Partridge obtains different results about the relationship between inequality and growth for different measures of income inequality. Forbes employs the same panel data on income inequality we utilize below to challenge the view that income inequality has a negative effect on economic growth.

Our paper is closely related to Krussell & Smith (1998), who show that macroeconomic behavior can be almost perfectly described using only the mean of the wealth distribution. In their model, however, all individuals face the same borrowing constraint. In this paper we argue that all individuals do not face the same borrowing constraints–access to credit depends on wealth (in our model, human capital wealth). Therefore, when credit constrained and unconstrained individuals have different consumption smoothing abilities, the distribution of wealth does affect aggregate volatility. Furthermore, when income depends on wealth, we also observe a relationship between income distribution and macroeconomic activity.2

Because we link the distribution of income to aggregate fluctuations in consumption and output, our work is also related to Deaton and Paxson (1994). In it, the authors show that the cross-sectional variation in consumption increases with age and argue that this evidence is consistent with the permanent income hypothesis. While we examine a slightly different phenomena—the variation in aggregate consumption growth in several countries across time—our conclusions might also be consistent with the permanent income hypothesis if the distribution of income determines the fraction of the population who have the ability to smooth consumption in the face of adverse shocks. Low-income individuals may smooth their consumption to a lesser degree than high-income individuals if the former are bound by liquidity constraints while the latter are not. Zeldes (1989) provides some evidence that the consumption behavior of less wealthy individuals is bound by borrowing constraints. Of course, the consumption variability of borrowing

2In Krussell and Smith’s model, the marginal propensity to save is largely independent of wealth, which allows them to generate their aggregation results. However, some of the very poorest agents do have lower marginal propensities to save, however, since they are very poor in relative terms, they do not substantially influence the aggregate. An alternative interpretation of our empirical results is that income distribution is an indicator of the relative importance of the very poor. In particular, in low income countries, an equal distribution of income implies that the very poor have greater influence on aggregate behavior; but in high income countries equal income distribution implies just the opposite.
constrained individuals may be reduced by precautionary savings.\footnote{\textsuperscript{3}}

When credit constraints bind lower income individuals, an increase in inequality may have differing effects in low- and high-income countries. If only relatively high-income individuals have access to credit, a more unequal income distribution in a low-income country would imply that a larger fraction of individuals can smooth consumption, and therefore that aggregate consumption would be smoother. Reinforcing this effect on aggregate outcomes is the fact that, when the income distribution is unequal, high-income families account for a large share of aggregate consumption and, therefore, their ability to smooth consumption would have a disproportionate effect on aggregate fluctuations. On the other hand, if middle- as well as high-income individuals had access to credit, as might be the case in a high-income country, a more unequal income distribution could imply that a smaller percentage of the population would be able to smooth consumption. This would generate a positive relationship between inequality and consumption in high-income countries.

In the final section of our paper we offer some preliminary evidence that is consistent with the idea that the development of financial markets may improve the consumption smoothing abilities of individuals in the middle and lower tail of the income distribution. Specifically, we show that in economies with less developed financial markets, more inequality leads to smaller fluctuations, possibly because higher levels of inequality in less financially developed economies generate more unconstrained consumption smoothers. For those countries that are the most financially developed, higher inequality leads to more fluctuations.

Das (1993) also takes up a similar question to the one we pursue here. Using time series data from the United States, he concludes that greater inequality is associated with more macroeconomic fluctuations. Our use of cross-country panel data, however, \footnote{\textsuperscript{3}If the precautionary savings motive is strong enough, borrowing constrained individuals may rarely hit their borrowing constraints and it is possible that richer, unconstrained individuals will have greater fluctuations in consumption. In fact, using Indian panel data, Ogaki and Atkeson (1997) show that rich households have more volatile consumption growth than poor households. While the results we obtain with macroeconomic data appear to be consistent with the opposite conclusion-that poor, borrowing-constrained individuals have more variable consumption-we can reconcile the two sets of findings if even the “rich” Indian consumers face liquidity constraints (as would be suggested by our interpretation of the income distribution data for India). Thus, the Ogaki and Atkeson results may speak to the difference in consumption variability among the constrained, while our macroeconomic results may provide some evidence regarding the consumption variability of the constrained vs. the unconstrained.}
allows us to reach a more general conclusion about how income inequality is related to macroeconomic fluctuations because we are able to analyze this effect in both high- and low-income countries.

Our investigation of the effects of income distribution on macroeconomic fluctuations are presented in the next four sections. Section 2 lays out our basic theoretical framework. Section 3 discusses our estimation and data selection strategy. Section 4 presents our main results, discusses the robustness of these results to changes in our estimation and data selection strategy, and provides some discussion of their interpretation. Section 5 concludes.

2. The Framework
2.1. Production

Our basic setup is a variant of that proposed in Freeman (1996). We model a small open economy in which a single good is produced with physical and human capital using a constant returns to scale (CRS) technology,

\[ Y_t = F(K_t, H_t), \]

where \( Y_t \) is aggregate output, \( K_t \) is the physical capital stock, and \( H_t \) is the aggregate human capital stock, which is the sum of all individuals’ human capital used in production. Suppose that the world interest rate is constant at \( \bar{r} \). Because there is perfect capital mobility, the interest rate in the small open economy is equal to \( \bar{r} \) as well. Given that the production function exhibits CRS, it is straightforward to show that \( K_t/H_t \) and \( \partial Y/\partial H_t \equiv F_H \) are also constant. Thus, factor payments are given by the following:

\[ r_t = \bar{r} = F_K(K_t, H_t) \quad \Rightarrow \quad F_H(K_t, H_t) = \bar{w}. \]

2.2. Individuals

Individuals live for two periods in overlapping generations and obtain utility from consuming in each period,
\[ U^i = u(c^i_t) + \delta u(c^i_{t+1}), \quad (3) \]

where \( \delta, 0 \leq \delta \leq 1 \), is the time discount factor, \( u(.) \) is homothetic and satisfies the standard Inada conditions.

When young, individuals inherit the human capital level of their parents for work in the first period, and invest time in enhancing their human capital for second period work. They also consume and save (or dissave) in the first period. In the second period, individuals work, consume, have children, and repay any loans. For simplicity, we assume that childrearing does not consume any time or other parental resources, and that there is no population growth.

The amount of human capital that an individual is able to accumulate depends on the amount of time spent in school in the first period and the level of the parent’s human capital. Specifically, an individual born at time \( t \) has human capital in the second period equal to

\[ h^i_{t+1} = A(e^i_t)^{\alpha}(h^i_t)^{1-\alpha}, \quad (4) \]

where \( e^i_t = 1 + x^i_t \) and \( x^i_t \) is the amount of time spent accumulating human capital. The specification in (4) implies that children whose parents have lower levels of human capital require more study time to generate the same level of human capital as a child with higher human capital parents.\(^4\)

At the beginning of the first period, individuals choose how much time to spend in school, \( x^i_t \), how much time to spending working, \( \ell^i_t \), and decide how much to save—or if they are not subject to credit constraints, borrow—in the first period by maximizing

\[
\max_{x^i_t, s^i_t} U^i = u(\bar{w}\ell^i_t h^i_t - s^i_t) + \delta u[\bar{r} s^i_t + \bar{w}(1 + x^i_t)^{1-\alpha}(h^i_t)^{1-\alpha}] \quad (5)
\]

\(^4\)Justification for parental level cite intergenerational earnings literature, perhaps Freeman, also, this specification implies that people with very low level of human capital will have more than their parents simply by working (return to work experience, perhaps?)
subject to \( x_t^i + \ell_t^i \leq 1, 0 \leq x_t^i \leq 1, \) and \( 0 \leq \ell_t^i \leq 1. \)

2.3. Without Borrowing Constraints

As a benchmark, we first discuss the solution to this problem when no one is subject to credit constraints. Then, the first-order conditions are given by

\[
u'(\bar{w}\ell_t^i h_t^i - s_t^i) = \bar{r}\delta u'[\bar{r}s_t^i + \bar{w}(1 + x_t^i)^{1-\alpha}(h_t^i)^{1-\alpha}]
\]

and

\[
\frac{u'(\bar{w}\ell_t^i h_t^i - s_t^i)}{u'[\bar{r}s_t^i + \bar{w}(1 + x_t^i)^{1-\alpha}(h_t^i)^{1-\alpha}]} \leq \frac{(1 - \alpha)\delta}{(1 + x_t^i)^{\alpha}(h_t^i)^{1-\alpha}}.
\]

where the inequality signs in (7) arise when the constraint \( 0 \leq x_t^i \leq 1 \) is binding. These conditions give rise to three different kinds of choices for \( x_t^i \). Specifically,

\[
x_t^i = \begin{cases} 
0 & \text{if } h_t^i \geq h^* \equiv \left(1 - \frac{\alpha}{\beta}\right)^{1-\alpha} \\
\left(1 - \frac{\alpha}{\beta}\right)^{1-\alpha}(h_t^i)^{1-\alpha} \right)^{\frac{1}{\alpha}} & \text{if } h^* > h_t^i \geq h^{**} \equiv \left(1 - \frac{\alpha}{2\beta}\right)^{1-\alpha} \\
1 & \text{if } h^* > h_t^i
\end{cases}
\]

Thus, as in Freeman, the children of the parents with lowest human capital levels spend more time studying. For these children, the marginal return to schooling is highest, and because they can borrow to finance first period consumption, will spend all their time in school. At higher levels of parental human capital, the marginal return to schooling is lower, and individuals spend time in school only until the return to schooling equals the world interest rate, \( \bar{r} \). Finally, for children who have parents with very high levels of human capital, the marginal return to schooling may be less than the world interest rate and these children spend no time investing further in human capital.

Note also that, since (6) satisfied for all individuals, aggregate consumption volatility across the two periods will be a function of the discount factor, \( \delta \), and the world
interest rate, \( \bar{r} \), only. Put differently, given that there exists no borrowing constraints, there will be perfect intertemporal consumption smoothing in this economy.\(^5\)

2.4. With Borrowing Constraints

Now suppose that lenders in this economy operate selectively in providing individuals credit and lend only to individuals with high earnings potential. This assumption can be motivated in a variety of ways and, as discussed in the introduction, is consistent with the empirical observation that low-income individuals have restricted access to credit.

For heuristic purposes let \( \tilde{h}, \tilde{h} = h^* \), denote the threshold level of human capital under which credit to potential borrowers is not available.\(^6\) Suppose that \( \tilde{h} > h^*_i \) for some \( i \) so that individuals with parental human capital levels less than \( \tilde{h} \) are constrained. For these individuals, the first-order conditions change slightly for two reasons: First, they would like to shift some of their second period income into the first period at the existing world interest rate, \( \bar{r} \). Second, \( x^*_i \leq 1 \) no longer binds because, for individuals who cannot borrow, choosing \( x^*_i = 1 \) would yield no consumption in the first period. Thus, the first-order conditions for these individuals become

\[
 u'(\bar{w}_i \bar{h}_i^* - s^*_i) > \bar{r} \delta u'(\bar{r}s^*_i + \bar{w}(1 + x^*_i)^{1-\alpha}(h^*_i)^{1-\alpha}) \quad (9)
\]

and

\[
 \frac{u'(\bar{w}_i \bar{h}_i^* - s^*_i)}{u'(\bar{r}s^*_i + \bar{w}(1 + x^*_i)^{1-\alpha}(h^*_i)^{1-\alpha})} \geq \frac{(1 - \alpha) \delta}{(1 + x^*_i)^{\alpha}(h^*_i)^{1-\alpha}}. \quad (10)
\]

It is straightforward to show that borrowing-constrained individuals choose study time that is less than or equal to the study time of unconstrained individuals.

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\(^5\)In fact, if the gross world interest rate, \( \bar{r} \), equals one and there is no time discounting so that \( \delta \) equals one as well, then, \( \forall i, c^*_i = c^*_{i+1} \), and the variance of lifetime consumption would equal zero.

\(^6\)Given this specification, the threshold level of income for access to credit is constant across countries, and it is independent of the level of potential per capita income. This simplification might be misleading, especially if an individual’s access to credit depends on his relative earnings potential. However, financial depth and development are positively related [See King and Levine (1993)]. While this does not guarantee that \( \tilde{h} \) is identical across countries as we assume, it does suggest that an increase in mean income, ceteris paribus, increases the availability of financial resources and the access to credit.
Importantly, though, the inequality introduced in the first condition in (9) now adds an additional source of consumption variability. Children of low-human-capital parents would like to devote all their time endowment in the first period to schooling and would like to borrow to finance their first-period consumption but they cannot, and thus must reduce their consumption in the first period below the desired level. Therefore, the larger the fraction of the population that is credit constrained is, the greater the aggregate variability in consumption.

Let \( g_t(h^i_t) \) and \( G_t(h^i_t) \) respectively denote the probability density function (p.d.f.) and the cumulative distribution function (c.d.f.) of parental human capital levels in period \( t \). Then, for generation \( t \), we can express the ratio of aggregate consumption in period \( t + 1 \), \( C^{D}_{t+1} \), to that in period \( t \), \( C^{D}_{t} \), as follows:

\[
\frac{C^{D}_{t+1}}{C^{D}_{t}} = \frac{\int_{h^*}^{h^{*+}} c^1_{t+1}g_t(h^i_t)dh + \int_{h^{*+}}^{\infty} c^1_{t+1}g_t(h^i_t)dh}{\int_{h^*}^{h^{*+}} c^1_{t}g_t(h^i_t)dh + \int_{h^{*+}}^{\infty} c^1_{t}g_t(h^i_t)dh}.
\]

(11)

Given that the utility function \( u(.) \) is homothetic, unconstrained individuals choose to allocate a constant fraction of their total income to consumption in the first period regardless of their income. In contrast, credit constrained individuals consume less than their desired level when young and, as a result, exhibit steeper lifetime consumption growth. Thus, we can rewrite (11) as

\[
\frac{C^{D}_{t+1}}{C^{D}_{t}} = \frac{\int_{h^*}^{h^{*+}} c^1_{t+1}g_t(h^i_t)dh + \kappa \int_{h^{*+}}^{\infty} c^1_{t+1}g_t(h^i_t)dh}{\int_{h^*}^{h^{*+}} c^1_{t}g_t(h^i_t)dh + \int_{h^{*+}}^{\infty} c^1_{t}g_t(h^i_t)dh}.
\]

(12)

where \( \kappa, \kappa > 0 \), denotes the optimal ratio of second period consumption to first period consumption for unconstrained individuals. Note that \( \lim_{h^* \to 0}(C^{D}_{t+1}/C^{D}_{t}) = \kappa \) and \( \lim_{h^* \to \infty}(C^{D}_{t+1}/C^{D}_{t}) > \kappa \).

The specification in (12) indicates that whether a greater degree of income inequality leads to a higher or lower variance of consumption depends on the distribution of parental human capital levels—as summarized by the c.d.f. \( G_t(h^i_t) \). To examine how higher income inequality might affect variations in aggregate consumption demand, consider a mean-preserving spread in the distribution \( G_t(h^i_t) \). If the average parental human
capital stock is relatively low such that, at time $t$, $G_t(h^*) > 1/2$, a majority of individuals are denied credit as their earnings potential is relatively low. Let $\tilde{G}_t(h^*)$ denote the new c.d.f. and $\tilde{g}_t(h^*)$ its p.d.f. Then, $G_t(h^*) > \tilde{G}_t(h^*) > 1/2$, which implies that $1 - G(h^*) < 1 - \tilde{G}(h^*)$, and the proportion of the population that has access to credit will be higher with greater inequality. In this case, an increase in income inequality unambiguously leads to a lower variance of consumption demand as

$$\frac{\int_0^{h^*} c_{t+1}^i g_t(h^*_i)dh + \kappa \int_{h^*}^{\infty} c_{t}^i \tilde{g}_t(h^*_i)dh}{\int_0^{h^*} c_{t}^i g_t(h^*_i)dh + \int_{h^*}^{\infty} c_{t}^i \tilde{g}_t(h^*_i)dh} > \frac{\int_0^{h^*} c_{t+1}^i \tilde{g}_t(h^*_i)dh + \kappa \int_{h^*}^{\infty} c_{t}^i \tilde{g}_t(h^*_i)dh}{\int_0^{h^*} c_{t}^i g_t(h^*_i)dh + \int_{h^*}^{\infty} c_{t}^i \tilde{g}_t(h^*_i)dh}.$$  

(13)

Now consider the case in which the average parental human capital stock is relatively high such that, at time $t$, $G_t(h^*) \leq 1/2$, and a majority of individuals have access to credit because their earnings potential is high. In this case, an increase in income inequality will lead to a greater variance of consumption demand because, when $G_t(h^*) \leq 1/2$, $G_t(h^*) < \tilde{G}_t(h^*) \leq 1/2$. Therefore,

$$\frac{\int_0^{h^*} c_{t+1}^i \tilde{g}_t(h^*_i)dh + \kappa \int_{h^*}^{\infty} c_{t}^i \tilde{g}_t(h^*_i)dh}{\int_0^{h^*} c_{t}^i \tilde{g}_t(h^*_i)dh + \int_{h^*}^{\infty} c_{t}^i \tilde{g}_t(h^*_i)dh} > \frac{\int_0^{h^*} c_{t+1}^i g_t(h^*_i)dh + \kappa \int_{h^*}^{\infty} c_{t}^i g_t(h^*_i)dh}{\int_0^{h^*} c_{t}^i g_t(h^*_i)dh + \int_{h^*}^{\infty} c_{t}^i g_t(h^*_i)dh}.$$  

(14)

In sum, taken together equations (12)-(14) demonstrate the impact of credit constraints on aggregate consumption demand, and how income inequality and aggregate consumption demand may be related. When only the lower classes are credit-constrained, greater inequality (a smaller middle class) leads to more fluctuations in aggregate consumption. When both the lower and middle classes are constrained, however, greater inequality may lead to less fluctuations in consumption. If a country’s per capita income is an indication of whether or not the middle-class is constrained, then income inequality and per capita income should be a “good” summary measure of the fraction of the population that is unable to smooth consumption. In poorer countries, both the lower and middle classes are likely to be constrained, whereas in richer countries only the lower class may be constrained. Thus, in low income countries greater inequality may translate
into less fluctuations in aggregate consumption, and in higher income countries greater inequality may result in more fluctuations.

The simple framework outlined above shows the link between income distribution and aggregate demand fluctuations, but an enhanced model with nominal or real rigidities (that help generate an upward sloping short-run aggregate supply curve) would also imply a similar relationship between the income distribution and real output fluctuations. Although we do not develop such a model here, in the next section we present—in addition to the consumption/inequality relationship outlined above—some empirical evidence on this relationship.

3. Estimation Strategy and Data

There are several important issues that we encounter in attempting to uncover the empirical relationship between income inequality and fluctuations in aggregate output or consumption. One of these issues is that institutional/cultural features of the economy that could be correlated with income inequality may also influence the variability of output or consumption. For example, a central bank’s willingness to accommodate adverse shocks may differ across countries, or perhaps, some countries may have more extensive automatic stabilizers and a greater commitment to providing a social safety net. These institutional/cultural factors could be correlated with income inequality, particularly in democracies where voting behavior can influence government policy. Fortunately, panel data is available, and we are able to address this issue by estimating a fixed-effects model.

A second issue that plagues our investigation is the fact that it is difficult to disentangle the effect of inequality on output or consumption variation from the effect of these fluctuations on inequality. If higher output variability creates greater inequality, one might expect to find a positive correlation between income inequality and macroeconomic fluctuations even if inequality had no effect on the severity of business cycles. We attempt to address this issue in two ways. First, to focus attention on the link from inequality to aggregate fluctuations, we use a lagged value of inequality, studying the relationship between initial income inequality and subsequent aggregate consumption and output variability. Second, as we explain below, we measure consumption and output variability.
variation over a fairly long period of time, increasing the likelihood that we observe both contractions and expansions during this time period. If one believed that expansions exacerbated inequality and recessions reduced it (or vice versa), our methodology should somewhat mitigate the concern that our results are caused by the link from output variability to inequality because our variability measures should capture both expansions and recessions. Nonetheless, neither of our proposed solutions solve this endogeneity problem entirely, and we remain cautious in our interpretation.

A third issue that needs to be addressed at the outset is the limitations put on us by the availability of data. As we will argue below, it is crucial that we not only implement a panel estimation but that we measure output and consumption variability over a sufficiently long time period. Thus, the data requirements of our task are substantial, but income inequality data sets are notoriously sparse and often of dubious quality. While our ability to expand our data set is limited, we are able to exclude the poorest quality inequality measures by using only the inequality measures that have received an “accepted” rating from Deininger and Squire (1996). We also recognize that our relatively small sample size makes our analysis sensitive to outliers and therefore we conduct several tests for robustness of our results.

Finally, our approach must also recognize that income inequality may have different economic significance at different stages of development. More specifically, if individuals’ behavior during periods of recessions and expansions can differ by income, the effect of inequality may also vary with the level of per capita income. For this reason, we allow the effect of inequality to vary with the latter.

Any effect of household income inequality is likely to manifest itself, first and foremost, in the component of aggregate economic activity that is engaged in by households: aggregate consumption. In addition, if there are any nominal rigidities in the economy, fluctuations in aggregate consumption will create variation in output. Therefore, we focus our analysis on the effect of inequality on consumption and output variability. After considering the issues discussed above, our empirical estimates of the effect of in-

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8Deininger and Squire include only observations that are based on household surveys, on comprehensive coverage of the population, and on comprehensive coverage of income sources. Their criteria is relatively strict—only 18 or the 55 observations used in Persson and Tabellini (1994) satisfy this quality criteria. They do accept measures of inequality using either households or individuals as the unit of observation, but show that this policy should not lead to systematic bias in empirical work.
come inequality on macroeconomic fluctuations are obtained by estimating the following equation with panel data.

\[ V_{i,t} = \mu_i + \lambda_t + \]

\[ \beta_1 \text{INCINEQ}_{i,t-1} + \beta_2 \text{INCINEQ}_{i,t-1} \times \text{MEANGDP}_{i,t-1} + \beta_3 X_{i,t} + \nu_{i,t} \]  

where \( V_{i,t} \) is the variation of real consumption or output growth at time \( t \) for country \( i \), \( \mu_i \) is a country-specific effect, \( \lambda_t \) is a time specific effect, \( \text{INCINEQ}_{t-1} \) is a measure of income inequality in the preceding period, \( \text{MEANGDP}_{t-1} \) is the average level of real per capita income in the preceding period, and \( X_t \) are additional control variables that may help to explain output fluctuations and \( \nu_{i,t} \) is the variability in consumption or output not explained by the regressors.\(^9\) We assume that \( \nu_{i,t} \) is uncorrelated with the regressors and is distributed normally with a mean of zero and a variance of \( \sigma_i^2 \).\(^10\)

The control variables in \( X_t \) include the average growth rate of real per capita income or consumption over the period, \( \text{GROWTH}_t \), \( \text{MEANGDP}_{t-1} \), the mean of inflation over the period, \( \text{INFMEAN} \), and the standard deviation of inflation over the period, \( \text{INFSTDEV} \). \( \text{GROWTH} \) is included because the standard deviation of growth rates may be correlated with the average growth rate, based purely on the manner in which standard deviation is constructed. \( \text{MEANGDP} \) is included to isolate its effect independent of its interaction with income inequality. Finally, we include the inflation mean and standard deviation because they will be correlated with output growth variability when the aggregate supply curve is upward sloping.\(^11\)

A natural choice for our empirical measure of output and consumption variability, \( V_{i,t} \), is the standard deviation of the annual growth rate of real GDP per capita and of

\(^9\)We measure both \( \text{MEANGDP} \) and \( \text{INCINEQ} \) at the same time because both are measures of the income distribution. Our conclusions are not materially affected if we measure \( \text{MEANGDP} \) at time \( t \).

\(^10\)In addition to adopting this assumption on the distribution of errors because of its intuitive appeal for cross-country data, we also confirmed it with a Cook-Weisberg test for heteroscedasticity.

\(^11\)For a recent survey of the vast literature on the output and inflation tradeoff, see Erceg, Henderson and Levin (forthcoming).
real consumption per capita. In order to calculate such a measure, however, we need to collapse several years of data into one time period.

When determining our data selection strategy, we also need to consider the fact that income inequality measures for most countries change very slowly. It is important to allow sufficient time between observations of the inequality measure so that we can observe significant changes in the income distribution. Thus, we face a tradeoff in constructing our data set: A larger number of years between observations allows us to examine more meaningful changes in the income distribution and calculate consumption and output variability over a longer time period, but at the same time, it also reduces the number of time periods we include in our regression, reducing the efficiency of our fixed effects estimation. With these tradeoffs in mind, we initially examine a two-period fixed effects model. Later, we consider a three-period model.

Our panel spans the years 1969 to 1992, and we divide it in half, calculating a standard deviation of annual growth rates from the periods 1972 to 1980 and from 1984 to 1992. For each of the countries in our panel, we have an observation on income inequality during the period 1969 to 1971 and during the period 1981 to 1983. Thus, we observe the characteristics of the income distribution ($INCINEQ$ and $MEANGDP$) during a three year period and then observe the variation of GDP or consumption growth over the subsequent 9 years.

Using this methodology, we are able to include 14 countries in our panel. By relaxing our criteria slightly and including observations that have an income inequality measure taken between 1967 and 1973 and between 1979 and 1985, we are able to almost double our sample to include 27 countries. We report results for both the restricted (14-

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12Given the constraints put on us by the sparsity of panel data on income inequality, one might be tempted to estimate (15) with a random effects specification. We do not pursue this option, however, because the country-specific effects are correlated with our regressors, thus rendering a random effects approach inconsistent. (A Hausman test rejects the random effects model with a p-value of less than .05 in seven of the eight specifications in Table 2.)

13While some countries in our sample have data available outside the time period 1969 to 1992, we chose this time period because it allows us to maximize the number of countries in our estimation. Later, we consider an exercise in which we extend the time period our panel covers prior to 1969 for a smaller number of countries.

14When we have more than one observation of inequality for a particular country over the three year period, we averaged the multiple observations to obtain a single estimate. This data selection strategy is defensible on the grounds that economy-wide measures of income inequality change very little on a year-over-year basis.
country) and full (27-country) samples. The data we use to estimate (15) come from a variety of sources. Real GDP per capita and consumption are taken from the Penn World Tables, Mark 5.6, income inequality measures are from Deininger and Squire (1996), and data on each country’s price level is from the International Financial Statistics published by the International Monetary Fund. Because different measures of inequality capture slightly different aspects of the income distribution, we use four different measures of income inequality: the Gini coefficient, \( GINI \), and three alternative measures of the percent of income earned by different income classes. The latter include the share of income earned by the top quintile, \( Q(5) \), as well as two measures of the income of the middle class—the income share of the third and fourth quintiles, and the income share of the second, third and fourth quintiles. Of course, while higher values for \( GINI \) and \( Q(5) \) imply higher inequality, higher shares of income of the middle class imply lower inequality. Therefore, to convert our measures of the middle class income share to measures of inequality, we subtract them from 100 and denote them as \( Q(3,4) \) and \( Q(2,3,4) \), where \( Q(3,4) \) is 100 minus the share of the third and fourth quintiles, and \( Q(2,3,4) \) is 100 minus the share of the second, third, and fourth quintiles.

Table 1 presents summary statistics from our full sample. While the sample contains both low- and high-income countries, it is important to note that, due to the lack of reliable income inequality data especially for low-income countries, our sample has a limited representation of such countries, making the average level of per capita income rather high (measured in 1985 dollars over the periods 1972-1980 and 1984-1992) and urging caution in interpreting our results for very low-income countries.\(^{15}\) Table 1 also shows that our four measures of inequality are highly but not perfectly correlated, indicating that each measure captures a slightly different aspect of the income distribution.

A final point to note from Table 1 is that the unconditional correlation between inequality and fluctuations in consumption and output growth is fairly low. This emphasizes the fact that the partial correlations we identify with our panel regressions are conditional on our control variables. In addition, our fixed-effects estimations identify a within-country relationship between inequality and fluctuations and not a relationship

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\(^{15}\)The countries in our full sample are: Australia, Bangladesh, Canada, Chile, Colombia, Costa Rica, Finland, France, Germany, India, Indonesia, Japan, Malaysia, New Zealand, Norway, Pakistan, Portugal, Singapore, South Korea, Spain, Sri Lanka, Sweden, Thailand, Trinidad, U.K., U.S.A., and Venezuela.
across countries.

[Table 1 about here.]

4. Results
4.1. Initial Estimates
Since the most direct link between household income inequality and aggregate fluctuations is likely to be through variation in consumption, we first estimate equation (15) using the variation of consumption growth. The results for the full and restricted sample appear in Tables 2 and 3.

In both tables, the first four columns present the results for the four different inequality measures without controlling for the inflation mean and standard deviation, while the last four columns show results that include these inflation measures. The results for both samples are qualitatively similar and we discuss here only the full sample results in Table 2. Using any of the four measures of income inequality, these results are consistent with the idea that income distribution and aggregate consumption fluctuations are closely related. This relationship, however, changes with per capita income. Greater inequality at the beginning of a period is associated with less variability in consumption growth over the subsequent 9 years in economies with low per capita income. However, when per capita income is higher, this effect is reversed and greater inequality is associated with higher aggregate consumption variability. The coefficients estimated in Table 2 indicate that the level of per capita income at which the turning point occurs is about $9,500 (in 1985 dollars). About a third of our sample is above this turning point.

[Tables 2 and 3 about here.]

As stated earlier, in the presence of some real or nominal rigidities, it is likely that variations in aggregate consumption demand will be correlated with fluctuations in real output. Tables 4 and 5 give results from repeating the preceding exercise using the standard deviation of real per capita GDP growth as the dependent variable. These results
are consistent with those presented in Tables 2 and 3, although one of our inequality measures, $Q(3,4)$, does not produce significant coefficients. It is also worthwhile to note that in Tables 2 through 5, the coefficient on $MEANGDP$, though not statistically significant in a few regressions, suggests that high-income countries have less variation in output and consumption. The microeconomic corollary to this finding is that individuals with higher incomes are better able to smooth consumption.

[Tables 4 and 5 about here.]

### 4.2. Sensitivity Analysis

As discussed above, the relatively small size of our data set makes our analysis sensitive to outliers and it is necessary to confirm the robustness of the results above. We undertook several exercises to this end.

First, we are concerned that our results might be heavily influenced by an individual country in our data set. To evaluate the effects of making small changes in our sample, we estimated equation (15) twenty-seven different times, each time dropping one country (two observations) from the sample.$^{16}$ Although we do not report the results for all of these regressions here, we do find that this exercise shows our results to be robust to removing individual countries from our sample. There was only one case in which the coefficient on an inequality measure ($Q(3,4)$) in the consumption regressions did not always retain a 5 percent significance level. Overall, our GDP results were not quite as strong: the interaction term for $Q(2,3,4)$ retained the right sign but was not always statistically significant and the p-value for the coefficient on $GINI$ dropped just below 10 percent in one specification. All in all, however, these results indicate that our initial conclusions are not the results of one unique country pulling our regression coefficients into significance. In particular, the two inequality measures that are most closely related to how rich the rich are, $Q(5)$ and $GINI$, perform the best.

In addition to performing this ad hoc sensitivity analysis, we also employ a robust regression technique that eliminates outliers (observations for which Cook’s $D > 1$) and

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$^{16}$We actually estimated each equation 54 different times (27 times with the inflation variables in and 27 times without the inflation variables) for each of the four inequality measures.
iteratively selects weights for the remaining observations to reduce the absolute value of the residuals.\textsuperscript{17} The results of this exercise for the full sample are in Tables 6 and 7. These results are generally consistent with those found above: The consumption results are robust to the change in the estimation procedure but the results for GDP are only robust for the inequality measures that capture the position of the upper class, $Q(5)$, and to a lesser extent, $GINI$. Thus, this exercise leaves us feeling confident about the consumption results and the GDP results for $Q(5)$ and $GINI$, but less confident about the GDP results with our middle class measure, $Q(3, 4)$ and $Q(2, 3, 4)$.

[Tables 6 and 7 about here.]

We also examined our findings in a third way by splitting our sample into high-income and low-income countries and somewhat relaxing the structure imposed by equation (15) by estimating it without the interaction term, $INCINEQ * MEANGDP$, for each of the two groups. Our initial results suggest that in these two split samples, the coefficient on $INCINEQ$ should be negative in the low-income sample and positive in the high-income sample. Of course, as mentioned above, the coefficients in Tables 2 and 4 indicate that “poor” countries are those with per capita income levels below $9,500. Thus, our “poor” country sample contains about 2/3 of the entire sample and includes many middle-income countries. The results from this test, presented in Tables 8a-b and 9a-b, confirm the full sample results. We obtain negative and significant coefficients on all four income inequality measures in our low- and middle-income sample, and positive coefficients on all four income inequality measures in our high-income sample.\textsuperscript{18}

[Tables 8.a-b and 9.a-b about here.]

If there is a structural shift across the two time periods in our sample, then the pooling required for our fixed effects estimation may result in biased coefficients. With

\textsuperscript{17}We use Stata’s \texttt{rreg} command.
\textsuperscript{18}Note that, due to our very small rich country sample, we have very few degree of freedom. Therefore, even though we obtain t-statistics over 2 in many of these regressions, they are not always significant.
only two time periods, it is difficult to perform a formal test for structural change, but we are able to re-estimate equation (15) under two different assumptions to determine how significant an impact potential structural change might have on our major conclusions. First, we estimated the regressions in tables 2 and 4 without time dummies to see if our coefficients changed significantly. Although we do not report the results here, we did not find that excluding time dummies changed the nature of the results already reported. In addition, we also re-estimated (15) using slightly different time periods to measure variation in output and consumption by shifting our current measurement period both forward and backward two years. We found that the results in our consumption regressions (Table 2) were not sensitive to this change but our GDP results were affected. In particular, when we shifted the measurement of GDP variation back two periods, we were not able to retain significance of the estimated coefficients on inequality.\footnote{As we describe below, we were also able to produce an additional extended sample of eight relatively high-income countries in order to add a third time period to our sample. The addition of the third time period allows us to perform a Chow predictive test for structural change on this smaller sample. Consistent with the findings we state above, these tests indicated that we could reject the hypothesis of stability across the time periods in our extended sample for the variation in real GDP growth, but not for the variation in consumption growth.} We do not, however, pursue the estimation of a time-varying coefficients model due to the limitations put on us by the size of our data set.

Finally, we attempted to determine how robust our results were to different sample selection strategies. As we mentioned above, our methodology requires a very long panel so that we can calculate standard deviations of aggregate variables over a sufficiently long time period and observe differences in a very slowly moving variable, income inequality. Unfortunately, applying our criteria to the available data resulted in identifying only two time periods for our estimation, a less than ideal data set for implementing a fixed effects estimation. By relaxing our criteria somewhat, we are, however, able to slice our data in a third way, generating a slightly smaller panel of 24 countries and 3 time periods. To do this, we reduce the time period between inequality observations and observe inequality measures in periods 1968 to 1970, 1976 to 1978 and 1984 to 1986 and we calculate the standard deviation of output and consumption growth between 1968 and 1976, 1977 and 1984 and 1985 and 1992. This new data set differs from our original two in that the change in inequality measures between time periods is smaller and there is
complete overlap between inequality observations and the period over which we calculate consumption and output variability.

Thus, in this third data set, the observed change in the income distribution may be less economically meaningful. In addition, endogeneity may be even more of a problem. If business cycle fluctuations create inequality, our overlapping of inequality and variability measures and the shorter time period over which we measure variability may subject the results to an even more problematic interpretation.

Results of the consumption variability estimation using our third sample appear in Table 10. As can be seen in this table, our results regarding the relationship between the variability of consumption growth and inequality are generally preserved. Three of the four inequality measures and their interaction terms retain the signs and significance of our original results. In addition, although they are not statistically significant, the signs on the coefficients in the GINI regression are consistent with our previous results.

[Table 10 about here.]

Our results using output growth variation cannot be replicated with this sample, however. Our estimation of equation (15) using output growth variability with this third sample did not yield significant coefficients on our income distribution variables and we do not report these results here. Thus, while a link between consumption variability and inequality is generally supported by this third sample, the confidence with which we link income inequality and variation of real GDP growth is somewhat reduced.

We also attempted to extend our sample coverage by adding a third, earlier, time period. To do this, we needed to find inequality observations over the time period 1956 to 1961 and output and consumption variability measures over the period 1960 to 1968. We were able to find such data for eight of the countries in our main 27-country sample. Unfortunately, the eight countries that have data available during this earlier time period are predominately high-income countries. Therefore, this additional data may not help us to identify a relationship between income distribution and fluctuations that changes with per capita income. Nonetheless, the results from this exercise (available upon request), are slightly better than our third sample results discussed above. The coefficients on
all the income distribution variables in the consumption regressions retain the signs and significance reported for our main sample. However, in the GDP regressions, only the coefficients in the regression using $Q(5)$ as the inequality measure remain significant and of the correct sign.

We have several conclusions about the strength of our original results based on the sensitivity analysis we describe above. First, we find our consumption results to be very strong. They are robust to changes in our sample, changes in our estimation technique, and changes in our sample selection strategy. Second, our overall conclusions about the link between GDP variability and inequality are fairly robust within the original sample, although a robust estimation technique replicates the significance levels of our initial results for only a subset of inequality measures. A new sample selection strategy does not allow us to generalize the GDP results, possibly due to structural change that occurs across the two time periods. Finally, the inequality measure that appears to have the strongest link with consumption and output variability is $Q(5)$, the share of the top quintile. In the following section we briefly examine one possible channel through which inequality could affect consumption and output variability that is consistent with these findings.

4.3. Further Discussion

If the income distribution affects macroeconomic fluctuations because it determines the percent of the population that might be borrowing constrained, we would expect that financial development would also be associated with less fluctuations. In fact, in our results above, $MEAN\text{GDP}$ may be proxying for the level of financial development.

To test this idea, we employ several measures of financial development from King and Levine (1993): $LLY$ (M2 divided by GDP), $BANK$ (ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets), and $PRIVY$ (claims on nonfinancial private sector divided by GDP). As discussed in King and Levine, each of these three measures capture a slightly different aspect of finan-

\footnote{See King and Levine for details on the calculation of these measures. The underlying data is from IMF’s IFS. King and Levine also construct a fourth measure of financial development which they call $PRIVATE$ (ratio of claims on the nonfinancial private sector to total domestic credit). We do not use this measure due to lack of data availability for the majority of countries in our full sample.}
cial development. \textit{LLY} and \textit{PRIVY} are two measures of the overall size of the financial sector, while \textit{BANK} is a slightly more sophisticated gauge, measuring the importance of private sector financial institutions relative to the public sector. Higher levels of \textit{BANK} indicate that the private sector is more important, possibly indicating that there are less distortions in the decision to allocate credit. For our purposes, \textit{PRIVY}, the amount of credit provided to the private sector as a percentage of GDP, probably most closely resembles a measure that will indicate the extent to which the economy is influenced by borrowing constraints.

As a first step, we checked to determine whether including a measure of financial development alters our original conclusions about the relationship between inequality and variability. Although we do not report the details of our estimation, we found that it did not. Interestingly, the financial development indicators often were insignificant in these regressions and flipped signs in the different specifications, suggesting that if any relationship exists between these measures and macroeconomic fluctuations, it is not captured by a linear coefficient.

As mentioned above, it is also possible that in our original specification \textit{MEANGDP} is proxying for financial development. To test the validity of this idea, we include an interaction term between \textit{INCINEQ} and the three different measures of financial development to see whether \textit{MEANGDP} or \textit{FINDEV} is a better explanatory variable. The results of this “horserace” appear in Tables 11a and 11b. In the consumption regressions, the coefficients on \textit{LLY} and \textit{PRIVY} are now significant and have the expected negative sign when each of the four inequality measures is used, while the coefficient on \textit{BANK} is negative and significant for only two of the four inequality measures. In the GDP regressions, \textit{LLY} and \textit{PRIVY} again enter negatively and significantly in seven out of 8 specifications while \textit{BANK} is significant with the wrong sign in one out of four regressions. This indicates that the measures of overall financial depth, \textit{LLY} and \textit{PRIVY} seem to better explain macroeconomic fluctuations than the relative importance of private sector financial institutions. We believe that these results are reasonable if the cause of more severe fluctuations is credit-constrained households.

The race between interaction terms is a bit too close to call. In several regressions, both interaction terms remain significant, although when we focus on the specifications
using only $LLY$ or $PRIVY$, the financial development indicator wins by a nose. We interpret these results as suggesting that, while financial development may play an important role in minimizing aggregate fluctuations, the level of per capita income still retains some explanatory power. Thus, other aspects of development not related to financial development may be important in the short-run macroeconomic performance of the economy. The coefficients estimated in Tables 11a and 11b continue to imply that for the majority of the countries in our sample, higher levels of inequality are associated with lower variability in consumption and output. Consequently, only for the wealthiest and most financially developed economies does greater equality lead to smaller aggregate fluctuations.\(^{21}\)

5. Conclusion
We have documented a relationship between income inequality and variability in aggregate consumption growth. In low-income countries, higher levels of inequality are associated with less fluctuations in consumption growth, and in high-income countries, more inequality is associated with greater fluctuations. Some preliminary results indicate that financial development may help to explain the relationship between inequality and aggregate consumption variability. While we have presented some results that suggest that variability in GDP growth is also related to income inequality in the same way, these results are not robust to alternative sample selection strategies and estimation techniques. Perhaps our failure to find strong evidence that these fluctuations in aggregate consumption find their way through to GDP fluctuations is indicative of the fact that, as suggested by the literature on economic growth and inequality, the supply side of the economy may be affected by the income distribution as well.

We do want to be cautious in making a welfare statement about these findings. Our attempt to link the household distribution of income to aggregate economic activity

\(^{21}\)We also performed a similar exercise to that discussed above, splitting our sample based on the sign of $\partial V/\partial INCINEQ$ and reestimating (1) without any interaction terms. Our results were qualitatively similar to those reported earlier with the exception that, in one specification in our high income country sample, a statistically insignificant coefficient on $GINI$ displayed the incorrect sign.
highlights an important point—less aggregate fluctuations does not necessarily mean the majority of individuals in an economy are better off—only those individuals who account for a substantial portion of aggregate consumption are.
6. References


