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Income Inequality and the Business Cycle

Summary: This paper first examines the relationship between ordinary least squares estimators of consumption and investment for 36 selected countries with their respective Gini indices. The analysis shows that income inequality is consistent with a smaller estimator of consumption and a greater estimator of investment. Second, the cycles of GDP, consumption and investment are dated separately to determine how the deepness and duration of cycles of those variables are correlated with the Gini indices of countries. The results show that income inequality leads to a deeper and longer decline of GDP, which causes a greater cumulative income loss of GDP during recession, and a somewhat faster speed of recovery during expansion. Likewise, the result of a correlation between Gini indices and the number of cycles in consumption, investment and GDP indicate that income inequality is associated with a greater number of cycles in consumption and GDP and a lower number of cycles in investment.

Key words: Business cycle, Consumption, Cumulative loss, Amplitude, Dating the cycle, Recession.

JEL: E25, E32.

Since the 1950s, the study of the business cycle and its impact on income inequality has been the topic of many investigations. Most of this research aimed to study the dynamic or static impact of a business cycle on income distribution within countries. Although some of these studies, theoretically and empirically, highlight these impacts, very little is known about the possible relationship between income inequality and the severity of business cycles and the number of business cycles that a country may experience over time. Likewise, as an economy enters a recession, how quick and deep the collapses of aggregate demand occur in countries with a less equal income distribution. Finally, does greater inequality of incomes within a country affect the cyclical patterns of business cycles? These relationships may help to understand whether countries with a more or less equal distribution of income can cope better with the economic shocks that create recessions. Dating the cycles of GDP, consumption and investment shows how the severity of these cycles are correlated with Gini indices of countries and how they may affect the cyclical patterns of business cycles.

The initial objective of this study is to find out how the degree of responsiveness of consumption and investment to GDP varies between countries with different levels of Gini indices. For this purpose, we run an ordinary least squares (OLS) model for a set of 36 countries over a period of 40 years. A correlation is then made be-

tween all the estimators of consumption and investment with the average of Gini indices of countries over the past 40 years. This analysis is carried out to determine whether consumption or investment is the leading variable causing fluctuations of GDP.

The second objective is to find a possible relationship between the degree of income inequality and the severity of business cycles shown as the duration and depth of recessions and expansions for the countries under study. To identify true business cycles that affect GDP followed by consumption and investment, we employ the algorithm proposed by Don E. Harding and Adrian Pagan (1999) to date the cycles of GDP, consumption and investment. These are calculated for each individual country during the period 1970 to 2009. A set of correlations is then made between the value of the estimates of these parameters for the 36 countries for 40 years and the average of the Gini indices reported for each individual country. This analysis shows whether income inequality is associated with a more or less intense recession and expansion. This also demonstrates how consumption and investment may play a role in intensifying or alleviating the effects of business cycles in countries with different levels of income inequality.

As a final objective of the paper, the number of cycles in GDP, consumption and investment is calculated for all the countries over the course of 40 years. For this purpose, a random walk model with a drift for each variable is estimated to obtain the ratio of drift to standard deviation. A correlation is then made of these ratios with the Gini indices for the countries for all three mentioned variables of each individual country separately, to highlight the possible relation between income distribution and the number of cycles in each of the above mentioned variables.

For the purpose of this study we employ annual data on GDP, consumption and investment for all 36 selected countries over the years 1970 to 2009 reported by the World Bank. Annual data on Gini indices are also collected from the World Bank. It seems that greater income inequality is correlated with less sensitivity of GDP to consumption and more sensitivity of GDP to investment. In addition, more income inequality leads to a longer and deeper recession in which the role of consumption in alleviating the effects of economic shocks that create recessions is less significant for countries with a less equal income distribution. Finally, greater income inequality is correlated with a greater number of cycles in GDP and consumption, and with a lower number of cycles in investment.

1. Literature Review

In the 1950s Simon Kuznets was one the first researchers who presented the idea that there exist an inverted-U relationship between *per capita* gross national product (GNP) and inequality in the income distribution. His findings were later described as an "inverted-U hypothesis". His hypothesis was later criticized by Gomez and Foot, who remarked that "if Kuznets was correct in his original hypothesis and income inequality reduces with economic development, developing countries facing high income inequality need not to be concerned with rising inequality" (Rafael Gomez and David K. Foot 2003). However, typically, long-run data for developed countries

supports Kuznets' proposition, while studies of developing countries have produced conflicting results.

Bengoa and Sanchez-Robles designed an endogenous model to include equality as an argument that increases the utility of a representing agent. They concluded that the relationship between equality and growth is shown to be hump shaped, whereas the impact of equality on growth could be different at various stages of development (Marta Bengoa and Blanca Sanchez-Robles 2005). Similarly, by employing a neo-classical growth model, assuming that agents are heterogeneous in their initial wealth, Maliar, Maliar, and Mora showed that inequality in both wealth and income follows a counter-cyclical pattern during business cycles experienced by the US over time (Lilia Maliar, Serguei Maliar, and Juan Mora 2005).

Berg, Ostry, and Tettelmeyer based on the multi-decade and multi-country evidence proposed that greater equality can sustain growth. They build they work on a tentative consensus in the growth literature and concluded that inequality can undermine progress in health and education, causing political and economic instability, and undercut the social consensus required to adjust in the face of major shocks, and thus that it tends to reduce the pace and durability of growth (Andrew G. Berg, Jonathan D. Ostry, and Jeromin Zettelmeyer 2012).

In addition, a study of the causality and feedback of the relationship between equality and growth through application of a vector autoregression model (VAR) in conjunction with timeseries data on the US economy for the period of 1947 to 2001 highlighted the fact that there is a two-way positive relationship between a more equal distribution of income and a higher rate of economic growth (Kamran M. Dadkhah 2006). In other words, applying any policy that promotes income equality will encourage growth, and *vice versa*. Likewise, Birdsall indicated that inequality is more likely to harm growth in countries possessing less than $3200 GDP *per capita* (in 2000 dollars), and this effect emerges at high levels of inequality where the Gini coefficient is greater than 0.45 (Nancy Birdsall 2007).

In contrast to all these studies, Gallo suggested that most of the theories of income distribution have little to contribute in terms of explaining the size distribution of income, and hence state only a part of the income distribution trend. Thus, researchers are far from determining which economic growth improves the income distribution. Gallo's final conclusion stated that there exists no definite relationship between economic growth and income inequality (Cesar Gallo 2002).

However, with regard to the relationship between the business cycle and income inequality, this relationship was studied by Hoover, Giedeman, and Dibooglu, who showed that during recession periods an increase in unemployment intensifies the income inequality but during expansion periods a reduction in the unemployment rate has a short-lived effect on reducing income inequality (Gary A. Hoover, Daniel C. Giedeman, and Sel Dibooglu 2009). Likewise, several articles analyzed recessions from multifarious aspects. For instance, Josifidis, Dragutinivić Mitrović, and Ivančev highlighted the role of financial integration on deepness of crisis in Emerging European economies both in 2008 and 2009 (Kosta Josifidis, Radmila Dragutinović Mitrović, and Olgica Ivančev 2012). Stiglitz stresses the role of political-economy factors (especially the influence of the rich) as an engine to create financial excess

followed by economic crisis (Joseph E. Stiglitz 2013). Nevertheless, on top of all these studies, Rajan emphasized that inequality intensifies the leverage and financial cycle leading to a crisis (Raghuram G. Rajan 2010).

In view of this, it is worth looking at the problem from another perspective to investigate the degree of severity of the business cycles that hit countries with different levels of income distribution, and whether this effect is greater in relation to consumption or investment. It seems that consumption-smoothing behavior of consumers in countries with a more equal income distribution will help these countries to experience a less costly recession. In addition, it is important to know that whether the severity of business cycles emerges from longer durations or deeper amplitudes. Finally, it would be interesting to explore any possible relationship between levels of income inequality and the number of business cycles of GDP, consumption and investment that countries might experience. In this regard, the role of uncertainty and speed of information flow, as well as the degree of effectiveness of fiscal and monetary policies, might lead us to observe a greater number of cycles in investment and a lower number of cycles in GDP and consumption for countries with more income equality.

2. Dating the Cycles

Following Harding and Pagan (1999), the turning points of the data series for GDP, consumption and investment must first be explored. In order to determine these points, the algorithm determines the potential turning points of the series, including peaks and troughs, and selects only those episodes where the peaks and troughs alternate. It then re-combines the turning points to ensure that phases of the cycle have a minimum duration of 6 months, and a complete cycle has a minimum duration of 15 months.

To identify the peaks and troughs the concepts of: (a) contraction terminating sequences (CTS) and (b) expansion terminating sequences (ETS) are employed. The algorithm uses the rule popularized by Arthur Okun which requires a recession to have at least two quarters of negative growth. Likewise, an expansion starts when two quarters of positive growth are experienced.

When measuring the severity of the cycle, it is important to focus on three measures (see Figure 1). The duration of CTS is shown as AB and the duration of ETS as BC; the amplitude of the phases of the cycle "di" is measured as $\sum_{i=A}^{B} di$ and $\sum_{i=B}^{C} di$ (shown by the vertical lines inside the cycle in Figure 1); the cumulative losses within each phase of the cycles are shown as the area PTM for the CTS phase and the area MTD for the ETS phase.

Over the 40-year period covered by this study the Harding and Pagan (1999) algorithm identifies the true cycles for each individual country based on a set of censoring rules. It also calculates the areas of loss accumulated for each phase of the cycles (PTM and MTD). It then calculates the average (percentage) loss for each phase separately across all the business cycles experienced by a country (1970-2009) with respect to the GDP trend for each country at the time of the business cycle.
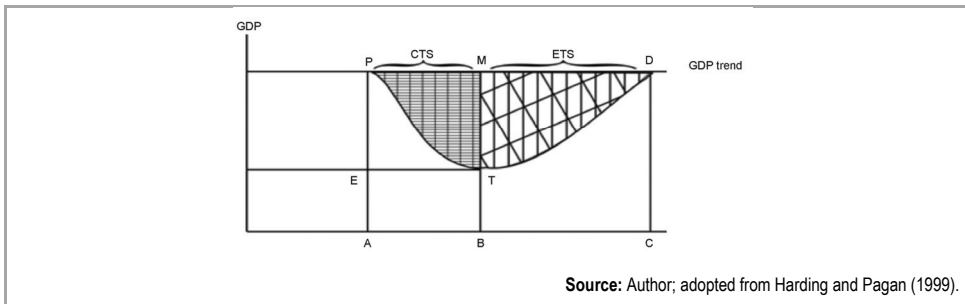
Figure 1 Duration, Amplitude and Cumulative Loss of the Phases of the Business Cycle

Because we have only annual data available for this set of 36 countries for the entire period we wish to study, the values of these variables are calculated for each individual country using the Gauss program employing the algorithm rules applicable to annual data (Harding and Pagan 2011). Using this algorithm we are able to estimate the average duration, amplitude and cumulative loss for peak to trough (CTS) and trough to peak (ETS) of cycles.

3. Data

We select 36 countries for which annual data on GDP, consumption and investment are available from 1970 to 2009 from the *World Development Indicators* of the World Bank (World Bank 2011[1]). Using the GDP deflator, these data are transformed to constant 2000 local currency units (in millions). The data on Gini indices of countries are also collected from the World Bank for the years 1980 to 2009. Given that the applied algorithm for dating the cycles calculates and presents a single average value for the duration, amplitude and cumulative loss of the contractionary and expansionary phase of the cycles for each individual country over the period of 1970 to 2009, for consistency of study we also calculate an average of the estimated Gini indices for each country. All the correlations throughout this study are made between these average numbers. It should be noted that since the Gini indices data of all the countries under study were not available for the years before 1980, we assume that inaccessibility to those data will not significantly harm our results, since the deviation of those data from the mean is assumed to be minor.

4. Empirical Approach and Related Arguments

4.1 Coefficients of Investment and Consumption

As a first step, an OLS model is estimated for GDPs of selected countries in order to obtain the related estimators of consumption and investment (Table 1). We then group our sample into 3 sets of countries. The first includes the full sample of countries. The second group contains 21 countries that fall into the high and higher mid-

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dle income group: Argentina, Australia, Brazil, Canada, Chile, Denmark, France, Germany, Greece, Ireland, Japan, Malaysia, Mexico, New Zealand, Norway, South Africa, Spain, Sweden, Turkey, United Kingdom and US. The third group is the 15 countries that are classified as lower middle income and low income: Benin, Bolivia, Burundi, China, Congo Republic, Gabon, Gambia, Guinea, India, Jordan, Kenya, Morocco, Philippines, Tunisia and Zambia. The negative correlation of those estimators with the average of Gini index of all countries in the first group (Set 1) reveals that the responsiveness of GDP to consumption is greater for the countries with greater income equality (Table 2). This correlation is significant at a 99% confidence level. This responsiveness falls considerably when we compare high and middle income countries (Set 2) with low and lower middle income countries (Set 3), as shown in Table 2. This is consistent with the Keynesian theory which indicates that as the income distribution improves, the average propensity to consume (APC) will rise, leading to higher consumption. However, the positive sign of the respective correlation between the Gini indices and investment coefficients leads us to conclude that responsiveness of GDP to investment falls as income distribution improves. This conclusion, however, is not as strong as the previous conclusion for consumption, since this value is only significant at the 95% confidence level. Nevertheless, this responsiveness increases considerably when we compare high and middle income countries (Set 2) with low and lower middle income countries (Set 3) as shown in Table 2, showing that GDP in low income countries is more sensitive to variation in investment.

Table 1 Coefficients of Consumptions and Investments Regressed against GDP (Year 1970-2009)

Country	Gini index	Consumption	Investment	Country	Gini index	Consumption	Investment
Argentina	47.92	0.46	0.31	Turkey	42.78	0.88	0.09
Australia	35.00	0.80	0.22	UK	36.00	0.86	0.11
Brazil	58.46	0.78	0.23	US	41.00	0.82	0.09
Canada	33.00	0.79	0.20	Benin	39.00	0.76	0.08
Chile	55.17	0.75	0.25	Bolivia	54.13	0.59	0.36
Denmark	25.00	0.87	0.08	Burundi	35.25	0.75	0.03
France	33.00	0.84	0.17	China	42.00	0.64	0.39
Germany	28.00	0.91	0.16	Congo	47.00	0.62	0.56
Greece	34.00	0.73	0.23	Gabon	41.00	0.51	0.44
Ireland	34.00	0.91	0.15	Guinea	43.25	0.24	0.43
Japan	25.00	0.77	0.21	Gambia	48.50	0.39	0.36
Malaysia	44.67	0.63	0.26	India	37.00	0.80	0.27
Mexico	48.62	0.76	0.25	Jordan	38.00	0.70	0.23
New Zealand	35.00	0.84	0.14	Kenya	47.67	0.59	0.33
Norway	26.00	0.90	0.34	Morocco	39.44	0.63	0.09
South Africa	58.00	0.83	0.18	Philippines	43.33	0.85	0.13
Spain	35.00	0.83	0.07	Tunisia	41.67	0.81	0.12
Sweden	25.00	0.82	0.10	Zambia	50.25	0.74	0.21

Source: World Bank (2011).

Table 2   Correlations between Coefficients of Consumption and Investment with Gini Index

	Consumption	Investment
	All countries	
Correlation coefficient (1)	-0.46	0.36
t-test	-3.20**	2.39*
	High and upper middle income countries	
Correlation coefficient (2)	-0.41	0.29
t-test	-2.75*	1.84
	Lower middle income and low income countries	
Correlation coefficient (3)	-0.33	0.48
t-test	-2.18*	3.35**

Notes: * significant at 95% level of significance; ** significant at 99% level of significance.

Source: Author.

The reason for this may relate to the fact that owing to a shortage of capital, the rate of return on capital in less developed countries (which mostly have high Gini indices; Garth Frazer 2006) is higher in comparison to developed countries. Therefore, the GDP in those countries seems more sensitive to investment variation. This clarification will help us to understand how consumption and investment play their role in intensifying or alleviating the effect of business cycles experience by countries with different levels of income inequality.

4.2 Income Inequality and GDP, Investment and Consumption

In this step, the dating procedure is undertaken to obtain the average duration, amplitude and cumulative loss for peak to trough (CTS) and trough to peak (ETS) of cycles of GDP, consumption and investment. The countries are grouped into 3 categories as previously described, and correlations are made between the average Gini indices of countries with the average values obtained for duration, amplitude and cumulative loss of each phase of the business cycle. The findings of this empirical investigation are reported in Table 3.

Table 3   Correlations of the Average Gini Coefficients by Country and the Characteristics of the Business Cycle

	GDP						Consumption						Investment					
	CTS			ETS			CTS			ETS			CTS			ETS		
	DUR	AMP	CUM	DUR	AMP	CUM	DUR	AMP	CUM	DUR	AMP	CUM	DUR	AMP	CUM	DUR	AMP	CUM
							Full set of countries											
Correlation	0.35	0.53	0.36	-0.22	-0.11	-0.07	0.08	0.52	0.30	-0.41	0.05	-0.10	-0.01	0.33	0.19	-0.28	0.25	0.03
t-test	2.18*	3.60**	2.28*	-1.31	-0.64	-0.41	0.49	3.51**	1.85	-2.64*	0.29	-0.58	-0.07	2.01*	1.13	-1.71	1.48	0.20
							High and upper middle income countries											
Correlation	0.53	0.83	0.67	-0.24	-0.12	-0.17	-0.07	0.73	0.55	-0.45	-0.12	-0.04	0.18	0.39	0.30	-0.37	0.22	0.04
t-test	2.70**	6.42**	3.95**	-1.09	-0.54	-0.76	-0.28	4.66**	2.89**	-2.19*	-0.54	-0.19	0.79	1.82	1.35	-1.71	0.97	0.16
							Low and lower middle income countries											
Correlation	-0.28	-0.17	-0.30	0.18	0.27	0.32	0.18	-0.09	-0.13	-0.10	0.26	0.03	0.38	0.11	0.21	-0.20	0.09	-0.09
t-test	-1.67	-1.01	-1.81	1.08	1.63	1.97	1.05	-0.51	-0.76	-0.57	1.55	0.20	2.39*	0.64	1.25	-1.20	0.51	-0.50

Notes: * significant at 95% level of significance; ** significant at 99% level of significance.

Source: Author.

In the full sample of 36 countries it can be seen that the correlation coefficients between the Gini indices and the duration, amplitude and cumulative loss in GDP of the contractionary phase of the cycle are positive and significant at either a

95% or 99% confidence level (Table 3, row 1). This result strongly supports the hypothesis that income inequality (higher Gini index) is associated with longer durations, deeper amplitude, and greater cumulative losses in GDP as economy enters to recession.

When we look at the duration, amplitude and cumulative loss of cycles in consumption and investment as major components of GDP for the full set of countries, the sign of correlations with duration of cycles shows that we may observe longer duration in cycles of consumption and shorter duration in cycles of investment for the countries with less equal income distributions. Likewise, we may observe a larger cumulative loss in cycles of consumption and investment for the countries with less income equality. However, none of these results are significant. But when we look at the amplitude of cycles in consumption and investment, we observe that inequality of income is significantly associated with deeper cycles in consumption and investment, and that this correlation is more significant for consumption than for investment (99% level of significance *versus* 95% level of significance).

Looking at the second set of countries, we observe that only consumption plays a significant role in alleviating the effects of shocks (0.55), although the sign of the correlation coefficient for investment shows that investment may play some role in this direction (0.30). Another important implication of these results is that, as a shock hits the economy, both consumption and investment play some role in alleviating its effects for countries that have more equal income distributions. However, this role seems to be more effective for consumption than for investment (0.30 *versus* 0.19). Given that GDP in countries with greater income equality is more sensitive to variations in consumption than those in investment, the consumption-smoothing behavior of a large middle income group of consumers as well as better access to the credit market helps those countries to sustain their GDP at a higher level and to experience a less costly recession.

The empirical results of the full set of countries also reveal that there is a negative correlation between the Gini index and the duration, amplitude and cumulative loss of the expansion phase of the cycles of GDP (ETS). Hence, those countries with greater income inequality (higher Gini index) may experience a shorter and less deep period of recovery from a recession, although these numbers are not statistically significant.

The reasons behind these facts can be explained by considering the importance of the consumption-smoothing theories such as the permanent income hypothesis and the life-cycle model of consumption for people with different levels of income. As shown by Amorosi, Gosling, and Leon-Ledesma (Gabriele Amorosi, Amanda Gosling, and Miguel Leon-Ledesma 2012), consumption-smoothing by middle income households is higher, while investment decisions are affected by the concepts of uncertainty and irreversibility.

The importance of uncertainty has also been emphasized by many researchers, who have concluded that uncertainty suppresses investment, since higher uncertainty actually reduces the responsiveness of investment to demand shocks. This is due to the fact that investment decisions on installed capital must take into account future cost and demand conditions, even though this reaction may be more severe for risk-

averse firms (Steven A. Holland, Steven H. Ott, and Timothy J. Riddiough 2000; Nicholas Bloom, John van Reenen, and Stephen Bond 2007; Luke C. D. Stein and Elizabeth C. Stone 2012).

4.3 Income Distribution and the Number of Business Cycles

Given that output processes in a variety of real business cycle (RBC) models follow the structure of a model containing a random walk with a drift ($\Delta Y_t = \mu_y + \sigma\, e_t$) (Timothy Cogley and James M. Nason 1995), we estimate such a model for GDP, consumption and investment separately for each country. These are carried out to compute the ratio of the drift to standard deviation (μ/σ) in order to obtain the number of turning points of the cycles. According to Harding and Pagan (1999), in this typical model, the probability of obtaining one quarter of negative growth is $\Phi(-\mu_y/\sigma)$, where $\Phi(.)$ represents the cumulative normal distribution and (σ) stands for standard deviation. In this case, the ratio of drift to standard deviation shows the number of turning points such that a larger μ_y/σ indicates that fewer turning points will be observed in a series (Harding and Pagan 1999).

Taking the correlations between the Gini indices and the ratio of drift to standard deviation of GDP, consumption and investment for the entire set of countries reveals that countries with less equal income distributions are likely to experience a higher number of cycles in GDP and consumption. This is shown by the negative sign of their respective coefficient correlations where these correlations are statistically significant at the 95% and 99% confidence levels respectively (Table 4). Looking at the second set of countries (higher income and upper middle income), this effect is stronger for GDP, but almost the same for consumption. However, the correlations for the third set of countries (lower middle and low income) predict the same outcome even though the obtained coefficients are not statistically significant. In contrast, the correlation coefficients for the Gini indices and investment for the first and second sets of countries have a positive sign, leading to the conclusion that greater income inequality is consistent with a lower number of cycles in investment. The insignificant *t*-test value for investment, however, does not strongly support this conclusion.

Table 4 The Correlations of Average Gini Coefficients by Country with Ratio of Drift to Standard Deviations of GDP, Consumption and Investment

	GDP	Consumption	Investment
	Full set of countries		
Correlation coefficient (1)	-0.33	-0.44	0.15
t-test	-2.07*	-2.85**	0.94
	High and upper middle income countries		
Correlation coefficient (2)	-0.6	-0.49	0.22
t-test	-3.3**	-2.85**	0.98
	Lower middle income and low income countries		
Correlation coefficient (3)	-0.11	-0.24	-0.08
t-test	-0.40	-0.91	0.94

Notes: * significant at 95% level of significance; ** significant at 99% level of significance.

Source: Author.

The fact that the numbers of peaks and troughs in consumption and GDP become less as income distribution improves over the countries may be due to the higher degree of effectiveness of fiscal and monetary policies in developed countries. However, in order to understand the reason for observing more volatile investment patterns in countries with a more equal income distribution, we need to examine the relationship between investment and flow of information as well as uncertainty and the flow of information affecting investment decisions in advanced countries.

As Strebulaev, Zue, and Zryumov pointed out, the investment decision no matter resourced from equity or debt is sensitive to the flow of information (Ilya A. Strebulaev, Haoxiang Zhu, and Pavel Zryumov 2014). Emphasizing the role of uncertainty Bernanke stated that the timing of irreversible investment projects can be quite sensitive to the arrival of new information. He suggested that if we have a realistic assumption that these uncertainties will be reviewed periodically in the light of new information, we may observe more fluctuations in investment, especially in more developed countries, since the flow of information is faster than that in developing countries (Ben S. Bernanke 1983).

5. Conclusion

From the empirical results it would appear that a less equal income distribution leads to deeper and more costly recessions. Overall, the duration of contraction when going into a recession is longer for countries with a less equal distribution of income, while the speed of recovery during the expansionary phase of a recession (ETS) is somewhat faster. The duration and depth of the decline of aggregate demand in the first phase of the cycle (CTS) results in greater cumulative income losses of GDP for countries that have greater inequality.

Moreover, we show that greater income inequality is associated with a smaller responsiveness of GDP to consumption and greater responsiveness of GDP to investment. In this case we observe that during the recession, consumption in countries with greater income inequality plays a greater role in pulling the economy down compared to investment, while for the countries with greater income equality, consumption alleviates the effects of recession to prevent GDP from entering deeper recession. In addition, a higher level of income equality will lead to a lower number of cycles in GDP and consumption. The same conclusion cannot be drawn as clearly for investment. While it is the case that a more equal income distribution is desirable for many social reasons, these results add one more argument in support of policies that serve to improve the distribution of income within countries over time.

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