Impact of Income Inequality on Economic Growth: The Case of Taiwan and Policy Implications

Yu Hsing*

Abstract

In this paper, a classical K-L production function augmented with human capital and technological progress to estimate the effect of income inequality on economic growth in Taiwan has been employed. The generalised autoregressive conditional heteroskedasticity (GARCH) and/or ARCH models have been applied to estimate regression parameters. The research findings suggest that a higher Gini coefficient deteriorates economic growth. When measured by the ratio of the highest fifth’s income to the lowest fifth’s income, the negative relationship between inequality and economic growth is also confirmed. Other results are consistent with the economic theories: growth in employment, human capital investment, and R and D spending all contributing to economic growth.

Introduction

The phenomenal growth of Taiwan has slowed down in recent years as a result of the Asian financial crisis, burst of the economic bubble in Japan, global recession, increasing international competition, and soaring labour costs. Despite the overall economic hardship, a few entrepreneurs have managed to succeed in information technology, internet industry, and other niche fields, and have made a good fortune. The large family-owned conglomerates have also maintained their market dominance and have continued to expand and generate enormous profits. In contrast, unemployment has worsened, wage differentials between skilled and unskilled workers have increased, demographic patterns have changed (with more single parents than in the past), and investment outflows and businesses emigration to China have accelerated. These factors appear to widen income inequality. During 1990-2001, the Gini coefficient increased by 4.5 per cent from 0.312 to 0.350, and the ratio of top fifth’s income to the bottom fifth’s income rose by 23.36 per cent from 5.18 to 6.39. The once fabled East Asian miracle with rapid economic growth and exceptionally high equality (the Gini coefficient at 1972 was 0.27) seems to enter a different phase of economic development.

This study attempts to examine the impact of rising income inequality on economic growth in Taiwan, and then provides policy reference. The highlights are listed as follows: On the model framework, it incorporates human capital input and technological progress into the classical capital-labour production function. On

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measuring income inequality, the Gini coefficient is first considered, and then the regression is iterated using the ratio of the top quintile to the bottom quintile household income to see whether the procedure would yield different results. On capital stock measurement, capital growth is replaced by the investment-output ratio multiplied by the marginal product of capital. This substitution is necessary due to the absence of data for capital stock. On selecting the econometric instrument for analysis, the generalised autoregressive conditional heteroskedasticity (GARCH) or ARCH model is applied to see whether the error variance depends on the size of past squared errors and past error variances.

**Literature Survey**

Snower (1998) cites three common causes of income inequality as deindustrialisation, globalisation, and skill-biased technological change. Deindustrialisation refers to the structural shift from the declining low-wage manufacturing sectors to the rising high-wage service sectors, which leads to unemployment and rising inequality. Globalisation or trade tends to depress the return of low-skill workers and raises the return for the high-skill ones, which worsens the income distribution as suggested in the factor proportions trade theory. Technological progress serves to improve the productivity and return of the skilled rather than the unskilled workers.

In a study on monetary policy and poverty, Romer and Romer (1998) find that an increase in the unexpected inflation rate improved income equality, an increase in output and inflation variability worsened inequality, a decline in the unemployment rate reduced poverty rate, and monetary policy could help the poor. They argue that monetary policy aimed at price and growth stability would benefit the poor in the long-run; though the impact of expansionary policy on poverty reduction was only temporary. However, their research did not confirm that the Gini coefficient was correlated with the unemployment rate.

Furman and Stiglitz (1998) confirm that unemployment and income inequality were correlated, and there existed a vicious cycle of high inequality and high unemployment. However, they find that income inequality might be neither the cause nor the result of growth. Lindback (1998) proposes several policies to reduce income inequality ranging from augmenting minimum wages with a payroll taxes reduction to providing vocational and educational training for less productive workers. He notes that the vocational programmes in the private sector were more cost-effective. He also indicates that some social welfare programmes might reduce worker’s incentives and the impact of poverty-reduction programmes might vary across countries.

Dimelis and Livada (1999) examine the relationship between business cycles and income inequality for the U.S., the U.K., Italy, and Greece. Their findings suggest higher output reduced inequality in the U.S. and the U.K., but increased inequality in Greece. In addition, the poor suffered more from high unemployment, but gained from high inflation.
Jao (2000) reports that the Taiwanese government had increased the welfare spending substantially over the years in an attempt to reduce income inequality. Balisacan (2000) shows that economic growth had helped the poor in the Philippines, but the benefit of growth was not evenly distributed. Shari (2000) reports that the New Economic Policy in Malaysia reduced income inequality in the late 1970s, but the reversal of deregulation, liberalisation, and privatization had led to higher inequality since the late 1980s. Asra (2000) finds that economic growth in Indonesia reduced poverty in the last 20 years, but the Gini coefficient failed to show a clear trend of income inequality.

Leung (2001) finds that as the coverage of social insurance reduced, productivity, output growth rate, and income inequality all increased. An increase in social insurance coverage, however, did not guarantee an improvement in income equality. Acemoglu and Robinson (2002) claim that growth did not necessarily follow a Kuznets curve: growth and might lead to either an “autocratic disaster” with low output and high inequality, or an “East Asian Miracle” with high output and low inequality.

The Model

Extending the works of Jao (2000), Balisacan (2000), Shari (2000), Asra (2000) and others, a real output (Y) model is constructed to include major input factors such as labour employment (L), capital stock (K), technology (T), human capital (H), and income inequality (IQ).

\[ Y = F (L, K, T, H, IQ) \]  

(1)

Let the production be a simple function of L, K, and T. Totally differentiate the production function and divide it by output Y, then the output growth rate equation is obtained.

\[ \frac{\dot{Y}}{Y} = \frac{\partial Y}{\partial L} \frac{\dot{L}}{L} + \frac{\partial Y}{\partial K} \frac{\dot{K}}{K} + \frac{\partial Y}{\partial T} \frac{\dot{T}}{T} \]  

(2)

The impact of capital stock growth on output growth is replaced by the product of marginal product of capital and investment-output ratio (\( \beta * IY \)), since capital stock data for Taiwan is not available. Next, enter human capital and income inequality measure into the equation for growth rate. We obtain equation (3) for estimation.

\[ GY = \beta_1 GL + \beta_2 IY + \beta_3 GT + \beta_4 H + \beta_5 IQ \]  

(3)

\[ \frac{\dot{Y}}{Y} \equiv GY = \text{the growth rate of real GDP.} \]
\[
\frac{L}{L} \equiv GL = \text{the growth rate of labour employment.}
\]

\[
\frac{T}{T} \equiv GT = \text{the growth rate of technological progress.}
\]

\[
\frac{\partial Y}{Y} \frac{\partial L}{L} \equiv \beta_1 = \text{the labour input elasticity of output.}
\]

\[
\frac{\partial Y}{\partial K} \equiv \beta_2 = \text{the marginal product of capital.}
\]

\[
\frac{\partial Y}{\partial T/T} \equiv \beta_3 = \text{the technology input elasticity of output.}
\]

\[
IY \equiv \frac{K}{Y} = \text{the ratio of investment spending to output.}
\]

The sign of \( \beta_5 \) is determined by the relationship between income inequality and economic growth. Furman and Stiglitz (1998) identify four plausible channels—savings, imperfect information and agency costs, fiscal policy, and social or political stability. Though the rich tended to save more, the empirical result on rising income inequality and aggregate saving was inconclusive. Segmented markets and imperfect information often plagued a society with uneven distribution of income. Asymmetric information lead to the principal-agent problem and high agency cost, and resulted into a widespread economic inefficiency and slow growth. Under the pressure of rising income inequality, governments might pursue a more progressive income tax policy to redistribute wealth. However, such policy might hinder capital accumulation and economic growth. Or the rich and the powerful might lobby for lowering the tax rate and government spending. If income inequality continued to worsen, social unrest and political instability would occur, which strained the growth.

In analysing macroeconomic data, one may observe that variance of the forecast error depends on the size of the previous disturbance. Thus, we select the GARCH model instead of the usual time-series models. The GARCH model employed can be expressed as:

\[
V_t = \beta_0 + \sum_{i=1}^{m} \beta_i \epsilon_{t-i}^2 + \sum_{j=1}^{n} \theta_j V_{t-j}
\]

(4)
It indicates that current error variance $V_t$ is a function of past squared errors $e_{t-1}^2$ and past error variances $V_{t-j}$. Note that if $\theta_j = 0$, equation (4) reduces to an ARCH model.

**Empirical Results**

The sample runs from year 1981 to 2001. Data for R and D spending prior to 1981 were not available, and the most recent figures of income inequality were for year 2001. Data sources came from the 2003 *Taiwan Statistical Data Book*, published by the Council for Economic Planning and Development and the *Social Indicators*, published by the Directorate General of Budget, Accounting, and Statistics in Taiwan. Per cent of population with a high school diploma aged 15 or older was selected to represent human capital, denoted by $H$. Technological progress ($GT$) was expressed as the growth rate of R and D spending. The Gini coefficient took values between zero, representing complete income equality, and one, representing complete inequality. An alternative inequality measure was the ratio of the highest fifth’s income to the lowest fifth’s income, denoted by HFLF. GDP, investment spending, and R and D spending were measured in millions of NTD (New Taiwan Dollars). Employment is expressed in thousands.

The GARCH (1,1) model is applied first. The results have been outlined in Table 1. As shown in the variance equation, the coefficients of lagged squared residuals and lagged residual variance are significant at the one per cent level. Because the Durbin-Watson statistic of 2.09 is less than the critical value of 3.439 ($4 - d_L = 4 - 0.561$) at the one per cent level, the null hypothesis of no negative autocorrelation cannot be rejected. All the coefficients are significant at the one per cent level. The sign for the Gini coefficient is negative and significant, suggesting that an increase in income inequality is detrimental to the economic growth. If the Gini coefficient increases by 0.01, real GDP will decline by 1.61 percentage points. The signs for the coefficients of other input factors areas are expected. Based on the estimates, a one percentage point expansion in labour employment would lead to 1.58 per cent of real GDP growth, and one percentage point increase in R and D spending would lead to 0.079 percentage points of growth. The marginal product of capital is estimated to be 0.545. Moreover, if percent of population with a high school diploma aged 15 or older rises by 1 percentage point, real GDP would grow by 1.23 percentage points.

As a comparison with the GARCH model, the results from the OLS regression are outlined in Table 2. As shown, all coefficients are significant at one per cent except that the coefficient of $GT$ is significant at the 10 per cent level. The values of the coefficients are similar to those obtained from the GARCH model. However, based on the log-likelihood function, Akaike information criterion, and Schwarz criterion in selecting a model, it appears that the GARCH estimation is more appropriate than the OLS. Major reasons are that the OLS does not consider autoregressive conditional heteroskedasticity, residual variance is likely to be biased, and hypothesis tests are invalid.
The results using the ratio of the top fifth’s income to the bottom fifth’s income (HFLF) have been presented in Table 3. The ARCH (1) model is chosen because the coefficient for the lagged squared residuals is significant, but the coefficient for the lagged residual variance is insignificant. As shown, the coefficient of HFLF is negative and highly significant. However, the values of the estimated coefficients for some variables are different from those in Table 1. These results suggest that different measures for income inequality do affect the empirical result.

Table 4 compiles statistics for the latest Gini coefficient and the annual economic growth rate during the 10-year period for eight countries in East Asia. The data were taken from the International Monetary Fund and the World Bank. As shown, the Gini coefficient ranges from a low of 24.9 in Japan to a high of 46.1 in the Philippines. Taiwan’s income inequality ranked the third lowest among these countries. The annual economic growth rate ranges from a low of 2.28 per cent in New Zealand to a high of 9.94 per cent in China. When we regress the economic growth rate on the Gini index with the sample of eight countries including Taiwan or seven countries excluding Taiwan, the coefficient of the Gini index has a positive sign and is insignificant at the 10 per cent level. It suggests that when a cross-country sample is employed in empirical work, the outcome may be different from the result using a time series for an individual country.

Policy Implications

The empirical results from testing the Gini coefficient suggest that improvement in income equality may contribute to the growth of the Taiwanese economy. Therefore, economic policy should target on human capital formation, labour employment opportunities, business investment prospects, assistance to single-parent households, and income equality.

1. Human capital formation policy

Traditionally, governments are inclined to pursue a redistributive policy to solve the problem of income inequality, i.e., relatively high taxation for the rich versus subsidies and low taxation for the poor. Policymakers, however, need to know how large the trade-off is between taxation and economic efficiency, and how high taxation affects the investment behaviour of the rich.

An alternative is a policy on promoting formation and equal distribution of human capital. The Taiwanese government had quite a legacy on improving the quality and equality of human capital in the past, and that paved the road to the country’s economic success and social equity. Recently, however, there are concerns on the quality of education and school funding after deregulation of the education sector. The Ministry of Education of Taiwan should safeguard its role in setting and monitoring national educational standards, reviewing occupational needs, and financing schools to avoid uneven distribution in the opportunities and quality of human capital. With a more equal distribution of human capital, not only greater growth and efficiency, but also greater equality can be realised.
Other related issues include higher education and training programmes. Institutes of higher education in Taiwan should be more responsive to the demand of labour market by preparing students with adequate career skills. Training programmes need to promptly adapt to structural shift of the economy, e.g., the current programme should focus on information technology.

2. Social welfare policy

Rising unemployment undermines economic growth and worsens’ income inequality, and the poor, in particular, are more at risk of being trapped in unemployment. The poor, unlike the rich, do not have the means to improve their human capital and job prospect when unemployed. Furthermore, they are at a greater risk of social disintegration including crime and family breakup. The equality-oriented policy, therefore, should aim at the poor with objectives to provide them work incentives and opportunities for human capital improvement. To name a few, options include a tax benefit plus housing subsidy for the low-income workers and a vocational school with internship system for the unemployed.

The minimum wage for workers should be raised to at least the subsistence level. “Equal pay for equal work” policy needs to be implemented to reduce wage differentials between genders.

The Taiwanese government currently has one-time six-month unemployment compensation policy. There are talks on more benefits in the light of the recent severe recession. A more generous programme certainly improves the income distribution, but its impact on job seeking incentive, the reservation wage, and wage bargaining behaviour should be carefully weighed.

On an average, earnings of single parents are less than half the income earned by families with two parents. Thus, single-parent households are more likely to fall into lower quintiles of income groups, and children growing up in such an environment are likely to be trapped in a vicious cycle. In Taiwan, there has been a significant increase in single-parent households since the 1990s, and it contributes to rising inequality. To cope with the issue of changing family structure, policymakers could make childcare subsidy and tax credit available for single parents. A long-term approach, however, is to emphasise on human capital formation in single-parent households, such as subsidising a working mother with schooling children and offering preferential access to education.

3. International business policy

For an economy the size of Taiwan, a close tie to the global market, especially China, is pivotal. Its international business policy should be pragmatic: focus on facilitating companies in market expansion, establishing effective channels to handle disputes, and providing insurance against risks. The Taiwanese government needs to evaluate and clarify its current trade and investment policy provisions on China, expedite the direct transport policy with China, and abolish business restrictions that are detrimental to economic growth of Taiwan. By allowing
for greater factor mobility, the economy will benefit from improved business efficiency, job creation, and repatriated investment income.

Summary and Conclusions

This paper employs an augmented production function to examine the trade-off between income inequality and economic growth in Taiwan. The GARCH or ARCH model is chosen for empirical analysis. Empirical evidence strongly supports that rising inequality, as measured by the Gini coefficient, indeed impairs economic growth, and its impact could be significant. With the application of the alternative HFLF inequality measure, however, the relationship between income inequality and economic growth becomes inconclusive. One explanation may be that the Gini coefficient records the income distribution of the whole economy, but the HFLF targets the richest and poorest groups only, leaving out the entire middle class. Other findings indicate that growth in employment, investment spending, human capital, and technology all contribute to economic growth. Although similar results are obtained from the OLS, the residual variance is biased and hypotheses tests are likely to be invalid because the OLS fails to address autoregressive conditional heteroskedasticity in time-series data.

Policy implications relate to human capital, social welfare, labour market, and international business opportunities. At issue is to emphasise on human capital formation and even distribution as the long-term objective, while thoroughly weighing the cost and benefit of a redistributive policy for the short-term. Policymakers should be mindful about social welfare spending as it involves economic inefficiency.
Table 1: GARCH Regression with GINI

Dependent Variable: GY
Method: ML - ARCH (Marquardt)
Sample (adjusted): 1982 2001
Included observations: 20 after adjusting end points
Convergence achieved after 21 iterations
Bollerslev-Wooldrige robust standard errors & covariance
Variance backcast: ON

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-Statistic</th>
<th>Prob.</th>
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<tbody>
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<td>GT</td>
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<td>H</td>
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<td>-52.83116</td>
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Variance Equation

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-Statistic</th>
<th>Prob.</th>
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<tbody>
<tr>
<td>C</td>
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<td>ARCH(1)</td>
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</table>

R-squared: 0.893661
Mean dependent var: 6.771752
S.D. dependent var: 3.122409
Akaike info criterion: 2.855231
Schwarz criterion: 3.253523
Durbin-Watson stat: 2.090036

Table 2: OLS Regression with GINI

Dependent Variable: GY
Method: Least Squares
Sample (adjusted): 1982 2001
Included observations: 20 after adjusting end points

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>Std. Error</th>
<th>t-Statistic</th>
<th>Prob.</th>
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R-squared: 0.900234
Mean dependent var: 6.771752
S.D. dependent var: 3.122409
Akaike info criterion: 3.258862
Schwarz criterion: 3.507795
Durbin-Watson stat: 2.305803
Table 3: ARCH Regression with HFLF

Dependent Variable: GY
Method: ML - ARCH (Marquardt)
Sample(adjusted): 1982 2001
Included observations: 20 after adjusting endpoints
Failure to improve likelihood after 35 iterations
Bollerslev-Wooldridge robust standard errors & covariance
Variance backcast: ON

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<th>Std. Error</th>
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<th>Prob.</th>
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<td>-3.485063 0.0005</td>
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Variance Equation

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<tr>
<th>Coefficient</th>
<th>Std. Error</th>
<th>z-Statistic</th>
<th>Prob.</th>
</tr>
</thead>
<tbody>
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R-squared: 0.735959
Adjusted R-squared: 0.614094
S.E. of regression: 1.935962
Mean dependent var: 6.771752
S.D. dependent var: 3.122409
Akaike info criterion: 4.197426
Schwarz criterion: 4.545933
Durbin-Watson stat: 1.935760

Table 4: Gini Coefficients and Economic Growth Rates for Selected East Asian Countries

<table>
<thead>
<tr>
<th>Gini Index</th>
<th>Growth Rate (In Percentages)</th>
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<tbody>
<tr>
<td>Australia</td>
<td>35.2</td>
</tr>
<tr>
<td>China: Mainland</td>
<td>44.7</td>
</tr>
<tr>
<td>China: Hong Kong</td>
<td>43.4</td>
</tr>
<tr>
<td>Japan</td>
<td>24.9</td>
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<tr>
<td>Korea</td>
<td>31.6</td>
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<tr>
<td>New Zealand</td>
<td>36.2</td>
</tr>
<tr>
<td>The Philippines</td>
<td>46.1</td>
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<tr>
<td>Taiwan, ROC</td>
<td>35.0</td>
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References


