

Income Inequality, Inflation and Nonlinearity: The Case of Asian Economies

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Abstract

In this paper, we propose a new way of looking at the relationship between income inequality and inflation. We argue that such relationship is in fact nonlinear. Based on data from 7 Asian countries, we conclude that the inequality rises at a very high inflation rate as well as at a very low rate. Moreover, we find that both income inequality and inflation are endogenous variables. However, only the long-term component of inflation causes changes in inequality. Two policy implications can be drawn from this paper. First, the monetary authorities should keep the rate of inflation around 5% if their goal is to reduce the inequality. Second, they should not frequently generate monetary shocks to stimulate the economy as the shocks do not improve the inequality directly and may even worsen it indirectly through the increasing uncertainty about inflation.

Contents

1	Introduction	1
2	How Can Inflation Affect Income Inequality?	1
3	The Model	5
4	Data Considerations	7
5	Estimation Results	10
6	Causality Tests	13
7	Conclusions and Suggestions	15

1 Introduction

Reducing income inequality may be one of a few goals that all policymakers agree to. Yet, we seem to have a little knowledge about the inequality. For a long time, economists tend to believe in the Kuznets curve, but this hypothesis has recently been challenged in many ways. While there is much debate over the link between growth and inequality, this paper adds to the debates by examining the relationship between the income inequality and another important macroeconomic indicator, the inflation.

The objective of this paper is to collect existing knowledge about the links between income inequality and inflation, to propose a nonlinear effect of the inflation on the inequality, and to test causality between the two variables. Section 2 reviews the effects of inflation on the income inequality that have been discussed in the literature. Section 3 proposes a new model of nonlinear relationship, and data considerations are mentioned in Section 4. Section 5 presents the estimation results and the robustness tests. Section 6 investigates the causality between inflation and inequality. Conclusions and suggestions in section 7 then completes this paper.

2 How Can Inflation Affect Income Inequality?

Before discussing how the inflation can affect the income inequality, it is important to point out a few concepts related to inflation. First, the effects of inflation should be distinguished between long run and short run. It is generally agreed that inflation has no impact on the real economy in the long run. The inflation-inequality relationship should therefore exist only in the short run. Although there is no consensus on how long is the long run, one can think

of a 10-year period as a considerably long period. This answers why some empirical studies that used decade-average inflation rates found no relationship between the inflation and the inequality. This type of study includes, for example, Blank and Blinder (1986) that used average data between 1948 and 1983. These studies are useful but not suggestive to our question, which focuses on the short-run effects.

Second, the distinctions between anticipated and unanticipated inflation should not be ignored. They are equally important but yet have different effects on the economy. The anticipated inflation influences consumption path that agents choose over lifetime according to the consumption Euler equation. The unanticipated inflation is what economists usually pay more attentions. When rigidities are added into some components of the economy, this monetary shock can influence the real economy as well. Although the effects of anticipated and unanticipated inflation are clearly differentiated in theories, less efforts have been made to distinguish the two in empirical studies. To the author's little knowledge, Romer and Romer (1998) may be the only study that separated the anticipated and unanticipated inflation effects on the inequality. They used the expected inflation from the Survey of Professional Forecasters (SPF)¹, and the unanticipated inflation is simply the difference between the actual and expected inflation.

Once we understand these differences, we next present how the inflation affects the income inequality. One of the effects that people primarily think of is the impact on real wealth. If wages are fixed, the real wealth declines with the rising inflation. This effect may not be symmetric to all consumers because some people, especially those who receive high income,

¹The survey asks professional forecasters of their expectations (forecasts) on many economics indicators, including the inflation rate. Currently, the survey results are available from the Federal Reserve Bank of Philadelphia

may not receive fixed wages. Only the nominal income of the top bracket rises with inflation, while the income of the bottom bracket remains unchanged. Then, the income inequality must also rise with the inflation. Survey results from Shiller (1996) and Easterly and Fisher (2001) showed how important this effect is in practice. Shiller reported that the largest concern with inflation appeared to be that it lowered standard of living. Easterly and Fisher using a different survey confirmed that the poor are more concerned about inflation than the rich.

The next channel that relates the inflation and the inequality is through the Phillips curve. According to Phillips (1958), inflation and unemployment are negatively related. In particular, the unanticipated inflation can stimulate the employment level. Because in general people whose earnings are initially low experience a higher probability of being unemployed, a reduction in unemployment rate should directly benefit this group more than those with high income. Though the inflation effect on the unemployment is clear, the unemployment effect on inequality may be ambiguous depending on how the inequality is measured. As the newly employed are concentrated in the low income group, the income distribution will skew more to the left. It is difficult to predict the change personal-income based inequality from the change in skewness. On the contrary, if the inequality is measured from household income, it will most likely decrease. The fixed number of household and the additional sources of income available for the low-income households will increase the income of low-income households more than the high-income households.

In addition to the channels mentioned above, Lucas (1972) also showed that the inflation can increase the real output when agents cannot distinguish between real and monetary shocks from the observed shocks. However, Agénor (2002) found that a very high inflation

rate can instead retard growth, although not significantly so. These two authors may lead us to believe in the Kuznets curve, which relates growth and inequality in a nonlinear way. However, the hypothesis is largely rejected by the Latin effect. Although we want to believe that higher income leads to lower inequality, the supporting evidence may not be as strong as our belief. Based on the evidence from developing countries in the 1980s, Ravallion (1995) studied the effect of growth on poverty and concluded that the economic growth can have some influences, but it is not all that matter.

Both unemployment and growth effects may be considered short-run phenomena. Once the inflation rate returns to its “normal” level, the unemployment and growth rates as well as the inequality should return to their long-run levels as well. Frequent inflation surprises may end up hurting the distribution of income instead. The main reason is that high economic volatility can increase uncertainty, reduce investment, and hinder growth. Romer and Romer (1998) showed that countries with larger standard deviations of GDP growth tend to have higher values of the Gini coefficient. Also, a stylized fact from Barro (1997) indicates that countries with higher inflation rates tend to have higher variance of inflation as well. Thus, following this line of argument, we might as well see positive relationship between inflation and inequality.

Another channel that the inflation can have an influence on the inequality involves with the inflation tax argument. As pointed out by Phelps (1973), money growth actually generates revenue for government. The inflation can be considered as a tax on money holdings, and it is said to be the “cruellest tax” on the poor. That is because low-income consumers usually have less access to financial markets, and major part of their wealth is stored in the form of money (or in non-liquid real assets such as pigs, cows, chickens, gold objects, etc). Their real value

of wealth falls with the inflation. The inflation can be positively related to the inequality in this case. However, Easterly and Fisher(1986) directly investigated this inflation tax claim and found the relationship that is positive but not significant.

Lastly, the inflation can affect the income inequality through balance sheets. For any given nominal interest rate, a change in inflation rate causes an equal change in the real interest rate. Real values of nominal assets and liabilities decline when the inflation rate increases. Income redistribution is then made from creditors to debtors. Since the poor are on average debtors, this effect of increasing inflation should on average benefit the poor. Romer and Romer (1998) examined this claim by looking at the composition of assets and liabilities of the poor. The data confirm that the poor are in fact debtors. However, the economic significance of this effect may be trivial since the amount of debt, at least on the average, is not very large. They showed that an average poor household has a net worth of \$-1,816. If the inflation rate were to be 32 percentage points higher than expected over a period of ten years, the real capital gain to the average poor household would be only \$80 per year.

3 The Model

Having explained how the inflation can possibly affect the income inequality, we will next argue that the impact is in fact nonlinear. Studied in the context of growth, Barro (1997) pointed out that the growth-inflation relation may be driven by a few extreme observations where hyperinflation and economic contraction are concurrent. Thus, on one hand, a high level of inflation can push up the inequality through the severe economic recession. On the other

hand, a very low level of inflation can also drive the economy into recession and raise the inequality. A perfect example would be Japan before it experiences the decade-long deflation. With the low rate of inflation, consumers have strong doubts that the prices will decrease in the future. They optimally postpone part of their consumption to the future to benefit from the possibly lowered prices. Aggregate demand shrinks, and the economy slips into a recession.

Bulř (2001) also argued that inflation affects inequality in a nonlinear fashion. Using dummy variables for countries with hyperinflation, high inflation and low inflation, he concluded that countries with the lowest Gini coefficient tend to be those with “high” inflation (defined as inflation between 41 percent and 300 percent annually). Although his results clearly suggest nonlinear relationship between inflation and inequality, the suggested turning point of the relationship is skeptical. This paper follows the concept of nonlinearity proposed by Bulř, but it differs greatly in the estimation technique. The relationship between inflation and inequality is estimated based on the Kuznets hypothesis. We estimate the following model.

$$I_{it} = a_0 + a_1 y_{it} + a_2 y_{it}^2 + a_3 \pi_{it} + a_4 \pi_{it}^2 + \mathbf{bX}_{it} + e_{it} \quad (1)$$

where I is the measure of income inequality, y is the income, π is the inflation rate, and \mathbf{X} is a set of control variables. The subscript i and t denote country and time, respectively. Our focus is on 7 Asian countries—Hong Kong, Singapore, South Korea, Taiwan, Thailand, Malaysia, and the Philippines. We estimate equation (1) by using the pooled OLS. Although our data is cross-sectional time series, they do not allow us to employ the panel regression techniques such as regression with fixed effect or random effect. For some countries, only 9 observations are available. This amount of observation per country is not sufficient for the panel regression.

4 Data Considerations

Data on income inequality are taken from the famous Deininger and Squire (1996) dataset. There are two measures of inequality available from the dataset, the Gini coefficient and the income shares by quintile. Based on the availability of data, this paper choose only the Gini coefficient (*GINI*) as the key measure of income inequality. We select only the coefficients that are calculated from income (as opposed to expenditure), that use household as the recipient unit (as opposed to effective members), and to a lesser extent that rely on gross-of-tax income (as opposed to net-of-tax income). All observations are national representative with only a few exceptions for Malaysia and Thailand in order to increase the sample size of these countries. Originally, Indonesia was included in our study. However, all inequality measures of Indonesia are calculated from the expenditure. Therefore, the country is dropped from our sample as it fails our most important criterion.

Other economic variables are taken from the Penn World Table (Mark 6.1) (PWT). The real output (y) in this study refers to the GDP per capita at a constant chained price in logarithm form. Inflation (π) is calculated from GDP deflator. We employ the Hodrick and Prescott (1981)'s filter (HP-filter hereafter) to smooth the inflation series and use the HP-filtered inflation (π^{hp}) as our estimates for the anticipated inflation. The difference between the actual and HP-filtered inflation rates, called the inflation gap (π^{gap}), is assumed to be the unanticipated component of inflation. In doing so, we make a few assumptions here. First, it is assumed that agents know the true structure of the economy, and they can distinguish between the long-term component and the short-term shock from the observed inflation. Next, agents are assumed to

follow a “clever” naïve expectation formation. It is naïve in the sense that the agents expect the future inflation to be equal to the current inflation. Yet, it is “clever” in the sense that agents use only long-term component of inflation in forming the expectations. In other words, the agents expect the future inflation to be equal to the current HP-filtered inflation.

Other control variables used here include the average schooling years in the total population aged 15 and over (*SCHOOL*), the proportion of workers to total population (*WK*), and the unemployment rate (*UR*). The *SCHOOL* series is taken from the Barro-Lee (1994) dataset. The data are available quinquennially from 1960 to 2000, and we interpolate geometrically over the period to obtain annual data. Data for *WK* is calculated from y and the real GDP per worker. Both are available from the PWT. Lastly, the LABORSTA database from the International Labour Organization (ILO) provides the data on *UR*. However, the data are available only from 1970. For technical reasons, we recode all missing values in *UR* to zero and call the new variable *URO* and create a dummy variable (*URMISS*) that takes the value of 1 when the actual *UR* is missing. Both *URO* and *URMISS* are included in the regression.

In our robustness test, we add a few variables to our main regression separately. From the PWT, we utilize variables such as population in logarithm form (*LPOP*), government share of real per capita GDP (*GOV*), trade share of real per capita GDP (*OPENK*), investment share of real per capita GDP (*INV*), and saving rate (*SAVE*). Openness dummy (*OPENSW*) from Sachs and Warner (1995) is also used to additionally observe the impact of openness, even though the measure is convincingly questioned by Rodriguez and Rodrik (2000). Density (*DEN*) measured by the number of persons per squared kilometer, which is available from the U.S. Bureau of Census’ International Data Base, is added into the robustness test as well.

Lastly, from some variables mentioned above, we calculate three more variables-output gap (y^{gap}), variance of π^{gap} by country ($\text{Var}(\pi^{gap})$), and variance of y^{gap} by country ($\text{Var}(y^{gap})$). The output gap is the difference between the actual and HP filtered real GDP.

Our sample covers the period from 1950 to 2000. We drop observations with missing values for *GINI*, *SCHOOL* or *OPENSW*. At the end, we have the total of 115 observations, ranging from 9 observations in Hong Kong and the Philippines to 37 observations in Taiwan. The summary statistics are shown in Table1, and the plots of *GINI* and inflation rates are presented in Figure1 and 2.

It is obvious that Malaysia has the highest income inequality, while Taiwan has the lowest inequality. Different countries exhibit different patterns of *GINI* over time. For instance, Taiwan, Malaysia and Hong Kong show decreasing trend of inequality over time. Inequality in South Korea declined in the 1950s and 1960s, escalated during the first Oil Shock, and has declined since then. Inequality in Thailand increased prior to the Asian Financial Crisis, but it dropped considerably after the Crisis. The Philippines does not show any sign of increasing or decreasing inequality over the past 50 years.

Obviously, Singapore and Hong Kong share many characteristics. They have high income per capita, highly integrated to the world, severe trouble in density, and rather low unemployment rate. The lowest average unemployment rate is found in Thailand mainly because of the labor absorption capability of its agricultural sector. In our sample, the Philippines has the lowest income per capita, the highest average unemployment rate, the lowest average years of schooling, and relatively high percentage of government spending. It is also interesting to see that the Philippines has a different long-term inflation pattern from other countries. In other

countries, the HP-filtered inflation reached the peak in the 1970s and has been on a declining trend. However, the long-term inflation in the Philippines picked up in 1995 and has increased through the new millennium.

5 Estimation Results

In our first estimate (Table 1 Column 1), we choose the aggregate inflation rate as employed by other studies. Similar to other studies, the aggregate inflation rate is not significant. All other control variables in the model are significant at 5%. The Kuznets hypothesis holds in this model (and almost in all of the rest). Increasing income causes income inequality to rise at a declining rate. The coefficients of y and y^2 imply that the maximum inequality, given everything else constant, is reached when income is approximately \$10,612; that is, $\exp(-50.687/(2 \times -2.734))$. Hong Kong, Singapore, Taiwan and South Korea have passed this turning point in 1977, 1979, 1989, and 1991, respectively. Per capita income in 2000 in Malaysia, Thailand and Philippines are \$9919, \$6857 and \$3425, respectively. Thus, we can expect increasing inequality when the income rises in these countries. Further, higher average schooling years reduce income inequality. Higher share of worker to population and higher unemployment rate push the inequality up as expected. Adjusted R^2 is approximately 51.6. Based on the Breusch-Pagan test, we found no evidence of heteroscedasticity.

In column 2 of Table 1, we use the HP-filtered inflation in place of the aggregate inflation. This anticipated inflation enters the model negatively and nearly significant at 5%. Other variables remain significant at 5%. The coefficients of income terms change slightly and im-

ply a lower level of income associated with maximum inequality at \$9,186. This experiment implies that the HP-filtered may be better in capturing the inflation effect on income inequality.

The focus of this paper is on the nonlinear effect of inflation. As shown in column 3, when we add a squared term of the HP-filtered inflation into our model, the results improve significantly from those in column 2. Both level and squared terms of inflation are significant at 5%. This confirms that the effect of inflation on inequality is nonlinear as suggested by Bulř (2001). The coefficients imply that the Gini coefficient will be at its minimum level if the HP-filtered inflation is at 5%, or $3.727/(2 \times 0.373)$. The heteroscedasticity problem is not detected according to the Breusch-Pagan test. No major change in other coefficients is found.

In column 4, we add the short-term inflation shock into the equation. Both terms of the HP-filtered inflation remain roughly significant at 5%. However, the newly added inflation gap turns out to be insignificant. There is virtually no change in the model ability to explain the variation in the income inequality from the previous model. A few explanations are possible in this case. First, the inflation gap usually has impact on the real economy in short run, while the income inequality is rather considered a medium- to long-run matter. Thus, although the monetary shock could influence the real economy, its impact is not strong or long-lasting enough to change the income inequality. Second, the unanticipated inflation as discussed in section II affects the income inequality in a variety of ways; for example, it reduces unemployment and inequality, or it could create uncertainties and raises the inequality. Therefore, it is possible that these effects are cancelled out and leave no relation between unanticipated inflation and inequality on the average.

The rest of this section presents results from the robustness test on the model in column

4 table 2. We add variables as discussed in the data section to this model one-by-one (see Table 3). In general, the negative relation between the HP-filtered inflation and the inequality survives all robustness tests, but the evidences for the nonlinear relationship are not. However, it is still convincing that the relation is nonlinear as only 2 out of 10 tests found nonlinear relationship at 10% significance level. The strongest evidence of all seems to be that the inflation gap is not important in explaining the income inequality. In all cases, the inequality can be minimized if the HP-filtered inflation is set between 4.7% and 5.3%.

The robustness tests also present some interesting insights about the income inequality. For example, the real shock as measured by the output gap has negative relationship with the income inequality but not significantly so. Consistent with Romer and Romer (1998)'s results, our results show that countries with higher variances of monetary shocks and real shocks have higher income inequality. Government spending can possibly reduce inequality, but it is not statistically significant in this paper. It should be noted that our government spending is the total spending. If we select only the spending on the welfare purposes, it should be negatively and significantly related to the inequality. The two measures of openness give conflicting conclusions, but neither is significant. Country with higher population tend to have higher income inequality. Lastly, investment and saving rates do not influence the income inequality.

In sum, we have shown that many studies failed to observe any relationship between inflation and inequality because they did not take into account the different effects from different components of inflation. Here, we illustrate that only the anticipated inflation has any impact on the inequality, while the unanticipated inflation does not. The effect from the anticipated inflation is in fact nonlinear. The inequality rises at a very high inflation rate as well as at a

very low rate. Also, the evidences suggest that the inflation rate of 5% per year provides the lowest income inequality *ceteris paribus*. These results survive most of the robustness tests.

6 Causality Tests

So far, we have merely mentioned how the inflation can affect the income inequality. However, many studies—including Beetsma and Van der Ploeg (1996), Al-Marhubi (1997), and Dolmas *et al.* (2000)—assume a rather opposite causality. They argued that an economy with larger inequality tend to have higher inflation rate. Beetsma and Van der Ploeg explained that the poor are likely to elect political parties that favored the unanticipated inflation for their own benefits. Al-Marhubi claimed that inequality created “political deadlocks”, which prevent a quick implementation of stabilization policies and cause high and highly fluctuated rate of inflation. Domas *et al.* found that Gini coefficient influences inflation in democratic society but not in non-democratic countries.

In this section, we present additional evidences on the causality. We employ the Granger causality test² with the number of lags equal to 2. This number of lag is chosen from 1 to 4 lags that maximizes the Akaike Information Criterion (AIC)³. The data are selected only from Taiwan because the country provides the richest set of time series; that is, 34 consecutive observations on the Gini coefficient from 1964 to 1997. The augmented Dickey-Fuller tests suggests that the Gini coefficient, the aggregate inflation and the HP-filtered inflation are I(1), while the inflation gap is I(0) (Table 4). The cointegration tests further indicate that the

²see Greene, 2003 or Enders, 1995

³or minimizes the AIC depending on how it is calculated

Gini coefficient and the aggregate inflation are cointegrated, as well as the Gini coefficient and the HP-filtered inflation (Table 5). This test also confirms that the Gini coefficient and the inflation gap is not cointegrated as previous shown that the two variables are integrated of different order. Thus, we run the causality test among the I(1) variables only.

The Granger causality test suggests that both Gini coefficient and aggregate inflation are endogenous. The aggregate inflation does Granger cause the income inequality as the coefficients of inflation are jointly significant in the Gini coefficient equation (Table 5). The reverse causality is also true because the coefficients of Gini coefficient are jointly significant in the inflation equation. Any study that directly links the aggregate inflation and the income inequality may find itself facing a serious endogeneity problem. This evidence also supports the claims by Beetsma and Van der Ploeg (1996), Al-Marhubi (1997), and Dolmas *et al.* (2000) that the Gini coefficient can cause changes in the inflation level as well.

When we test the causality between the Gini coefficient and the HP-filtered inflation, a different conclusion is found. Only the HP-filtered component of inflation can Granger cause the income inequality, but the reverse is not true. The coefficient of HP-filtered inflation are jointly significant in the Gini coefficient equation, but the coefficient of Gini coefficient are not in the HP-filtered inflation equation. On one hand, this result is consistent with those in the previous section that the only the HP-filtered component of inflation is significant in the model. This also eliminates any endogeneity argument on the HP-filtered inflation in equation (1). The Gini coefficient is the endogenous variable, but the HP-filtered inflation is not.

On another hand, this causality pattern leads us to an even more confusing conclusion about what component of inflation the Gini coefficient can actually create changes. It is said

that the Gini coefficient causes the aggregate inflation but not the HP-filtered component of the inflation. So, does the Gini coefficient actually cause the other component of inflation, which is the inflation gap? Following the claims by the authors mentioned above, the answer is “probably yes”. It should be noted that the monetary authorities can mainly influence the unanticipated inflation (i.e. inflation gap). Thus, any impediment caused by the income inequality to the government as claimed by these authors should reflect only in the unanticipated inflation. However, following the econometric argument, the answer is “clearly no”. It is based on the simple fact that the Gini coefficient and the inflation gap are integrated of different order. Any estimated relationship between these two variables is simply “spurious”. Obviously, a comprehensive study is in need to address this question.

7 Conclusions and Suggestions

This paper studies the possible link between inflation and income inequality. It shows that there are many channels that the inflation can affect the income inequality in an economy. For example, the inflation can reduce the real wage, or it can stimulate the employment level. As shown above, it is important to distinguish the effects of anticipated and unanticipated inflation as well as the short-run effects and the long-run effects. Based on the data from 7 Asian countries, we conclude that the inflation-inequality relationship is nonlinear. A very high inflation rate can increase the income inequality as well as a very low rate. Moreover, we find that both income inequality and inflation are endogenous variables. However, only the long-term component of inflation causes changes in inequality. Policy implication from

this paper is that the monetary authorities should keep the rate of inflation around 5% if they intend to reduce the inequality. Also, they should not frequently generate inflation shocks as the shocks do not improve the inequality directly and may even worsen it indirectly through the increasing uncertainty about inflation.

We believe that the results presented here can be improved in many ways. Our greatest concern is that the literature has not shown any micro-founded model for the income inequality. The simplest reason may be that it is more difficult to model how inflation affect the second moment of income than the first moment. Instead of having a representative consumer as assumed in many models, one would need to set up different types of consumers or a distribution of consumers, and inflation must affect these agents asymmetrically. We propose that the asymmetric effects can be produced by different in human capital possessed by different agents. Such model will advance our understandings of the income inequality and its relationship with inflation further.

References

- [1] Agénor, Pierre-Richard. "Macroeconomic Adjustment and the Poor: Analytical Issues and Cross-Country Evidence." *Journal of Economic Surveys*, 18(3), Jul. 2004, pp. 351-408.
- [2] Al-Marhubi, Fahim. "A Note on the Link between Income Inequality and Inflation" *Economic Letters*, 55(1997), pp. 317-319.
- [3] Barro, Robert J. "Determinant of Economic Growth: A Cross-Country Empirical Study." MIT Press, Cambridge, 1997.
- [4] Barro, Robert J. and Jong-Wha Lee. "International Measures of Schooling Years and Schooling Quality." *American Economic Review*, 86(2), May 1994, pp. 218-223.
- [5] Beetsma, Roel and Frederick Van der Ploeg. "Does Inequality Cause Inflation? The Political Economy of Inflation, Taxation and Government Debt." *Public Choice*, 87(1996), pp. 143-162.
- [6] Blank, Rebecca M. and Alan S. Blinder. "Macroeconomics, Income Distribution, and Poverty." In Sheldon H. Danziger and Daniel H. Weinberg, eds., *Fighting Poverty: What Works and What Doesn't*, Harvard University, Cambridge, 1986, pp. 180-208.
- [7] Bulíř, Aleš. "Income Inequality: Does Inflation Matter?" *IMF Staff Paper*, International Monetary Funds, 48(1), 2001, pp. 139-159.
- [8] Deininger Klaus and Lyn Squire. "A New Data Set Measuring Income Inequality." *World Bank Economic Review*, 10, Sept. 1996, pp. 565-591. Updated data are available from the World Bank.
- [9] Dolmas, Jim, Huffman, Gregory W. and Mark A. Wynne. "Inequality, Inflation, and Central Bank Independence." *Canadian Journal of Economics*, 33(1), Feb. 2000, pp.271-287.
- [10] Easterly, William and Stanley Fisher. "Inflation and the Poor." *Journal of Money, Credit, and Banking*, 33(2), May 2001, pp. 160-179.
- [11] Enders, Walter. *Applied Econometric Time Series*, John Wiley & Sons, Inc., 1995.
- [12] Greene, William H. *Econometric Analysis*, 5th eds., Prentice Hall, 2003.
- [13] Hodrick, Robert J. and Edward C. Prescott. "Postwar U.S. Business Cycle: An Empirical Investigation." Working Paper, Carnegie-Mellon University, 1981. Reprinted in *Journal of Money, Credit and Banking*, 29(1), Feb. 1997, pp. 1-16.
- [14] Lucas, Robert E. "Expectations and the Neutrality of Money." *Journal of Economic Theory*, 4(2), Apr. 1972, pp. 103-124.

- [15] MacKinnon, James G. "Numerical Distribution Functions for Unit Root and Cointegration Tests." *Journal of Applied Econometrics*, 11, 1996, pp. 601-618.
- [16] Phelps, Edmund S. "Inflation in the Theory of Public Finance." *Swedish Journal of Economics*, 75(1), 1973, pp. 67-82.
- [17] Phillips, Alban W. "The Relationship between Unemployment and the Rate of Change in Money Wage Rates in the United Kingdom, 1861-1957." *Economica*, 25(100), Nov. 1958, pp. 283-299
- [18] Ravallion, Martin. "Growth and Poverty: Evidence for Developing Countries in the 1980s," *Economic Letter*, 48(1995), pp. 411-417.
- [19] Rodriguez, Francisco and Dani Rodrik. "Trade Policy and Economic Growth: A Skeptic's Guide to the Cross-National Evidence." *NBER Macroeconomics Annual*, 2000, pp. 261-325.
- [20] Romer, Christina D. and David H. Romer. "Monetary Policy and the Well-Being of the Poor." *NBER Working Paper*, 1998, No. 6793.
- [21] Sachs, Jeffrey and Andrew Warner. "Economic reform and the process of global integration." *Brookings Papers on Economic Activity*, 1995(1), pp. 1-118.
- [22] Shiller, Robert J. "Why Do People Dislike Inflation?" *NBER working paper*, 1996, No. 5539.

Table 1 Summary Statistics by Country

	Hong Kong	S. Korea	Singapore	Taiwan	Malaysia	Philippines	Thailand
<i>GINI</i>	42.66 (3.24)	34.69 (2.98)	42.10 (3.40)	31.05 (4.33)	50.01 (2.39)	46.59 (1.80)	44.97 (3.10)
<i>Y</i>	9.17 (0.55)	8.09 (0.54)	9.24 (0.46)	8.55 (0.74)	8.29 (0.35)	7.90 (0.15)	7.98 (0.54)
<i>π</i>	4.44 (2.93)	4.41 (2.77)	5.74 (2.93)	4.10 (2.75)	5.94 (4.50)	3.21 (3.00)	3.70 (2.41)
<i>π^{hp}</i>	4.80 (1.76)	4.43 (1.73)	5.09 (1.34)	4.14 (1.73)	4.95 (1.75)	3.44 (1.57)	3.63 (1.79)
<i>π^{gap}</i>	-0.37 (2.18)	-0.02 (1.61)	0.64 (2.46)	-0.04 (1.96)	0.99 (3.81)	-0.23 (2.14)	0.07 (1.87)
<i>URO</i>	1.89 (1.98)	2.81 (2.14)	3.15 (1.16)	1.25 (1.37)	1.61 (2.77)	5.49 (3.47)	0.99 (1.10)
<i>URMISS</i>	0.44 (0.53)	0.33 (0.49)	0.07 (0.26)	0.27 (0.45)	0.71 (0.47)	0.22 (0.44)	0.50 (0.52)
<i>WK</i>	58.60 (4.23)	36.95 (2.51)	44.34 (5.40)	40.85 (2.45)	36.42 (2.33)	37.72 (1.47)	51.14 (1.66)
<i>SCHOOL</i>	7.25 (1.23)	6.37 (1.69)	5.63 (0.38)	6.67 (1.48)	4.69 (0.89)	6.23 (1.39)	4.84 (0.86)
<i>Y^{GAP}</i>	0.02 (0.04)	-0.01 (0.03)	0.01 (0.05)	0.00 (0.03)	-0.01 (0.04)	-0.01 (0.04)	0.00 (0.05)
<i>GOV</i>	6.02 (0.36)	10.17 (1.91)	8.30 (0.79)	19.71 (4.91)	17.98 (1.23)	16.64 (1.55)	16.08 (1.95)
<i>OPENSW</i>	1.00 (0.00)	0.67 (0.49)	1.00 (0.00)	0.92 (0.28)	1.00 (0.00)	0.33 (0.50)	1.00 (0.00)
<i>OPENK</i>	113.26 (39.78)	21.07 (13.39)	232.22 (39.38)	60.20 (24.73)	88.13 (30.56)	51.63 (22.01)	54.00 (17.32)
<i>LPOP</i>	8.42 (0.18)	10.42 (0.15)	7.82 (0.14)	9.73 (0.19)	9.47 (0.21)	10.79 (0.34)	10.72 (0.24)
<i>INV</i>	26.43 (3.83)	22.71 (7.59)	45.93 (5.73)	17.32 (3.87)	18.75 (5.50)	13.89 (2.35)	30.44 (6.23)
<i>SAVE</i>	31.53 (2.41)	19.96 (11.49)	47.34 (6.28)	21.69 (7.24)	25.61 (4.58)	12.52 (2.84)	29.14 (4.22)
<i>DEN</i>	4645.53 (840.85)	345.81 (52.83)	4027.59 (583.38)	531.61 (98.21)	40.16 (8.52)	177.49 (55.95)	91.36 (19.13)
# Obs.	9	15	15	37	14	9	16

Note: Standard deviations are in parenthesis.

Table 2 Regression Results

Variable	(1)	(2)	(3)	(4)
<i>Y</i>	50.687 (2.475)	65.302 (3.035)	59.741 (2.795)	59.761 (2.784)
<i>Y</i> ²	-2.734 (-2.304)	-3.578 (-2.869)	-3.259 (-2.63)	-3.261 (-2.621)
<i>SCHOOL</i>	-3.865 (-6.835)	-3.989 (-7.18)	-4.037 (-7.366)	-4.017 (-7.244)
<i>WK</i>	0.324 (3.748)	0.332 (3.888)	0.330 (3.927)	0.332 (3.921)
<i>UR0</i>	2.132 (6.380)	2.099 (6.364)	2.245 (6.745)	2.235 (6.652)
<i>URMISS</i>	8.456 (4.002)	8.270 (3.970)	8.398 (4.089)	8.413 (4.077)
π	-0.101 (-0.541)			
π^{hp}		-0.638 (-1.845)	-3.727 (-2.403)	-3.634 (-2.289)
$(\pi^{hp})^2$			0.373 (2.041)	0.361 (1.917)
π^{gap}				0.071 (0.302)
<i>Constant</i>	-190.035 (-2.153)	-250.005 (-2.712)	-220.692 (-2.4)	-220.966 (-2.392)
Adj. R ²	0.516	0.53	0.548	0.548

Note: t-statistics are in parenthesis.

Table 3 Robustness Tests

Variable	(1)	(2)	(3)	(4)	(5)
<i>Y</i>	60.482 (2.806)	12.594 (0.660)	51.572 (2.557)	59.917 (2.786)	73.077 (3.166)
Y^2	-3.296 (-2.640)	-0.888 (-0.817)	-2.873 (-2.463)	-3.296 (-2.644)	-4.005 (-3.010)
<i>SCHOOL</i>	-4.084 (-7.233)	-1.881 (-3.397)	-1.912 (-2.596)	-3.999 (-7.194)	-4.096 (-7.398)
<i>WK</i>	0.338 (3.961)	0.530 (6.993)	-0.020 (-0.172)	0.313 (3.563)	0.369 (4.211)
<i>URO</i>	2.214 (6.547)	1.503 (5.042)	1.527 (4.244)	2.141 (6.014)	2.153 (6.366)
<i>URMISS</i>	8.288 (3.991)	2.096 (1.081)	7.749 (4.004)	8.018 (3.776)	8.361 (4.076)
π^{hp}	-3.537 (-2.214)	-3.162 (-2.396)	-2.892 (-1.935)	-3.591 (-2.257)	-3.078 (-1.900)
$(\pi^{hp})^2$	0.351 (1.853)	0.299 (1.911)	0.274 (1.548)	0.351 (1.858)	0.301 (1.576)
π^{gap}	0.049 -0.206	-0.028 (-0.143)	0.083 -0.377	0.087 -0.369	0.088 -0.375
Y^{GAP}	-9.938 (-0.680)				
$Var(\pi^{gap})$		7.151 (6.952)			
$Var(Y^{GAP})$			405.967 (4.026)		
<i>GOV</i>				-0.096 (-0.814)	
<i>OPENSW</i>					-3.068 (-1.515)
<i>Constant</i>	-224.559 (-2.421)	-27.134 (-0.333)	-191.589 (-2.211)	-217.264 (-2.345)	-279.411 (-2.806)
Adj. R^2	0.550	0.691	0.609	0.551	0.558

Note: t-statistics are in parenthesis.

Table 3 Robustness Tests (Cont'd)

Variable	(6)	(7)	(8)	(9)	(10)
<i>Y</i>	63.858 (2.951)	53.534 (2.522)	50.686 (2.245)	58.858 (2.720)	60.191 (2.686)
Y^2	-3.646 (-2.857)	-2.714 (-2.183)	-2.652 (-1.992)	-3.228 (-2.581)	-3.281 (-2.565)
<i>SCHOOL</i>	-3.283 (-4.128)	-4.793 (-7.473)	-4.263 (-7.272)	-3.842 (-5.731)	-4.048 (-5.682)
<i>WK</i>	0.344 (4.049)	0.292 (3.443)	0.377 (4.114)	0.319 (3.571)	0.334 (3.639)
<i>URO</i>	2.074 (5.802)	2.312 (6.981)	2.388 (6.704)	2.223 (6.572)	2.236 (6.612)
<i>URMISS</i>	8.266 (4.012)	10.052 (4.682)	9.219 (4.280)	8.606 (4.075)	8.403 (4.042)
π^{np}	-3.735 (-2.358)	-3.027 (-1.917)	-3.334 (-2.083)	-3.683 (-2.306)	-3.616 (-2.238)
$(\pi^{np})^2$	0.371 (1.973)	0.324 (1.749)	0.346 (1.841)	0.364 (1.925)	0.359 (1.887)
π^{gap}	0.070 (0.298)	0.048 (0.208)	0.051 (0.216)	0.075 (0.319)	0.072 (0.304)
<i>OPENK</i>	0.021 (1.285)				
<i>LPOP</i>		1.967 (2.282)			
<i>DEN</i>			-0.001 (-1.264)		
<i>INV</i>				0.032 (0.468)	
<i>SAVE</i>					-0.007 (-0.071)
<i>Constant</i>	-234.009 (-2.526)	-222.908 (-2.461)	-189.368 (-1.984)	-216.898 (-2.329)	-223.004 (-2.295)
Adj. R^2	0.555	0.570	0.555	0.549	0.548

Note: t-statistics are in parenthesis.

Table 4 Unit Root Tests, Taiwan, 1964 – 1997

$$\Delta X_t = a + bX_{t-1} + \sum_i c_i \Delta X_{t-i} + dt + u_t$$

H₀: b = 0

X	Constant (a) / Trend (d)	Lags (i)	t-statistics of b	p-value of b*
<i>GINI</i>	no constant/no trend	1	-0.376	0.541
π	no constant/no trend	1	-1.240	0.193
π^{hp}	no constant/no trend	3	-0.903	0.318
π^{gap}	no constant/no trend	0	-6.196	0.000

* MacKinnon (1996) one-sided p-values.

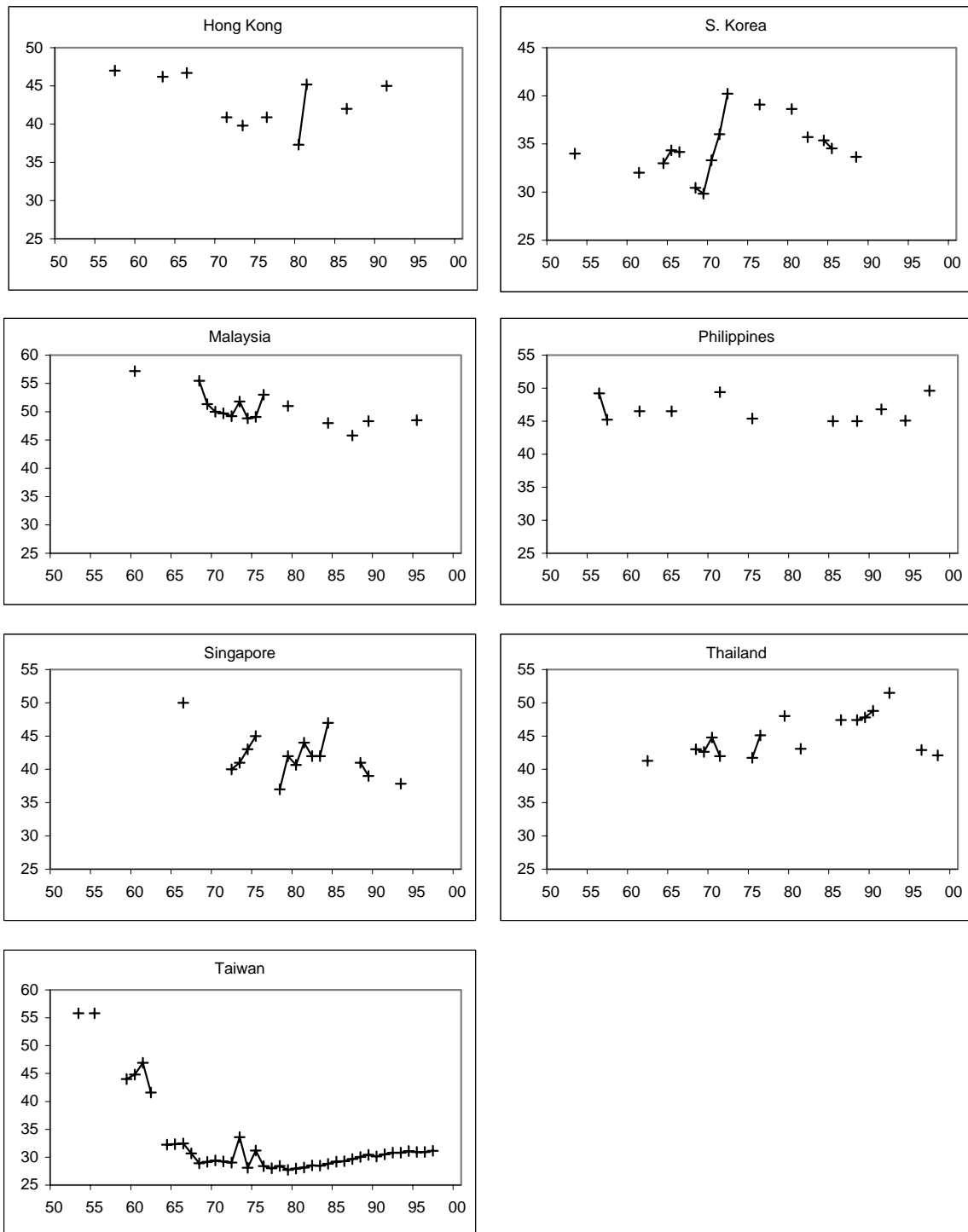
Table 5 Granger Causality Tests, Taiwan, 1964 – 1997

$$Y_t = a_0 + b_1 Y_{t-1} + b_2 Y_{t-2} + c_1 X_{t-1} + c_2 X_{t-2} + u_t$$

Y	X	Cointegration (unit root test on u _t)			Causality Test	
		Lags	t-statistics	p-value*	F-test on coeff.'s of X	p-value
<i>GINI</i>	π	0	-5.901	0.000	4.233	0.025
π	<i>GINI</i>	0	-4.780	0.000	8.466	0.001
<i>GINI</i>	π^{hp}	3	-3.995	0.000	4.206	0.026
π^{hp}	<i>GINI</i>	1	-2.536	0.013	1.892	0.170
<i>GINI</i>	π^{gap}	8	-0.855	0.335	<Not applicable. Series are not cointegrated.>	
π^{gap}	<i>GINI</i>	7	-3.383	0.002	<Not applicable. Series are not cointegrated.>	

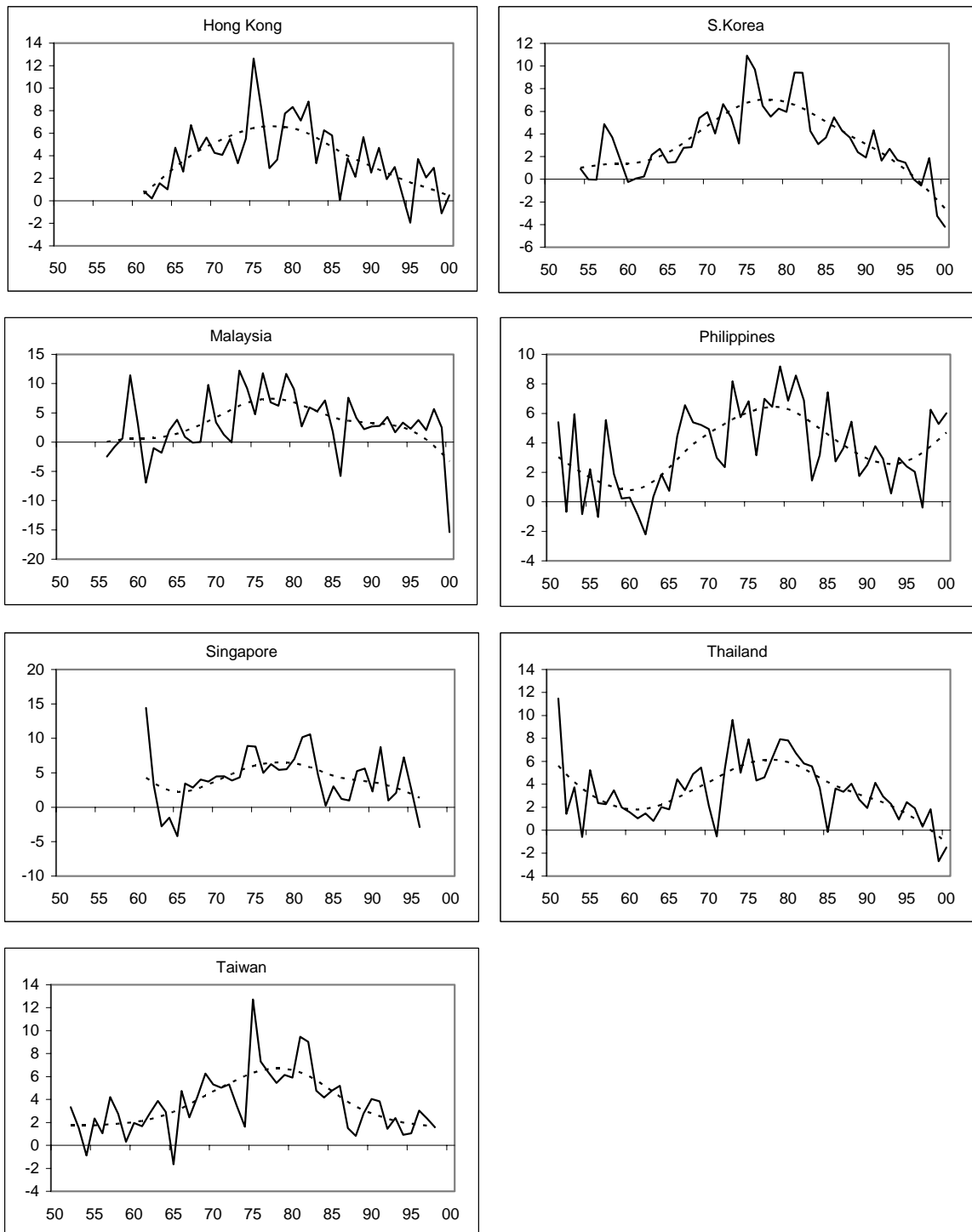
* MacKinnon (1996) one-sided p-values.

Figure 1 Gini Coefficient by Country, 1950-2000



Note: Markers represent available observations, and lines connect any two consecutive observations.

Figure 2 Aggregate Inflation and HP-filtered Inflation by Country, 1950-2000



Note: Thick lines are the aggregate inflation rates, and dotted lines represent the HP-filtered inflation.