DEPARTMENT OF ECONOMICS WORKING PAPER SERIES

A Global Analysis of Income Distribution and Capacity Utilization Interactions: The Structuralist View

Tanadej Vechsuruck

Working Paper No: 2017-08

November 2017

University of Utah
Department of Economics
260 S. Central Campus Dr., Rm. 343
Tel: (801) 581-7481
Fax: (801) 585-5649
http://www.econ.utah.edu

A Global Analysis of Income Distribution and Capacity Utilization Interactions: The Structuralist View

Tanadej Vechsuruck
University of Utah
e-mail u0702590@utah.edu

Abstract

The demand and distributive regimes are estimated from 62 countries around the world based on the Structuralist Goodwin model. The distributive regime appears to be Marxian/profit-squeeze and the demand exhibits a weekly profit-led regime. The profit-led demand regime and the profit-squeeze distributive regime are stronger in advanced economies than in emerging economies. The results are also supported when the slopes are allowed to be varied across regions. In the long run, the results reveal that the collective wage suppression would result only in declining wage share, and no positive gain in utilization is found both in developed and developing countries.

Keywords: Panel Analysis, Predator-Prey Models, Distributive-Demand Dynamics, Globalization
JEL Classification: C23, D3, O11, O47

A Global Analysis of Income Distribution and Capacity Utilization Interactions: The Structuralist View

Tanadej Pete Vechsuruck*

November 15, 2017

Abstract

The demand and distributive regimes are estimated from 62 countries around the world based on the Structuralist Goodwin model. The distributive regime appears to be Marxian/profit-squeeze and the demand exhibits a weekly profit-led regime. The profit-led demand regime and the profit-squeeze distributive regime are stronger in advanced economies than in emerging economies.The results are also supported when the slopes are allowed to be varied across regions. In the long run, the results reveal that the collective wage suppression would result only in declining wage share, and no positive gain in utilization is found both in developed and developing countries.

Keywords: Panel Analysis, Predator-Prey Models, Distributive-Demand Dynamics, Globalization

JEL Codes: C23, D3, O11, O47

*Department of Economics, University of Utah

1 Introduction

Inequality has recently become one of the greatest concerns for economic scholars. Several books have discussed the possible causes as well as the consequences and solutions (see Atkinson (2015), Piketty (2014), Milanovic (2005) among several others). Many international organizations have also investigated the issue in different dimensions (see UNCTAD (2012) and IMF (2017) for example). Similar to many other issues in the macroeconomic field, there is no consensus on the main cause of inequality. The causes can range from skill-biased technological change, international trade and capital account openness to financialization. There are many different ways to look at inequality. Functional income distribution, the income shares between capital and labor, is considered as the measure that has gained popularity in the past few years, since many studies have found wage share trends in several economies.

In particular, several studies have shown that the labor share in many developed and developing countries has fallen since the 1980s, although the causes are still controversial (see Stockhammer (2013) among others). This phenomenon is in contrast to one of Kaldor's stylized facts (Kaldor, 1957), which argued that the income share between labor and capital should be constant across time. The stability of the income shares is very crucial since it has been one of the main pillars of Neoclassical macroeconomics. For the neoclassical macroeconomics model, the shares of income should be constant because if wages become higher, firms should invest in more machines, and vice versa. The substitution between the two inputs should therefore stabilize the factor shares of income. When the shares are not stable, why the substitution does not work needs to be clarified. For instance, a decline in labor share might be explained by the decline of the relative price of investment goods (Karabarbounis and Neiman, 2013).

For post-Keynesian macroeconomics, the period of stability between wage and profit shares can be viewed as a temporary balance of social conflict, given the set of economic and political configurations. The income share fluctuation, according to the theory, creates fluctuations for demand components: consumption, investment and net exports. If the economy is demand-driven, instability in income shares can also create economic fluctuations. Thus, when the wage share falls in a certain economy, demand can be increased or decreased depending on how each component reacts. The total effect is therefore an empirical question. How does the wage share instability create a business cycle? At the international level, are the characteristics of business cycles in developed and developing countries similar? If not, what are the differences and what do they imply? In the long run, does the global economy gain from the instability of the wage share? If not, what are the possible explanations?

This study is intended to answer these questions. The Structuralist Goodwin model will be adjusted and empirically tested on the unbalanced panel data of 62 countries. Although many empirical studies have examined many different developed countries, only some studies have included developing countries. This study will compare and contrast the results between

regions and countries both in the short run and long run.

The structure of this study is the following. After the Introduction (1), the Theoretical Model section (2) will explain the construction of Structuralist Goodwin model. The third section, Empirical Analysis (3), will be separated into three subsections. The first subsection, Wage Share and Capacity Utilization data (3.1), will clarify how main variables data are gathered and adjusted for the study. The second subsection, Panel Data Analysis (3.2), will explain the econometric models this study is based on and analyze the findings. The third subsection, Discussion:the Global Beggar-My-Neighbor Game (3.3), will consider the implications of the results. Finally, the last part, Conclusion (4), will summarize the essence of this work and elaborate some concerns.

2 The Structuralist Goodwin Model

Following Marx's idea on social conflict (Marx, 1867) and the Lotka-Volterra mathematical model (Lotka, 1925) on the competition between species, Goodwin (1967) constructed a macroeconomic model to show that a business cycle can be explained by two endogenous variables: income distribution, or the predator, and employment, or the prey. In his model, Say's law is assumed as saving determines investment and an economy always operates at full capacity, which implies a constant capital-output ratio. A distributional conflict between labor and capital is shown along with the dynamics between wage share and employment ratio. Hirsch and Smale (1974, pp. 262) showed that with the construction of the system's Jacobian matrix, the main diagonal elements appear to be all zeros, which creates a closed orbit–the dynamics of wage share and employment ratio chasing each other in a counter-clockwise fashion. The business cycle is inherently started when employment (the prey) and wage share (the Predator) increase. As the wage share rises, it simultaneously decreases the profit share, economic growth, capital accumulation, and thus employment. The Goodwin cycle is therefore generated by only two conflicting endogenous variables.

Based on the literature from Keynes (1936), Kalecki (1971) and Steindl (1952), a number of post-Keynesian macroeconomists, including Bhaduri and Marglin (1990), Dutt (1984), Taylor (1991), Rowthorn (1981), Foley and Michl (1999) and Blecker (1989), among others, have developed Keynesian economic growth theory in which effective demand is emphasized as key to economic growth. The importance of income distribution is revived along the lines of classical economics dating back to Smith, Ricardo and Marx. The Structuralist Goodwin model presented below closely follows the business cycle model developed in N. H. Barbosa-Filho (2001), N. Barbosa-Filho and Taylor (2006) and Taylor (2004) in which income distribution and capacity utilization are endogenized. In particular, this heterodox business cycle model incorporates effective demand into social conflict in order to examine how income distribution interacts with business fluctuations. The concept of distribution-demand interactions was also further scrutinized in a non-linear fashion. Tavani et al. (2011)

propose that with a non-linear distributive curve that allows for both forced-saving and profit-squeeze in the system and profit-led demand curve, the US economy could have three equilibria corresponding to different rates of wage share and capacity utilization. Nikiforos and Foley (2012) show that with the U-shaped distributive curve, the economy might be stuck in a low equilibrium trap. Even though the whole demand regime is profit-led, the state of multiequilibria suggests that the low-level equilibrium can be reconsidered as wage-led and a redistribution toward labor at that point would improve the economy.

The Structuralist Goodwin model is fundamentally composed of two regimes: the demand regime and the distributive regime. The demand regime captures the causal effect from income distribution to effective demand. In a closed economy without government, the demand regime is considered profit-led [1] when a positive effect of higher profit share on investment dominates the negative effect of higher profit share on consumption. The opposite case is called wage-led when the positive effect of higher wage share on consumption is large enough to offset the negative effect of higher wage share on investment. The distributive regime, on the other hand, captures the causal effect from effective demand to income distribution. The distributive regime could also act in two main ways. If increasing economic activity causes a negative effect on wage share, we say the distributive regime is wage-squeeze, forced-saving, or Kaldorian.[2] However, if higher demand, which usually causes lower unemployment, lifts the bargaining power of labor and leads to a rising wage share, the distributive regime is labeled as profit-squeeze or Marxian. Next, the theoretical model will be analyzed in detail and its possible 'closures' (for more details, see Taylor (1991, pp. 41)) determined by different technological levels, labor market structures and institutions across economies.

Suppose a closed economy produces only one good and a government has no role. A society is divided into two classes: capitalists whose income is mainly derived from profit and workers whose income is mainly derived from wage. Capacity utilization (u) is defined as real output (X) over existing capital or potential output (K). Wage share (ψ) is defined as real wage (ω) over labor productivity (ξ). By differentiating u and ψ with respect to time (given that $\hat{x} = \frac{\dot{x}}{x}$ when x is continually differentiable), we have

$$\hat{u} = \hat{X} - \hat{K} \tag{1}$$

$$\hat{\psi} = \hat{\omega} - \hat{\xi} \tag{2}$$

The growth rate of utilization relies on the difference between growth rates of output and

[1] Suppose the total income is separated into wage and profit. The sum of the wage share and the profit share must equal one. The profit-led/wage-led definition was coined by Taylor (1991), while the meaning is comparable to the terms in Bhaduri and Marglin (1990), exhilarationist/stagnationist, respectively.

[2] Kaldor (1956) hypothesizes that an economy needs to shift distribution in favor of capitalists during the booming period, so they can have sufficient funds to make investments in the following period. Marx, on the other hand, emphasizes the role of the reserve army of unemployed that makes labor's bargaining power, and thus real wage, vary pro-cyclically.

capital (suppose there is no capital depreciation) while the growth rate of wage share is the difference of real wage growth and labor productivity growth. The relationship between utilization and wage share can be further scrutinized by using the Two-Species Model (for more details, see Shone (2002, chapter 14) since they can be thought of as two species that can be rivalry or predatory. Output, capital, real wage and labor productivity are constructed as a linear function consisting of our two species: utilization and wage share as follows,

$$\hat{X} = \alpha_0 + \alpha_u u + \alpha_\psi \psi \tag{3}$$

$$\hat{K} = \beta_0 + \beta_u u + \beta_\psi \psi \tag{4}$$

$$\hat{\omega} = \gamma_0 + \gamma_u u + \gamma_\psi \psi \tag{5}$$

$$\hat{\xi} = \delta_0 + \delta_u u + \delta_\psi \psi \tag{6}$$

Then equation (3) and equation (4) are substituted into equation (1) and equation (5) and equation (6) are substituted in equation (2). Also, let $\phi_j = \alpha_j - \beta_j$ and $\theta_j = \gamma_j - \delta_j$ for $j = 0, u$ or ψ. We can obtain

$$\dot{u} = u(\phi_0 + \phi_u u + \phi_\psi \psi) \tag{7}$$

$$\dot{\psi} = \psi(\theta_0 + \theta_u u + \theta_\psi \psi) \tag{8}$$

Equation (7) and equation (8) can be constructed as the utilization nullcline and distributive nullcline, respectively, after they are equated to zero. The stationary solution, the long-run solution and the stability analysis are elaborated in Appendix A. The slope of utilization nullcline depends on the sign of ϕ_ψ or the difference between the effects of wage share changes on output and capital. When the sign of ϕ_ψ is positive, the utilization nullcline is positively sloped or the demand regime is wage-led. The negative ϕ_ψ causes the utilization nullcline to be negatively sloped or the demand regime is profit-led. The slope of distributive nullcline, on the other hand, largely rests on the sign of θ_u or the difference between the effects of utilization changes on real wage and labor productivity. The positive θ_u results in a positively sloped distributive nullcline or the distributive regime is profit-squeeze. The distributive regime is considered as wage-squeeze when θ_u is negative, which causes the slope of the distributive nullcline to be negative as well.

Figure 1 illustrates the system with profit-squeeze distributive and profit-led utilization regimes. The system manifests counter-clockwise predator-prey dynamics, where the wage share is a predator and capacity utilization is a prey. At the beginning of the business cycle, a reduction in the wage share induces a higher investment that overshadows a fall in consumption. An increase in capacity utilization strengthens the bargaining power of labor that eventually leads to a higher labor share. This would set the stage for an economic slowdown and the cycle would come to an end. The new cycle will start when a lowering wage share stimulates the aggregate demand again. The dynamic behavior can be characterized as 'spiral sink' as it converges to the long-run equilibrium. In this system, a pro-labor distributive shock, or a leftward shift of the distributive nullcline, will improve the wage

share while worsening utilization. A positive demand shock, or a rightward shift of the utilization schedule, will improve both wage share and utilization in this system.

Wage-led and wage-squeeze dynamics regimes are shown in Figure 2 . The system exhibits clockwise predator-prey dynamics where a predator is instead performed by capacity utilization while wage share turns out to be a prey. The business cycle starts when the economy is boosted by an increase in wage share. Higher consumption is large enough to compensate for a reduction in investment. The economy expands until the profit share starts to increase. The period of recession stalls the economy until the wage share begins to rise again and the new cycle begins. Likewise, the dynamic behavior is still considered as 'spiral sink'. Nevertheless, a pro-labor shock in this system will improve both labor share and utilization, whereas a positive demand shock will improve only utilization but discourage labor share.

In Figure 3, the distributive curve shows the forced-saving/Kaldorian characteristic with the profit-led demand regime. In this case, the distributive schedule must cut the demand schedule from above to make the system stable (Taylor, 2004). In other words, the distributive schedule must be steeper than the demand schedule in order to have a positive determinant for the Jacobian matrix. As a result, the system also embraces counter-clockwise predator-prey, spiral-sink dynamics, as in the first case. However, while a pro-labor distributive shock causes the same effect as the case above, a positive demand shock will suffer the wage share in this case.

Economic structures, market characteristics and social institutions fundamentally determine the nature of distributive and demand regimes in each economy. Due to rapid globalization in the past few decades, many economists may expect the regime to be very similar across developed and developing countries. Even though we have seen evidence that many countries have tried to capture the benefit of globalized markets of goods and services by suppressing labor renumeration, how an economy reacts across a business cycle shall be left for empirical analysis. In the next section, the panel data analysis is utilized in order to see how the distributive and demand regimes look in developed and developing countries. Similarities and differences of the regimes will also be discussed between different groups of countries.

3 Empirical Analysis

This section will translate the Structuralist Goodwin model described earlier into the empirical model.

3.1 Wage Share and Capacity Utilization Data

Regarding the theoretical model above, we recognize that any econometric model that attempts to empirically test the Structuralist Goodwin model requires two endogenous variables' time series data, namely wage share and capacity utilization. The two variables are defined below.

First of all, capacity utilization cannot be defined straightforwardly as in the model. Although effective output is generally defined as the current GDP, difficulty exists in how to measure capital or potential output. In this study, capacity utilization is defined as the GDP gap, which is calculated by the percentage difference between actual (or effective) and potential GDP. The actual real GDP is measured at the 2005 constant local currency. All actual real GDP data are gathered from "National Accounts Estimates of Main Aggregates" from the United Nations Statistics Division (UNSD). Potential output is obtained from the standard Hodrick-Prescott (HP) filter with a smoothing parameter of 100 because the data are in the annual level. The idea of this statistical filter is simply to separate cyclical from structural components of actual GDP.

Far from uncontroversial, the HP filter has been criticized in the past few years. Cogley and Nason (1995) claim that the HP filter can potentially create spurious cycles. In addition, Hamilton (2017), while agreeing that the HP filter generally produces series with spurious dynamics relations, argues that the spurious dynamics, created by the filter, also make filtered values at each end of the sample very different from those in the middle. Blecker (2016) compares US utilization rates obtained from the HP filter and from a survey by US firms. He found that the utilization from the HP filter downplays the adverse effect from the 2008 financial crisis. Also, the HP filter fails to show the downward trend in utilization, as shown in the survey. Be that as it may, the HP filter is still considered to be one of the most conventional filters and most suitable to apply here because the data are collected annually and considered not rich in terms of their lengths and numbers of observations.

Wage share is defined as compensation of employee over gross value added. All data are collected from "National Accounts Official Data" Table 2.3 at UNSD, except data from China and Taiwan.[3] The wage share index is calculated as the current wage share over the 2005 wage share times a hundred. The index transformation allows us to compare the changes in wage share across time and location, considering the fact that absolute values are very different across countries.

How to calculate wage share is still far from conclusive especially in developing countries where labor markets are rampant with informal employment. In many emerging economies, a majority of the labor force works in unincorporated enterprises. Income data from such

[3]Chinese data from 1978-1995 are received from Li (1999). Afterwards, China Statistical Yearbook, published by the National Bureau of Statistics of China, provides all the data. Data for Taiwan are gathered from National Statistics (Republic of China (Taiwan)).

employment are difficult to record in national income account categories. Most countries, for a variety of reasons, just record the self-employed as capital income, so the size of wage share is underestimated. Gollin (2002) proposes an alternative methodology to deal with this issue by correcting the underestimation of unincorporated enterprises. Onaran and Galanis (2012) follow the methodology to deal with developing countries' wage shares but substituted operating surplus of Private Unincorporated Enterprise (OSPUE) with mixed income. The problem with the UN data we have is that the mixed income data are not consistent with the wage share data. There are only three developing countries (Brazil, Iran and Mongolia) that have the length of mixed income data equal to wage share data, whereas others have a shorter length of mixed income data or none at all. Moreover, it is very likely that the adjustment changes only the absolute values of wage share, not relative values. Figure 4 shows a comparison between the original and adjusted wage share for Brazil.[4] It clearly shows that the adjustment does not change the trend at any time and the size of mixed income seems to be constant throughout the time period, namely a constant gap between the original and adjusted wage shares. Therefore, we assume that the size of mixed income relative to total income is constant for all countries across time. The original wage share index is chosen to be estimated for all countries. [5]

Tables 1 and 2 summarize the list of countries, two main variables, and the period of data availability for each country. Overall, there are 62 countries from all regions around the world. Countries are selected if they have data available for constructing two indexes after 1970 and until 2014. Most countries have perfect data to construct the GDP gap during the period 1970-2014.[6] Unfortunately, only a handful of countries have the full range of data for wage share while most countries have different ranges, from more than 30 years to only 15 years. Countries are classified as developed or developing based on the pre-crisis report from IMF (2008) except that the Asian Tigers (Hong Kong, Singapore, South Korea and Taiwan) and Israel are categorized as developing countries because they were classified as developed countries only recently, in 1997. In addition, heavily indebted poor countries are excluded from developing countries in order to have a group of countries less variation in income levels. The post-Soviet states are also excluded as the collapse of the Soviet Union made the wage share highly volatile in the early 1990s.

[4]Here the adjustment method in Onaran and Galanis (2012) is used. The adjusted wage share equals the average of the two methods. The first method applies the definition that adjusted wage share equals to (compensation of employee + mixed income)/(gross value added) while the second method defines the adjusted wage share equals (compensation of employee)/(gross value added - mixed income). These two methods are not perfect in themselves. The first method might overstate the size of labor income as it incorporates all the mixed income in labor compensation. The second method is only plausible under the assumption that an unincorporated enterprise has the same proportion of income as the rest of the economy. The average of the two methods is therefore applied.

[5]Additionally, the Chinese data have already been adjusted for OSPUE several times in the past few years. See Zhou et al. (2010) and Qi (2014) for more details.

[6]Note that the full range of real GDP 1970-2014 is used to create the series of potential output for all countries despite the fact that not all numbers are used since the wage share indexes for many countries are shorter.

Figures 5, 6, 7 and 8 reveal some interesting trends in wage share across the globe. While most countries have inconclusive or stable trends, there are many countries whose wage share trends are very clear, i.e., increasing or decreasing. In agreement with many studies before, several countries around the world have suffered from falling wage share trends. Among developed countries, Figure 5 shows that wage shares in Australia, Canada, Germany, Ireland, Italy, the Netherlands, Norway, Sweden, the US and the UK have had stark falling trends since the 1970s . Only Denmark and Iceland have increasing trends as shown in Figure 6. Iceland's wage share has rapidly increased since 1984 after it had declined for a decade. Denmark's wage share, although the trend seems stable during the 1970s to 1990s, has gradually increased since the mid 2000s.

In developing countries, the big picture is very similar: only a couple of countries have increasing trends whereas many countries have declining trends. In Figure 7 , China, Peru, Mauritius, South Africa, Taiwan and Venezuela have falling wage share trends for the past few decades. On the contrary, wage shares in South Korea and Thailand, as shown in Figure 8, have increased over time since the 1970s but became stable after the Asian Financial Crisis in 1997. It should be noted that the Asian Tigers (Hong Kong, Taiwan, Singapore and South Korea) plus China and Thailand, countries that have rapidly grown since the 1970s, have experienced differently in terms of wage share trends. While South Korea and Thailand' s have significantly rising trends, as argued above, Taiwan and China have dramatically falling trends.

3.2 Panel Data Analysis

After several theoretical works published since the early 1990s, a sizable number of empirical literature have followed by investigating how changes in income distribution between wage and profit earners have a quantitative effect on the demand regime. According to Blecker (2016), those empirical studies can be approximately separated into two categories. The first category is called the 'structural approach'. Most studies in this category applied a single equation method to measure the partial effects of consumption, investment and net exports to wage share (or profit share). Whether the open-economy demand regime is wage-led or profit-led is calculated from the sum of all partial effects. For the close-economy demand regime, the calculation merely disregards the net exports effect. Until now, the empirical results have been inconclusive for many economies. Many studies found that for several countries, a close-economy demand regime tends to be wage-led, but the regime turns out to be profit-led once the economy is open, as the positive effect of increasing profit share on net exports overshadows the net negative effects between consumption and investment. For advanced countries, this type of evidence was found in many studies such as Bowles and Boyer (1995) on France, Germany and Japan, Ederer and Stockhammer (2007) on France and Naastepad and Storm (2006) on Japan and the US, among others. Onaran and Galanis (2012) also found the same results in some developing countries such as Argentina, China,

Mexico, India and South Africa. Hein and Vogel (2008) and Onaran and Galanis (2012) provide a comprehensive literature review of other studies in this vein.

The second category of past empirical studies is called the 'aggregative approach.' Often this approach directly regresses output on wage share and some other control variables. In some studies, when the model corrects the simultaneity bias by endogenizing wage share, or regressing the demand equation and wage share equations simultaneously, the approach is called 'aggregative-systems.' This approach is widely adopted by empirical studies whose theoretical models are largely based on the Structuralist Goodwin model. N. Barbosa-Filho and Taylor (2006) investigate the US economy during 1948-2002 by using quarterly data of business sector's labor share and output. The potential output was derived using the HP-filter and from the Congressional Budget Office (CBO) to compare for the results. They apply the vector autoregression (VAR) model to estimate the demand and distributive regimes. For the distributive regime, they find that a percentage increase in capacity utilization leads to 1.92 percentage increase in wage share. For the demand regime, a percentage increase in wage share results in 0.31 percentage decrease in capacity utilization. The economy therefore exhibits profit-squeeze/profit-led behavior. However, there is an exceptional period during 1954-1970 in which the distributive curve has a negative slope, or Kaldorian-type, which makes the wage share curve negatively-sloped and locally unstable.

Carvalho and Rezai (2015) extend the model by including the consideration of personal income inequality effect on the distributive and demand regimes. Following Kalecki's idea, the saving rate is adjusted to be a positive function of wage inequality. They look at the US data during 1967-2010 and employ the two-dimensional threshold vector autoregression (TVAR) that allows for non-linearity in the dynamic relationship. Even though they find the demand regime as profit-led and their results correspond to many results found in N. Barbosa-Filho and Taylor (2006), they additionally argue that the rise of personal inequality after 1980 in the US caused the demand regime to be more profit-led. A reduction of personal income inequality among workers, they argue, can cause demand to be more wage-led and eventually lead to higher output. Kiefer and Rada (2014) examine 13 OECD countries from 1971-2012. The quarterly data on wage share and capacity utilization, all gathered from OECD database, allow them to construct the unbalanced panel data to which the standard seemingly unrelated regression (SUR) applied. The demand regime appears to be profit-led as a percentage increase in wage share results in 0.06 decrease in capacity utilization. The distributive regime indicates the profit-squeeze type when a percentage increase in capacity utilization leads to 5.386 percentage increase in wage share. The study further shows that there is a long-run shift for lower wage share and capacity utilization. In other words, a negative distributive shock or the race to the bottom, although it might work in the short run, could not bear fruit in the longer period.

In this study, two time series data of 62 countries are combined into the unbalanced panel data. The empirical method below closely follows the method in Kiefer and Rada (2014) where the SUR with coefficients iterated to convergence is applied to two equations

simultaneously. In this manner, when income distribution is endogenized, the simultaneity bias between income distribution and demand regime ceases to be an issue. The estimable equations below (see Appendix B for more details on derivation) start with the difference equation version of the differential equation seen earlier in equations 7 and 8 . These equations are used as the base equations and will be extended further in the upcoming analysis. The two equations are

$$\psi_t - \psi_{t-1} = \alpha_0(\psi_{t-1} - (\psi_0^* - \alpha_1 u_0^*) - \alpha_1 u_{t-1})) + \epsilon_t \tag{9}$$

$$u_t - u_{t-1} = \beta_0(\psi_{t-1} - (\psi_0^* - \beta_1 u_0^*) - \beta_1 u_{t-1})) + \upsilon_t \tag{10}$$

where α_0 is wage share scaling, ψ_0^* is long run wage trend, α_1 is wage slope, u_0^* is long-run gap trend, β_0 is gap scaling and β_1 is gap slope. ϵ_t and υ_t are error terms. The long-run wage share (ψ_0^*) and capacity utilization (u_0^*) are exogenous.

The estimation begins with the 'NAIRU' model on which a cross-equation restriction that forces the equilibrium to stay on the wage share axis ($\psi^* = \psi_0^*$) and the long-run utilization to be equal to zero ($u^* = u_0^* = 0$) is imposed. It is assumed that the long-run equilibrium output is at the potential output or the GDP gap equals zero. The results are evaluated in Table 3. The wage slope ($\partial\psi/\partial u$), which signifies the distributive regime, is 3.536. In other words, a percentage increase in utilization causes 3.536 percentage increase in wage share. The distributive regime is therefore Marxist/profit-squeeze. It should be noted that this distributive regime is stronger than that found in the US in N. Barbosa-Filho and Taylor (2006) but weaker than in the OECD countries presented in Kiefer and Rada (2014). On the other hand, the utilization slope ($\partial\psi/\partial u$) is -28.625. The demand regime is thus profit-led. In particular, a percentage increase in profit share results in $1/28.625 = 0.035$ percentage increase in utilization. This profit-led global demand regime is apparently weaker than the two studies above suggested for the US and OECD economies. In other words, when the global economy is estimated, the result of the profit-led demand regime still seems to hold, but the effectiveness of the regime is clearly weaker. The restriction of NAIRU is relaxed in 'NAIRU Relaxation' in the same table. The potential output gap is allowed to be negative or positive in the long run. All the results in this model are consistent with the NAIRU. Also, the long-run utilization intercept (u_0^*) is insignificant, which implies that a zero output gap or NAIRU assumption in the long run might be plausible for the global economy. Figure 9 simulates the results from NAIRU to create trajectories of the system when the distributive nullcline is positively sloped (profit-squeeze) and the utilization nullcline is negatively sloped (profit-led). The counter-clockwise convergence to the long-run equilibrium (zero GDP gap) seemingly slows in the very first years but speeds up in later years. This implies that any negative output shock might create prolonged stagnation in the total system before it can reach recovery years.

The specifications are further adjusted to explore if there is any difference in the regimes between groups of countries. Table 4 estimates the NAIRU in which the slopes are allowed vary among groups of countries and regions. Overall, the slopes of the distributive

and utilization regimes across country groups still strongly indicate profit-led/profit-squeeze characteristics . Subsequently, Table 5 shows the estimation of NAIRU when the world economy is divided into developed and developing groups of countries. It is interesting to see that both distributive and demand regimes in developing countries are weaker than in developed countries. In developed countries, a percentage increase in capacity utilization results in 4.356 percentage increase in wage share, whereas a percentage increase in capacity utilization leads to 3.427 percentage increase in wage share in developing countries. While a percentage decrease of wage share can boost a $1/23.739 = 0.042$ percentage increase in utilization in developed countries, it only results in a $1/28.314 = 0.035$ percentage increase in developing countries.

These results underscore the different characteristics of developed and developing economies. To better illustrate this point, Figure 11 compares the demand regimes and distributive regimes between two groups. The dotted lines represent developing countries' distributive/demand regimes while the dashed lines represent developed countries' two regimes. As analyzed above, the developed countries' distributive curve is steeper, which may indicate the higher bargaining power of labor unions in advanced countries that are more likely to be able to pressure for higher wages amidst the economic upturns. The steeper slope of developing countries' demand regime in this $u - \psi$ plane automatically translates into the flatter slope of the regime in $\psi - u$ plane. In other words, in the short-run higher utilization can be achieved more for developed countries for every percentage reduction in wage share, given other conditions.

Furthermore, the linear trends for both the long-run coordinates are introduced to test if the long run equilibrium might move downwards or upwards. The ψ_0^* coefficient is reinterpreted as the 1970 wage share equilibrium and u_0^* as the 1970 utilization equilibrium. The trends can be negative or positive. The equations can be specified as

$$\psi_t - \psi_{t-1} = \alpha_0(\psi_{t-1} - (\psi_0^* - \alpha_1 u_0^* + (\psi_1^* - \alpha_1 u_1^*)(date - 1970)) - \alpha_1 u_{t-1}) + \epsilon_t \tag{11}$$

$$u_t - u_{t-1} = \beta_0(\psi_{t-1} - (\psi_0^* - \beta_1 u_0^* + (\psi_1^* - \beta_1 u_1^*)(date - 1970)) - \beta_1 u_{t-1}) + \upsilon_t \tag{12}$$

where ψ_1^* is long-run wage share trend and u_1^* is long-run utilization trend. The estimation results are presented in 'relaxation with linear trend' or the last column of Table 3 . Most coefficients correspond to the previous results. However, the last two coefficients pose two crucial points. First, the long-run utilization trend is insignificant. In other words, there is no long-term movement on capacity utilization. Second, the long-run wage trend is negative and very significant. In other words, there is a long-term downward movement of wage share. These results implicitly suggest that there is a collective effort to suppress labor income even though the benefit is not visible in the long run. Further, additional analysis is made to see if the same results are still valid across groups of countries. The relaxation with linear trend is separated between developing and developed countries in Table 6 to analyze if there is any difference in terms of their coefficients and long-term trends. It reveals that while the long-run utilization trends are still insignificant for both groups of countries, the

wage trend is significantly worse in developed countries than in developing countries. The wage trend results are illustrated in Figure 10. The projection exhibits that for more than four decades, the gap of long-run wage share between developed and developing countries irreversibly widens. Even though all the countries have attempted to suppress wages, labor in developed countries suffered more in the last few decades.

Lastly, the structural breaks are investigated since some countries in the sample were adversely affected by economic crises.[7] Two crises, Asian Financial Crisis and Latin American Debt Crisis, are scrutinized here. The estimation is interpreted to see if the crisis leads to any significant shift on wage share or utilization. A dummy coefficient is assigned for years after or free from the crisis. For the Asian Crisis, the post-era starts at 1998, whereas the Latin American Debt Crisis starts at 1982 and ends at 2002.[8] Table 7 presents the estimation for each crisis covering only the countries in the specific region not the whole sample. For both crises, slopes, intercepts and scaling are not much different from the previous models. However, there are significant negative effects on long-run wage share in both regions. Asian countries seem to suffer more from the crisis as the negative shift in wage share is significantly higher. The negative long-run shifts in utilization, on the other hand, is not significant for Asia but significant at 5 percent for Latin America. In other words, the crisis caused the both negative output and distribution shocks for Latin American countries whereas Asian countries suffered only from negative distribution shock after the crisis.

3.3 Discussion: the Global Beggar-My-Neighbor Game

Globalization, financialization and/or technological change have played the main roles in declining wage share around the world although the extent of each is different for developed and developing countries. Under the neoclassical theory of distribution, income shares are determined by technological change. From the 1980s onward, because skill-biased technological improvement has been dominant, new tools, computers and machines have replaced unskilled labor and favored skilled labor by shifting income shares toward them. Technological progress thus became more capital augmenting than labor augmenting and pushed down wage share. IMF (2007) finds that this has been the main cause of deteriorating wage share

[7] The 2008 financial crisis is ignored in this study because many developed countries' data were ended in 2008 in the UN database.

[8] The Asian Crisis erupted in July 1997 when the Bank of Thailand floated the Thai Baht. The negative effect on output had not lasted long and many countries in the region initially recovered within a few quarters. Nonetheless, the long-term effect on labor, investment and financial sector has been long-lasting until today (see Jomo (2007) for more details). However, the story of the Latin American Debt Crisis is more complicated. The fact that the economic stagnation had prevailed for many years, the so-called 'Lost Decade', and the crises that recurred in different countries within the region makes it hard to justify the beginning and the end of the crisis. Here the 1982 Mexican Debt Crisis is identified as the beginning because it was the very first crisis involving debt issue in the region and 2002 is marked as the end because it was the year Argentina recovered from the economic depression and the commodity boom gradually set off in the early 2000s (see Ocampo (2014) for more details).

in developed countries. However, Stockhammer (2013) finds that globalization, welfare state retrenchment and financialization significantly contribute to the decline in the wage share, where technological change contributes a very small negative effect in developed countries and even contributes a positive effect in developing countries.

International trade and finance policies and consequences, therefore, appear to better explain why the wage share has fallen over decades. In fact, there has long been a recognition of policies that could capture benefits from globalized markets. In her seminal article, Robinson (1947) argued that an increase in the balance of trade is tantamount to an increase in investment, which usually leads to an increase in employment. As the global market does not grow fast enough to accommodate all sales, each nation seeks to increase the share in the market that will benefit their own people but at the expense of other nations because the balance of trade of the world as a whole must be zero. This means an increase in exports for one country implies an increase in imports in another. In other words, under international competition, countries aim to increase their employment by exporting unemployment to the rest of the world. A beggar-my-neighbor game is therefore played between nations. After one nation succeeds at the expense of others, it will be retaliated against the others. Besides export subsidies and import restrictions, the principle devices to increase the balance of trade are exchange rate depreciation and wage cut. An exchange rate depreciation or a fall in money wages, for instance, would stimulate a primary increase in employment in export industries, assuming the Marshal-Lerner condition holds. Put simply, in Robinson's words, there are four suits in the pack and a country tries to play a higher card out of any suit to be ahead of others.

The empirical evidence of wage suppression has been ample across the globe, and globalization appears to result in a negative effect on wage share. Amsden and Hoeven (1996) reveal that many developing countries during the 1980s restructured their manufacturing sectors by reducing costs, closing inefficient factories and cutting wages to restore profitability. As a result, the declines in real wages and wage shares were prevalent across countries. Harrison (2005) also confirms the same phenomenon that, based on the panel data of developed and developing countries from 1960 to 2000, rising trade shares and exchange rate crises reduce wage share, while an increase in capital intensity, capital controls and government spending increase it.Jayadev (2007) instead emphasizes the financial liberalization aspect and found that there is a negative relation between capital account openness and labor share. His explanation is that the openness changes the bargaining power of capital against labor as an increase in capital mobility raises rents accruing to capital. Since the early 1980s, an increase of capital flows has coincided with rising foreign direct investment (FDI) as well. The widening income gap is found to be associated with both FDI outflows from developed countries and FDI inflows to developing countries. Crotty et al. (1998) explain that while developed countries might try to delay wage increase in order to slow down job relocation, developing countries may compete with each other for FDI by suppressing wages. The net result on income tends to be an increase of inequality in both regions. Onaran (2009), in addition, finds that FDI inflows have a negative effect on wage shares in South Korea, Mexico

and Turkey.

The long period collective wage suppression has not translated into higher capital accumulation. On the other side of the same coin, a reduction of wage share is a rise of profit share. Higher profit share should increase profit expectation on investment for business, since profit acts as an incentive, a source and an outcome of investment (Akyüz and Gore, 1996). After the profit from the initial investment is realized, higher retained earnings encourage firms to invest more in the next period. Profit is thus a key for investment. However, when profit share has risen, often it does not guarantee that it would automatically translate into higher investment. Profit without production could possibly emerge, especially when firms have other short-term options to invest or when they need to strengthen their balance sheets after the financial crisis erupts (Lapavitsas, 2013) .

Since the 1980s, accumulating evidence shows that the nexus between profit and investment has been weakened both in developed and developing countries (UNCTAD, 2016). By moving decision-making more to shareholder interests relative to other stakeholders, the commitment of any long-term investment is given less attention even though profit rises. Productive investment is therefore decoupled from profit and replaced with short-term, financial investment. For business in developed countries, financialization is one of the main explanations for the weakening of the profit-investment nexus. The term is defined as the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of domestic and international economies (Epstein, 2015). Business, as a result, tends to increase its financial activities even among non-financial corporations. The refocusing on financial activities could discourage productive and innovative investment, which could instead create employment. In particular, the pressures from stockholders to make short-term gains in the stock markets and threats of hostile takeovers when profit declines make firms less likely to invest in long-term physical investment projects. There is evidence of the negative relation between financialization in corporate strategy and productive capital formation both in national level (Stockhammer, 2004) and firm-level data (Tori and Onaran, 2015).

The investment slowdown has been observed in developing countries as well. According to Amsden and Hoeven (1996), the consequence of wage suppression during the 1980s was not pleasant for two reasons. First, most non-Asian developing countries suffered a collapse in investment. Second, advanced developing countries outside Asia also rolled back their R&D and technological capability building. After the 1990s, UNCTAD (2016) also finds that only Asian developing countries, on average, could maintain their investment shares of GDP. The investment shares, with the exception of Chile, fell moderately in Latin America, while the shares have been volatile in African countries in the past few decades. These different trends in investment in developing world coupled with the rise of profit shares in many developing countries underscore the sign of the decoupling of investment-nexus in emerging economies as well as advanced economies.

The long-run consequence of the global race to the bottom and the weakening profit-investment nexus can be illustrated by the Structuralist Goodwin model. Figure 1 shows the profit-led/profit-squeeze regime in accordance with the results in the previous section. When countries try to gain competitiveness by suppressing wages, it can be interpreted as the anti-labor distributive shock or a rightward shift of the upward sloping distributive curve. With lower long-run wage share, the profit-led regime should allow the economy to move toward higher long-run capacity utilization because investment responds positively to a rise in profit share. However, this might not be the case regarding the weakening profit-investment nexus that recently manifested in many countries. Rather, it could imply that the negative demand shock may occur and the utilization curve is also shifted to the left simultaneously. Investment in this situation does not strongly increase in response to lower wage share and disallows long-run utilization to increase much, or increase at all. The final result could be only a fall in wage share without any gain in capacity utilization in the long run as suggested in Table 6.

4 Conclusion

Based on the Structuralist Goodwin model, the panel data analysis shows that the world system exhibits a counter-clockwise oscillatory convergence to the equilibrium point in which wage share is a predator and capacity utilization is a prey. The distributive curve is upward-sloping, which represents a Marxian/profit-squeeze regime. The demand curve is downward-sloping, which implies the regime is profit-led. The results have been confirmed across regions both in developed and developing countries. In the short run, developed countries' demand schedule is more sensitive to a fall in wage share than developing countries' demand schedule. In the long run, there is no positive gain in utilization while the decline in wage share is intensified, especially in developed countries. The outcome could be interpreted as a result of the global beggar-my-neighbor game in which nations attempt to reduce wages but cannot translate into higher investment.

When there is no positive gain in the long-run utilization for the global economy, it may imply that the divergence between the rich and the poor countries could be perpetuated and global inequality would not be alleviated. Since the early 1980s, the conventional idea was that after economic integration and market liberalization closed the income gap between poor and rich countries across the world, the income gap between the poor and the rich within countries would also close too. Most studies, however, have shown that in the past few decades, the income gap between rich and poor countries has expanded, in contrast to the 'convergence story' even though markets have been freer and far from strictly regulated (see Pritchett (1997) and Pritchett (2000) among many others). Developed countries have experienced more stable growth path while developing countries have been impacted by the period of crises and growth collapses. Since 1980, only 20 developing countries have enjoyed periods of sustained economic growth, or periods of five years or longer during which there

was no growth or a decline in income per capita (Ocampo et al., 2007). Milanovic (2016) argues that before the twentieth century, it was 'class-based inequality,' inequalities within countries, that explains the global inequality. Since 1950, surprisingly, seventy percent of global income inequality can be explained by the 'location-based inequality' or inequalities between nations, as a result of growth divergence between the US-Western Europe and the rest. Together with our results from the empirical analysis, when the long-run gain in utilization is not seen, we may expect that the divergence can further intensify the global inequality for years to come.

References

Akyüz, Yilmaz and Charles Gore (1996). "The Investment-Profits Nexus in East Asian Industrialization". In: *World Development* 24.3, pp. 461–470. ISSN: 0305750X. DOI: 10.1016/0305-750X(95)00154-5.

Amsden, Alice H and Rolph Van Der Hoeven (1996). "Manufacturing output, employment and real wages in the 1980s: Labour's loss until the century's end". In: *The Journal of Development Studies* 32.4, pp. 506–530.

Atkinson, Anthony B (2015). *Inequality*. Harvard University Press.

Barbosa-Filho, Nelson Henrique (2001). "Essays on Structuralist Macroeconomics". PhD thesis. The New School of Social Research.

Barbosa-Filho, Nelson and Lance Taylor (2006). "Distributive and Demand Cycles in the US economy–a structuralist Goodwin model". In: *Metroeconomica* 57, pp. 389–411.

Bhaduri, Amit and Stephen Marglin (1990). "Unemployment and the Real Wage: the economic basis for contesting political ideologies". In: *Cambridge Journal of Economics* 14, pp. 375–393.

Blecker, Robert A (1989). "International Competition, Income Distribution and Economic Growth". In: *Cambridge Journal of Economics* 13, pp. 395–412.

— (2016). "Wage-led versus profit-led demand regimes: the long and short of it". In: *Review of Keynesian Economics* 4.4, pp. 373–390.

Bowles, Samuel and Robert Boyer (1995). "Wages, Aggregate Demand, and Employment in an Open Economy: an Empirical Investigation". In: *Macroeconomic Policy after the Conservative Era*. Cambridge University Press, pp. 143–171.

Carvalho, Laura and Armon Rezai (2015). "Personal Income Inequality and Aggregate Demand". In: *Cambridge Journal of Economics* 40.2, pp. 491–505.

Cogley, T and J M Nason (1995). "Effects of the Hodrick-Prescott filter on trend and difference stationary time series: implications for business cycle reseearch". In: *Journal of Economi Dynamics and Control* 19, pp. 253–278.

Crotty, James, Gerald Epstein, and Patricia Kelly (1998). "Multinational corporations in the neo-liberal regime". In: *Globalization and progressive economic policy*, pp. 117–143.

Dutt, Amitava K (1984). "Stagnation, income distribution, and monopoly power". In: *Cambridge Journal of Economics* 8, pp. 25–40.

Ederer, Stefan and Engelbert Stockhammer (2007). "Wages and Aggregate Demand in France: an Empirical Investigation". In: *Money, Distribution, and Economic Policy–alternatives to orthodox macroeconomics*. Edward Elgar.

Epstein, Gerald (2015). "Financialization: there is something happening here". In: *Political Economy Research Institute*.

Foley, Duncan K and Thomas R Michl (1999). *Growth and Distribution*. Harvard University Press.

Gollin, Douglas (2002). "Getting Income Shares Right". In: *Journal of Political Economy* 110.2.

Goodwin, Richard M (1967). "A Growth Cycle". In: *Socialism, Capitalism, and Growth*. Cambridge University Press.

Hamilton, James D (2017). "Why You Should Never USe the Hodrick-Prescott Filter". In: *NBER Working Paper No. 23429*.

Harrison, Ann (2005). "Has Globalization eroded labor's share? Some cross-country evidence".

Hein, Eckhard and Lena Vogel (2008). "Distribution and Growth Reconsidered: Empirical Results for Six OECD Countries". In: *Cambridge Journal of Economics* 32, pp. 479–511.

Hirsch, Morris W and Stephen Smale (1974). *Differential Equations, Dynamical Systems, and Linear Algebra*. New York: Academic Press.

IMF (2007). "The Globalization of Labor". In: *World Economics Outlook*. Washington: IMF. Chap. 5.

— (2017). *World Economic Outlook*. Ed. by IMF.

Jayadev, Arjun (2007). "Capital Account Openness and the Labour Share of Income". In: *Cambridge Journal of Economics* 31.3, pp. 423–443.

Jomo, K S (2007). "What Did We Really Learn from the 1997-98 Asian Debacle?" In: *Ten Years After: Revisiting the Asian Financial Crisis*. Asia Program of the Woodrow Wilson International Center for Scholars.

Kaldor, Nicholas (1956). "Alternative Theories of Distribution". In: *Review of Economic Studies* 23, pp. 83–100.

— (1957). "A Model of Economic Growth". In: *The economic Journal* 67.268, pp. 591–624.

Kalecki, Michal (1971). *Selected Essays on the Dynamics of the Capitalist Economy*. Cambrdige University Press.

Karabarbounis, Loukas and Brent Neiman (2013). "The Global Decline of the Labor Share". In: *The Quarterly Journal of Economics* 129.1, pp. 61–103.

Keynes, John Maynard (1936). *General theory of employment, interest and money*. Palgrave Macmillan.

Kiefer, David and Codrina Rada (2014). "Profit Maximising Goes Global: the Race to the Bottom". In: *Cambridge Journal of Economics* 39.5.

Lapavitsas, Costas (2013). "The financialization of capitalism: 'Profiting without producing'". In: *City* 17.6, pp. 792–805. ISSN: 13604813. DOI: 10.1080/13604813.2013.853865.

Li, Qiang (1999). *China's national income, 1952-1995*. Westview Pr.

Lotka, A J (1925). *Elements of Physical Biology*. Williams and Wilkins.

Marx, Karl (1867). *Capital, volume I*. Penguin Classics.

Milanovic, Branko (2005). *Worlds Apart: Measuring International and Global Inequality*. Princeton University Press.

— (2016). *Global Inequality: a New Approach for the Age of Globalization*. Harvard University Press.

Naastepad, C W M and Servaas Storm (2006). "OECD Demand Regimes (1960-2000)". In: *Journal of Post Keynesian Economics* 29.2, pp. 211–246.

Nikiforos, Michalis and Duncan K Foley (2012). "Distribution and Capacity Utilization: Conceptual issues and Empirical Evidence". In: *Metroeconomica* 63.1, pp. 200–229.

Ocampo, Jose Antonio (2014). "The Latin American Debt Crisis in Historical Perspective". In: *Life after Debt*, pp. 87–115.

Ocampo, Jose Antonio, K .S. Jomo, and Rob Vos (2007). "Growth Divergences: Explaining Differences in Economic Performance". In: ed. by Jose Antonio Ocampo, K S Jomo, and Rob Vos. United Nations. Chap. Explaining, pp. 1–24.

Onaran, Ozlem (2009). "Wage share, globalization and crisis: the case of the manufacturing industry in Korea, Mexico and Turkey". In: *International Review of Applied Economics* 23.2, pp. 113–134.

Onaran, Ozlem and Giorgos Galanis (2012). "Is Aggregate Demand Wage-led or Profit-led? National and Global Effects". In: *ILO Conditions of Work and Employment Series* 31.

Piketty, Thomas (2014). *Capital in the Twenty-First Century*. Harvard University Press.

Pritchett, Lant (1997). "Divergence, Big Time". In: *The Journal of Economic Perspectives* 11.3, pp. 3–17.

— (2000). "Understaning Patterns of Economic Growth: searching for hills among plateaus, mountains, and plains". In: *The World Bank Economic Review* 14.2, pp. 221–250.

Qi, Hao (2014). "The Labor Share Question in China". In: *Monthly Review* 65.8.

Robinson, Joan (1947). "Beggar-my-neighbour remedies for unemployment". In: *Essays on the theory of employment*.

Rowthorn, Robert (1981). "Demand, Real Wages and Economic Growth". In: *North East London Polytechnic*.

Shone, Ronald (2002). *Economic Dynamics: Phase Diagrams and their Economic Application*. Cambridge University Press.

Steindl, Joseph (1952). *Maturity and Stagnation in American Capitalism*. Basil Blackwell.

Stockhammer, Engelbert (2004). "Financialisation and the slowdown of accumulation". In: *Cambridge Journal of Economics* 28.5, pp. 719–741. ISSN: 0309166X. DOI: 10.1093/cje/beh032.

— (2013). "Why Have Wage Shares Fallen? An Analysis of the Determinants of Functional Income Distribution". In: *Wage-led Growth* 35, pp. 40–70. DOI: 10.1057/9781137357939{_}3. URL: http://link.springer.com/10.1057/9781137357939_3.

Tavani, Danielle, Peter Flaschel, and Lance Taylor (2011). "Estimated non-linearities and multiple equilibria in a model of distributive-demand cycles". In: *International Review of Applied Economics* 25.5, pp. 519–538.

Taylor, Lance (1991). *Income Distribution, Inflation, and Growth: Lectures on Structuralist Macroeconomi Theory*. MIT Press.

— (2004). *Reconstructuring Macroeconomics: Structuralist Proposals and Critiques of the Mainstream*. Harvard University Press.

Tori, Daniele and Ozlem Onaran (2015). "The effects of financialization on investment: Evidence from firm-level data for the UK". In:

UNCTAD (2012). *Trade and Development Report, 2012*.

— (2016). *Trade and Developemtn Report*. Tech. rep.

Zhou, Xiao M, W Xiao, and X Yao (2010). "Unbalanced Economic Growth and Uneven National Income Distribution: Evidence from China". In: *Institute for Research on Labor and Employment Working paper*.

Appendices

A Theoretical Model

Regarding equation (7) and equation (8), a non-trivial stationary solution, where $\dot{u} = 0$ and $\dot{\psi} = 0$, yields the utilization and distributive nullclines of the system, respectively

$$\dot{u} = 0 \rightarrow u = -\frac{\phi_0}{\phi_u} - \frac{\phi_\psi}{\phi_u}\psi \tag{13}$$

$$\dot{\psi} = 0 \rightarrow \psi = -\frac{\theta_0}{\theta_\psi} - \frac{\theta_u}{\theta_\psi}u \tag{14}$$

On the $u-\psi$ plane, the slope of demand and distributive curves are important as they signify the characteristics of each regime. The slopes can be derived as

$$\frac{d\psi}{du}|_{\dot{u}=0} = -\frac{\phi_u}{\phi_\psi} = \frac{\beta_u - \alpha_u}{\alpha_\psi - \beta_\psi} \lessgtr 0 \tag{15}$$

$$\frac{d\psi}{du}|_{\dot{\psi}=0} = -\frac{\theta_u}{\theta_\psi} = \frac{\delta_u - \gamma_u}{\gamma_\psi - \delta_\psi} \lessgtr 0 \tag{16}$$

The long-run solution or stable node, where wage share and utilization are constant, can be solved by equating two nullclines or equations (13) and (14) to have

$$u^* = \frac{\theta_0\phi_\psi - \phi_0\theta_\psi}{\phi_u\theta_\psi - \theta_u\phi_\psi} \qquad \psi^* = \frac{\phi_0\theta_u - \theta_0\phi_u}{\phi_u\theta_\psi - \theta_u\phi_\psi} \tag{17}$$

To determine the dynamics and the stability of the system, at the stationary points where $\dot{u} = \dot{\psi} = 0$, the Jacobian matrix, trace, and determinant can be obtained as

$$J = \begin{pmatrix} \phi_u & \phi_\psi \\ \theta_u & \theta_\psi \end{pmatrix} \qquad Tr(J) = \phi_u + \theta_\psi \qquad Det(J) = \phi_u\theta_\psi - \theta_u\phi_\psi \tag{18}$$

From this system, the stability condition, as well as the characteristics of each curve, cannot be determined *a priori*, since the slopes of both curves, the trace, and the determinant of the Jacobian matrix fundamentally depend on how wage share and utilization affect output, potential output, real wage, and labor productivity along the economic cycle. In the next step, some economically meaningful closures will be analyzed in order to have phase diagrams of the system. Note that the focus is more on the cases where the nullclines are stable in isolation ($\phi_u, \theta_\psi < 0$) and the system is locally stable ($Tr(J) < 0$ and $Det(J) > o$) which imply that only the signs of ϕ_ψ and θ_u are left to be explored.

Considering the demand regime, with Keynesian stability condition, α_u is assumed to be negative to decelerate economic growth in the long run as saving is growing faster

than investment. Capital accumulation is responded positively to utilization because, by profit rate accounting, an increase in utilization, given the rates of profit share and organic composition of capital, leads to an increase in profit rate. Similarly, a rise of profit share can boost profitability and investment demand. Both arguments thus implicitly mean $\beta_u > 0$ and $\beta_\psi < 0$. From equation (15), we can determine the sign of nominator as positive. The sign of the slope now depends only upon the sign of α_ψ or whether the demand schedule is wage-led or profit-led. As the demand regime is determined by whether the size of positive effect of increasing wage share on consumption can dominate the negative of increasing wage share on investment or not, economy is always wage-led (positive slope) when demand is wage-led ($\alpha_\psi > 0$). On the other hand, if demand is profit-led ($\alpha_\psi < 0$), the overall demand regime is inconclusive. N. Barbosa-Filho and Taylor (2006) finds that in the US the size of the negative effect on demand outperforms the negative effect on investment and capital accumulation ($|\alpha_\psi| > |\beta_\psi|$), which forces the slope to be negative, or the profit-led regime. If the opposite case holds, the demand regime is wage-led.

The distributive regime is slightly more complicated when we try to determine the signs of each coefficient. According to Marx's Reserve Army of Labor hypothesis, economic upswing will raise labor's bargaining power as the unemployed is depleted. Real wage therefore tends to vary pro-cyclically ($\gamma_u > 0$). Labor productivity is also assumed to react positively to utilization as firms invest more in new technology while they see improving profitability ($\delta_u > 0$). Now we can see that the sign of the nominator of equation (17) cannot be determined *a priori*. According to N. H. Barbosa-Filho (2001), suppose that growth rate of real wage is a negative function of the level of real wage and a positive function of labor productivity, we thus have a negative relation between wage share and real wage ($\gamma_\psi < 0$). It also suggests that firms invest in labor-saving technology while facing increasing wage share. And since we more emphasize on the the case in which the distributive nullcline is stable in isolation ($\theta_\psi < 0$), this would force δ_u to be positive. If the δ_u sign is negative, the sign of γ_ψ will depend on the difference between γ_ψ and δ_ψ. In the prior case, the denominator is forced to be negative. The sign of the distributive curve will rely only upon the nominator sign. In particular, if $\delta_u > \gamma_u$, we will have a forced-saving/Kaldorian distributive regime (negative slope distributive nullcline). If $\delta_u < \gamma_u$, we will instead have a profit-squeeze/Marxian distributive regime (positive slope distributive nullcline). For stability condition, we disregard the saddle point case, so the determinant of Jacobian matrix in (18) must only be positive.

B Econometric Model

Given the rate of change is defined as $\frac{\Delta x}{x} = \frac{x_t - x_{t-1}}{x_{t-1}}$, the pure or original Goodwin model, rather than in differential equation form, can be estimated by this following difference-equation specification

$$\psi_t - \psi_{t-1} = \alpha_0 \psi_{t-1}(u_{t-1} - u^*) + \epsilon_t \tag{19}$$

$$u_t - u_{t-1} = \beta_0 u_{t-1}(\psi_{t-1} - \psi^*) + \upsilon_t \tag{20}$$

where ϵ and υ are error terms. α_0 is wage share scaling, β_0 is gap scaling and ψ_0^* is long-run wage intercept. Long-run gap intercept is restricted at zero.

The original version often cannot provide the strong results. Therefore, there must be some adjustments for the equations. The general Goodwin model is an adapted version of the original Goodwin model above and can be shown as

$$\psi_t - \psi_{t-1} = \alpha_0(\psi_{t-1} - (\delta_1 + \delta_2 u_{t-1})) + \epsilon_t \tag{21}$$

$$u_t - u_{t-1} = \beta_0(\psi_{t-1} - (\delta_3 + \delta_4 u_{t-1})) + \upsilon_t \tag{22}$$

At the steady state, $\Delta\psi$ and $\Delta u = 0$, errors are gone, and ψ and u turn to be ψ^* and u^*, respectively. We have

$$\psi_0^* = \delta_1 + \delta_2 u_0^* \tag{23}$$

$$\psi_0^* = \delta_3 + \delta_4 u_0^* \tag{24}$$

Then we solve for δ_1 and δ_3 to have

$$\delta_1 = \psi_0^* - \delta_2 u_0^* \tag{25}$$

$$\delta_3 = \psi_0^* - \delta_4 u_0^* \tag{26}$$

And we plug back δ_1 and δ_3 into equations (23) and (24) to have

$$\psi_t - \psi_{t-1} = \alpha_0(\psi_{t-1} - (\psi_0^* - \delta_2 u_0^*) - \delta_2 u_{t-1})) + \epsilon_t \tag{27}$$

$$u_t - u_{t-1} = \beta_0(\psi_{t-1} - (\psi_0^* - \delta_4 u_0^*) - \delta_4 u_{t-1})) + \upsilon_t \tag{28}$$

where α_0 is a wage share scaling, ψ_0^* is the long-run wage trend, α_1 is a wage slope, u_0^* is the long-run gap trend, β_0 is a gap scaling and β_1 is a gap slope. These equations are used to estimate NAIRU and NAIRU relaxation.

For regional and developed/developing countries differences, the system of equations below simultaneously estimates wage and utilization slopes for each region or group of countries. In particular, the wage and utilization slopes are allowed to vary across different group of countries. The long-run output gap is set to be zero. The equations are

$$\psi_t - \psi_{t-1} = \alpha_0(\psi_{t-1} - \psi^* - \delta_2 u_{t-1}) + \epsilon_t \tag{29}$$

$$u_t - u_{t-1} = \beta_0(\psi_{t-1} - \psi^* - \delta_4 u_{t-1}) + \upsilon_t \tag{30}$$

where δ_2 and δ_4 vary by regions.

Finally, the structural breaks examine the effect from the economic crises. The are two crises: the Asian Crisis and the Latin American Debt Crisis. The specifications for each crisis are tested in separate groups of countries. Since the adverse consequence of each crisis was limited to the certain countries in the region, not all but only countries affected by the crisis are tested each time. The system of equation can be transformed into

$$\begin{aligned}\psi_t - \psi_{t-1} = (\alpha_0 + \beta_{10}post)(\psi_{t-1} - (\psi_0^* + \psi_{10}^* post - (\alpha_1 + \alpha_{11}post)(u_0^* + u_{10}^* post)) \\ -(\alpha_1 + \alpha_{11}post)u_{t-1}) + \epsilon_t\end{aligned} \tag{31}$$

$$\begin{aligned}u_t - u_{t-1} = (\beta_0 + \alpha_{10}post)(\psi_{t-1} - (\psi_0^* + \psi_{10}^* post - (\beta_1 + \beta_{11}post)(u_0^* + u_{10}^* post)) \\ -(\beta_1 + \beta_{11}post)u_{t-1}) + \upsilon_t\end{aligned} \tag{32}$$

where *post* signifies the time period after or free from any crisis.

Table 1: Data Summary of Developing Countries

Country	Period	Average GDP Gap	Average Wage Share Index
Africa			
Algeria	1989-2013	-0.375	142.338
Cameroon	1993-2011	-1.074	109.694
Kenya	1970-2013	-0.055	98.656
Mauritius	1970-2010	-0.032	115.321
Morocco	1998-2013	-0.261	100.025
Namibia	1989-2014	-0.097	99.696
South Africa	1970-2014	-0.021	111.887
Tunisia	1992-2011	0.114	106.5
Asia			
China	1978-2014	0.067	114.38
Hong Kong	1980-2013	0.004	103.139
India	1980-2012	-0.17	114.508
Mongolia	1995-2009	-0.919	104.297
Philippines	1992-2012	-0.445	92.71
Singapore	1980-2012	-0.001	104.437
South Korea	1970-2008	0.35	89.074
Sri Lanka	1983-2013	-0.039	89.423
Taiwan	1981-2014	0.116	104.87
Thailand	1970-2013	0.087	86.655
Latin America			
Argentina	1993-2013	0.853	128.222
Bolivia	1988-2014	-0.044	99.037
Brazil	1992-2009	-0.539	98.707
Chile	1974-2013	-0.399	98.711
Colombia	1970-2013	-0.047	107.476
Costa Rica	1970-2013	-0.033	94.627
Dominican Republic	1991-2005	-0.455	116.714
Honduras	1992-2014	0.059	101.972
Jamaica	1998-2014	-0.466	103.342
Mexico	1980-2011	0.306	104.756
Nicaragua	1994-2011	0.045	97.696
Panama	1989-2012	-0.613	114.086
Paraguay	1994-2013	-0.192	110.402
Peru	1970-2011	-0.163	114.826
Trinidad and Tobago	1970-2009	-0.097	146.312
Venezuela	1970-2013	0.025	116.92
Middle East			

Continued on next page

Table 1 – continued from previous page

Country	Period	Average GDP Gap	Average Wage Share Index
Bahrain	1992-2014	0.416	116.265
Iran	1994-2011	0.17	105.531
Israel	1995-2011	0.366	103.957
Oman	1988-2013	-0.38	113.437
Turkey	1987-2006	0.25	97.81
Europe			
Czech Republic	1992-2008	-0.342	99.3
Poland	1991-2008	-1.513	110.219
Romania	1989-2008	-1.235	101.387

Table 2: Data Summary of Developed Countries

Country	Period	Average GDP Gap	Average Wage Share Index
Australia	1970-2008	0.037	105.716
Austria	1970-2008	0.101	106.183
Belgium	1975-2008	0.085	102.587
Canada	1970-2006	0.043	106.781
Denmark	1970-2008	0.178	98.472
Finland	1970-2008	0.199	104.596
France	1970-2009	0.049	101.658
Germany	1970-2008	0.094	105.245
Iceland	1973-2005	-0.395	83.777
Ireland	1970-2008	0.263	115.061
Italy	1970-2008	0.15	107.75
Japan	1970-2011	-0.035	100.422
Luxembourg	1970-2008	0.172	102.782
Netherlands	1970-2008	0.097	104.895
Norway	1970-2009	0.086	116.03
Portugal	1977-2010	0.179	88.959
Spain	1980-2008	0.135	98.63
Sweden	1970-2008	0.15	105.785
UK	1970-2005	-0.044	101.155
US	1970-2011	-0.002	105.732

Figure 1: A profit-led/profit-squeeze Structuralist Goodwin Model with stable wage share dynamics (upward-sloping Distributive Nullcline and downward-sloping Utilization Nullcline)

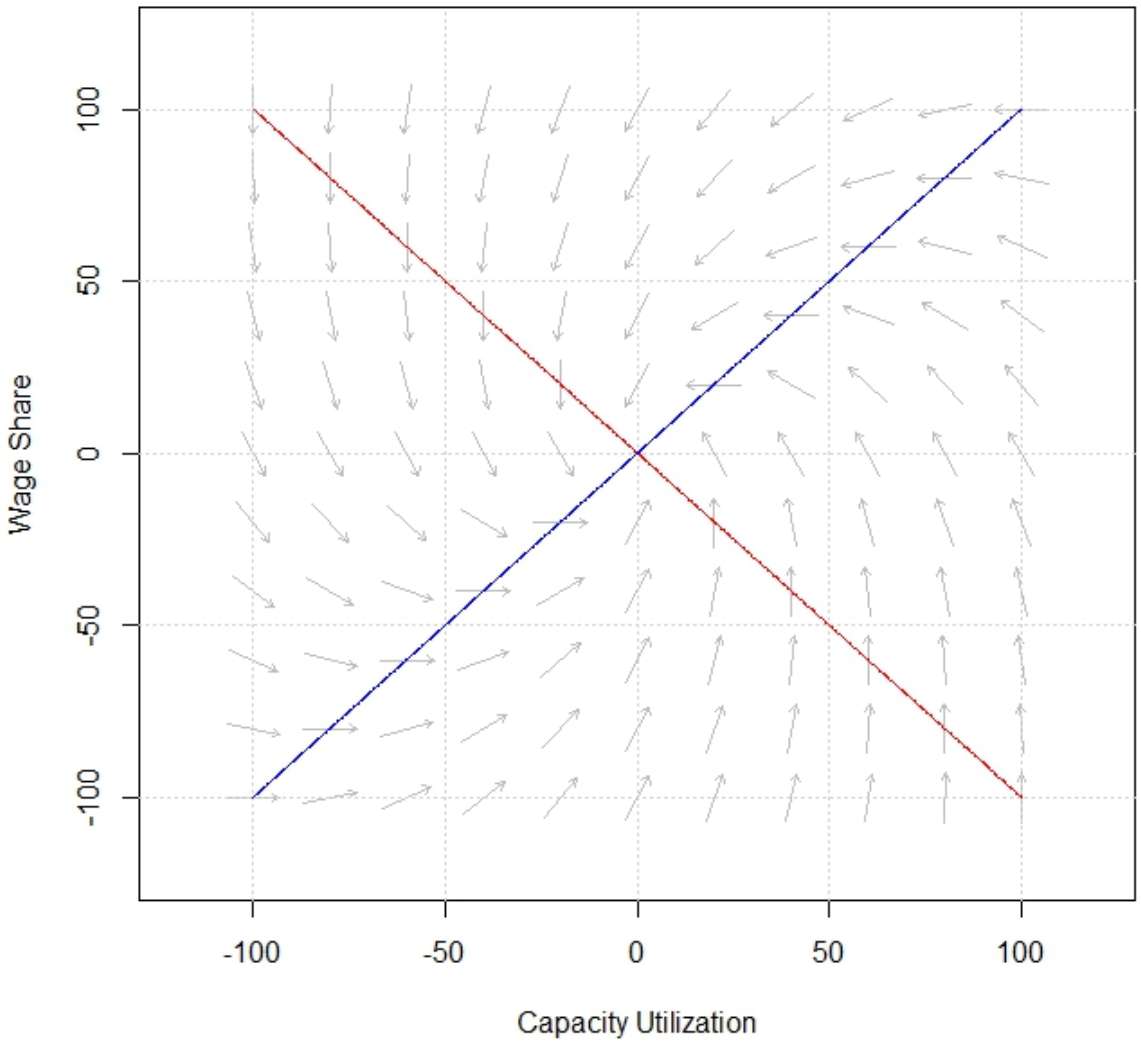

Figure 2: A wage-led/wage-squeeze Structuralist Goodwin Model with stable wage share dynamics (downward-sloping Distributive Nullcline and upward-sloping Utilization Nullcline)

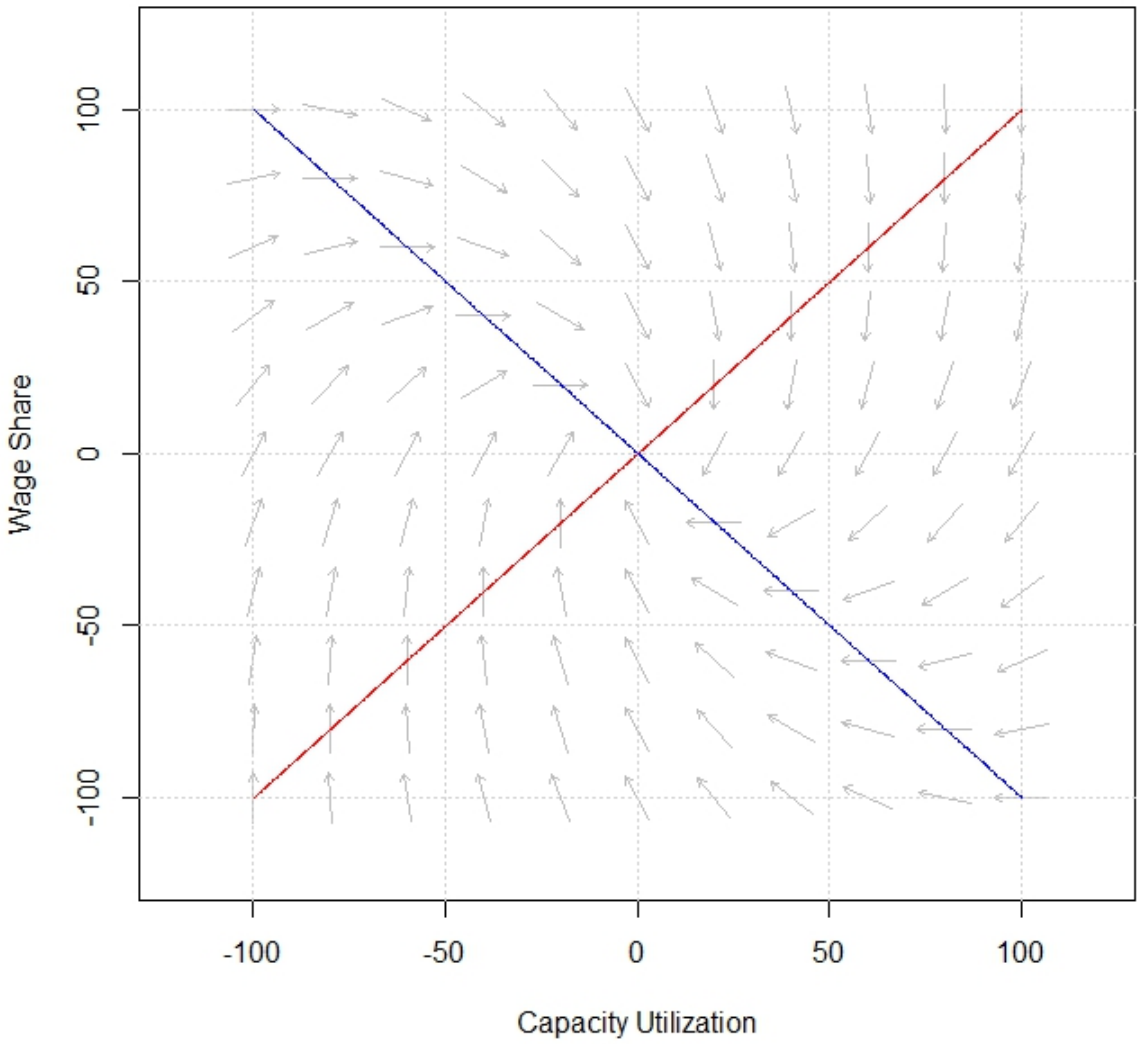

Figure 3: A profit-led/wage-squeeze Structuralist Goodwin Model with unstable wage share dynamics (downward-sloping Distributive Nullcline and downward-sloping Utilization Nullcline

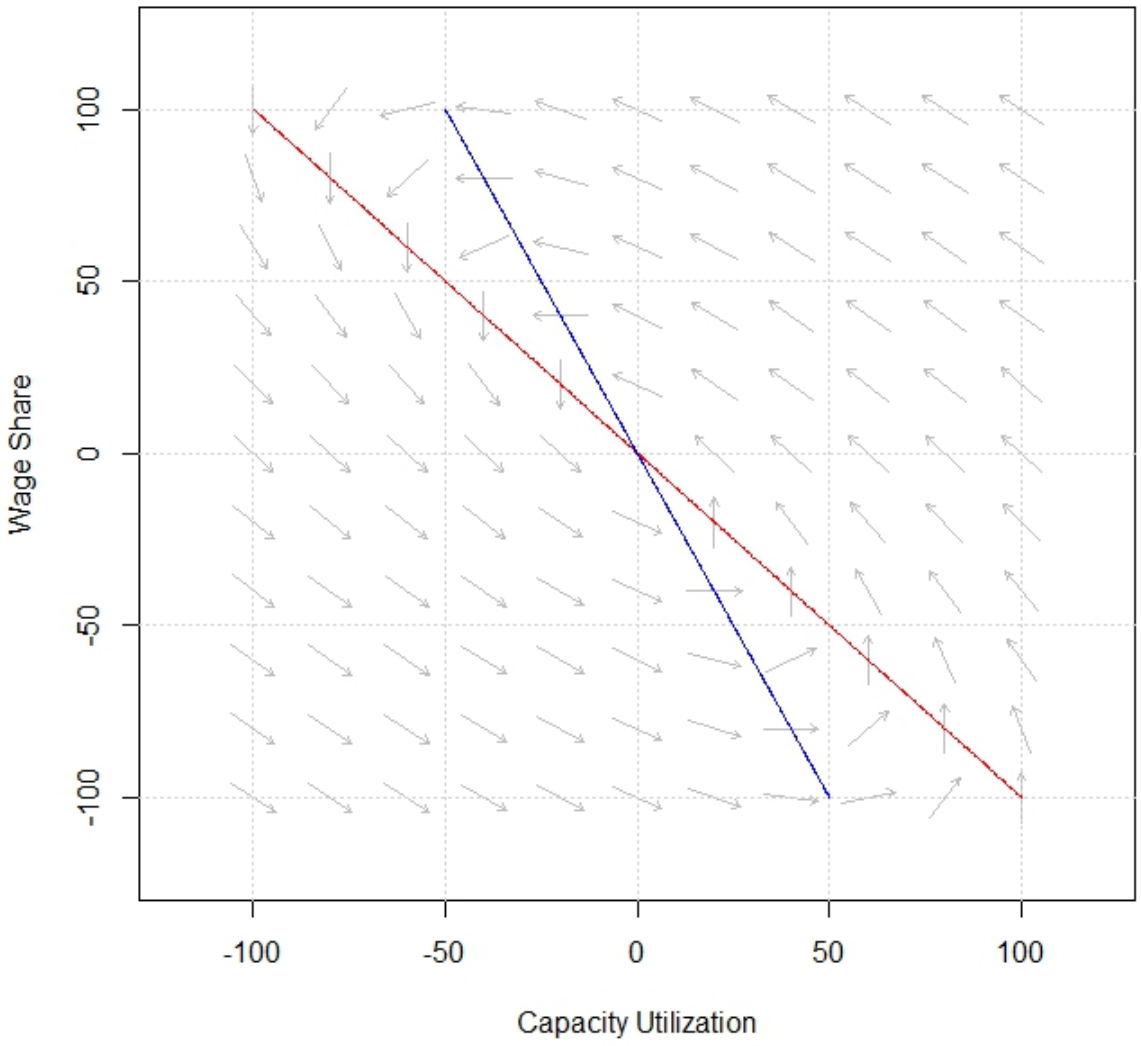

Figure 4: Original and Adjusted Wage Share of Brazil (absolute numbers)

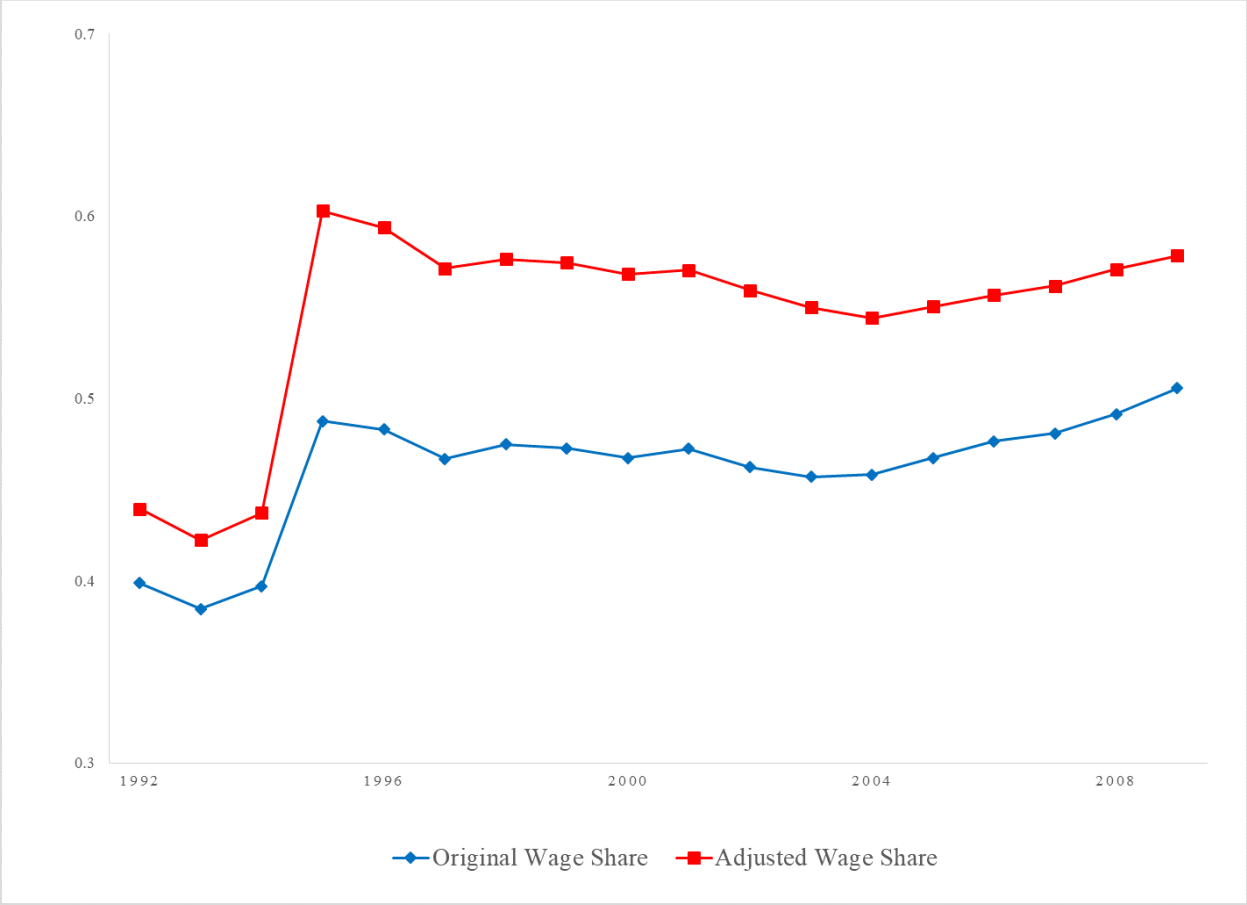

Figure 5: Decreasing Wage Share Trends in Developed Countries

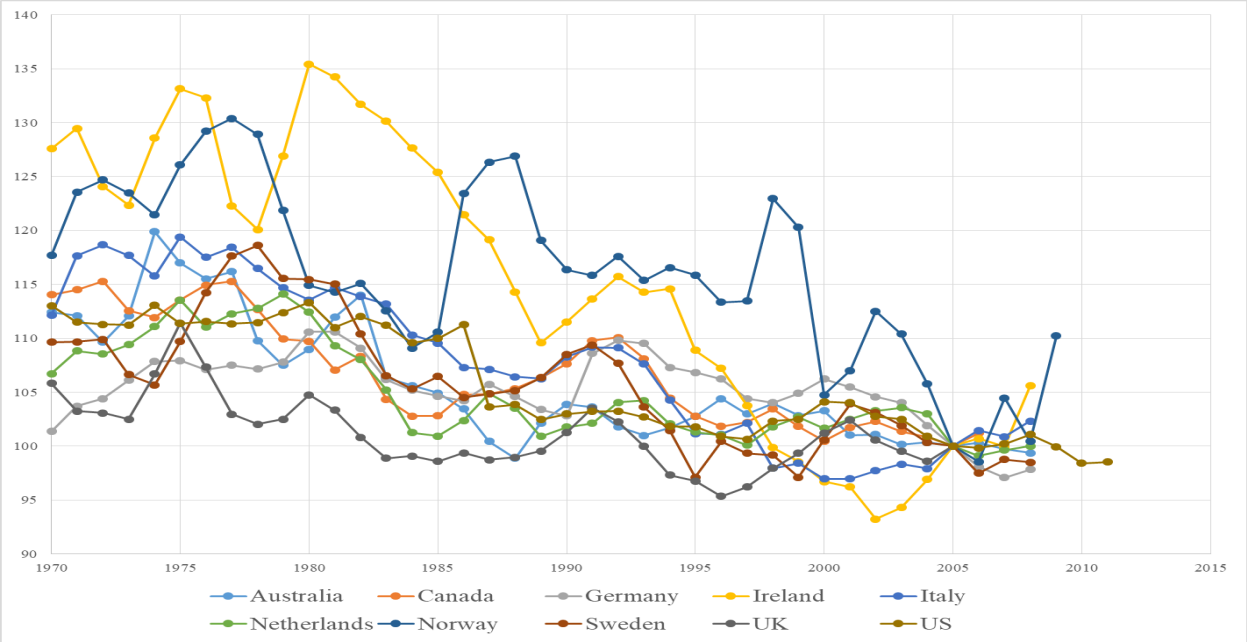

Figure 6: Increasing Wage Share Trends in Developed Countries

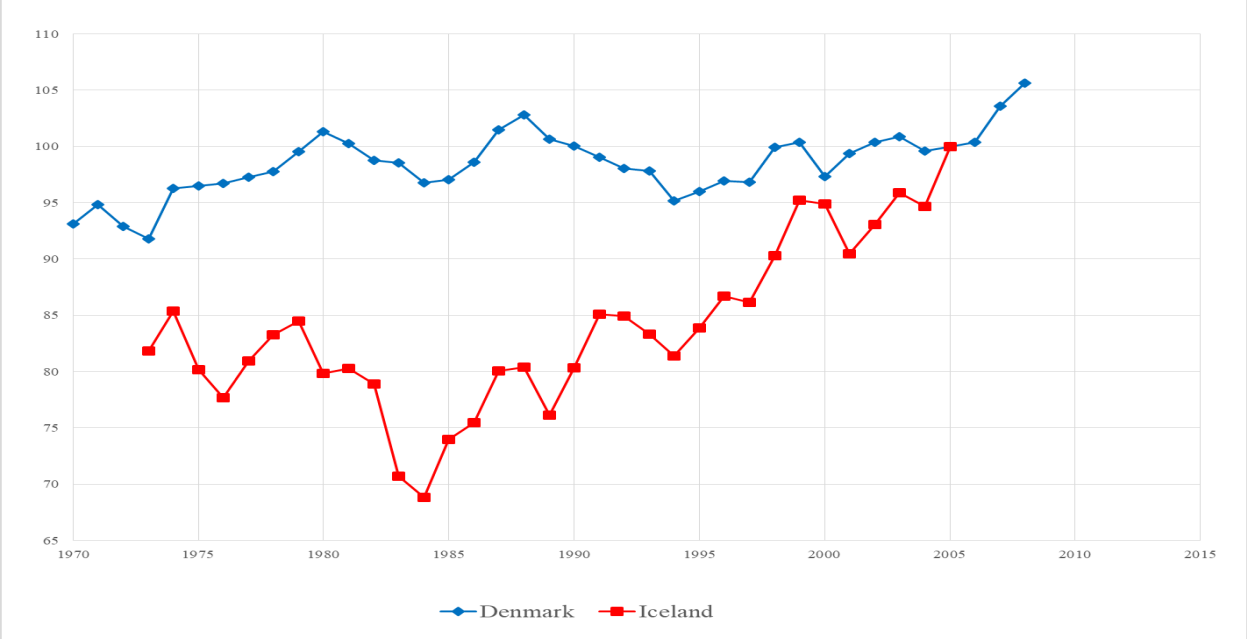

Figure 7: Decreasing Wage Share Trends in Developing Countries

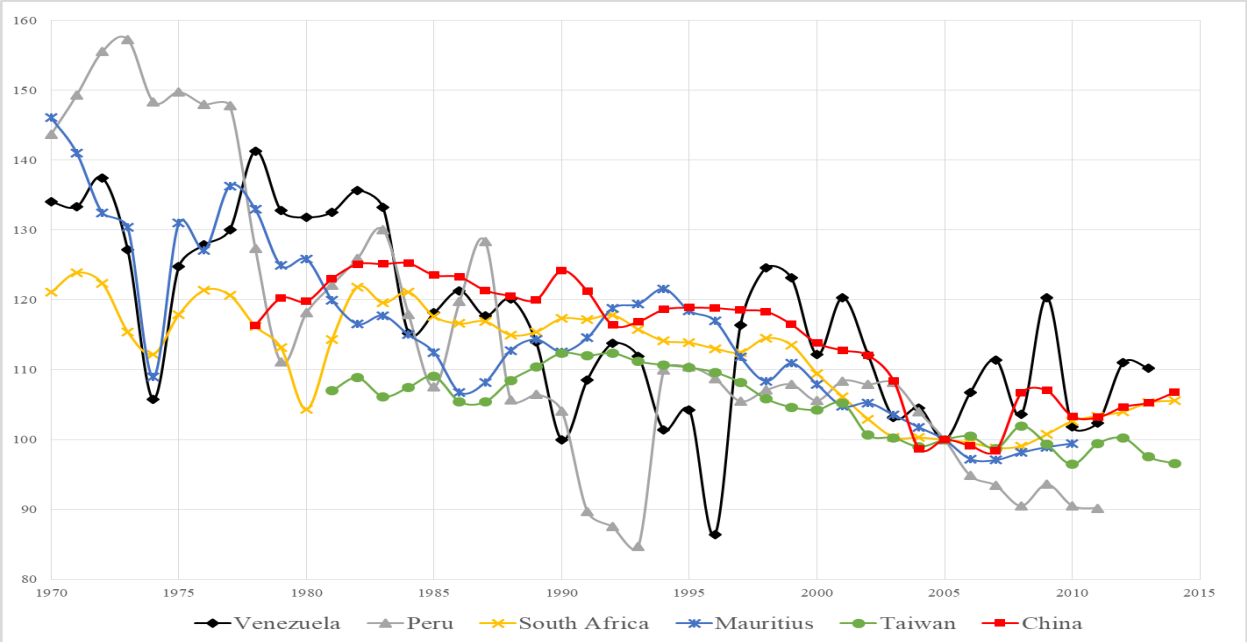

Figure 8: Increasing Wage Share Trends in Developing Countries

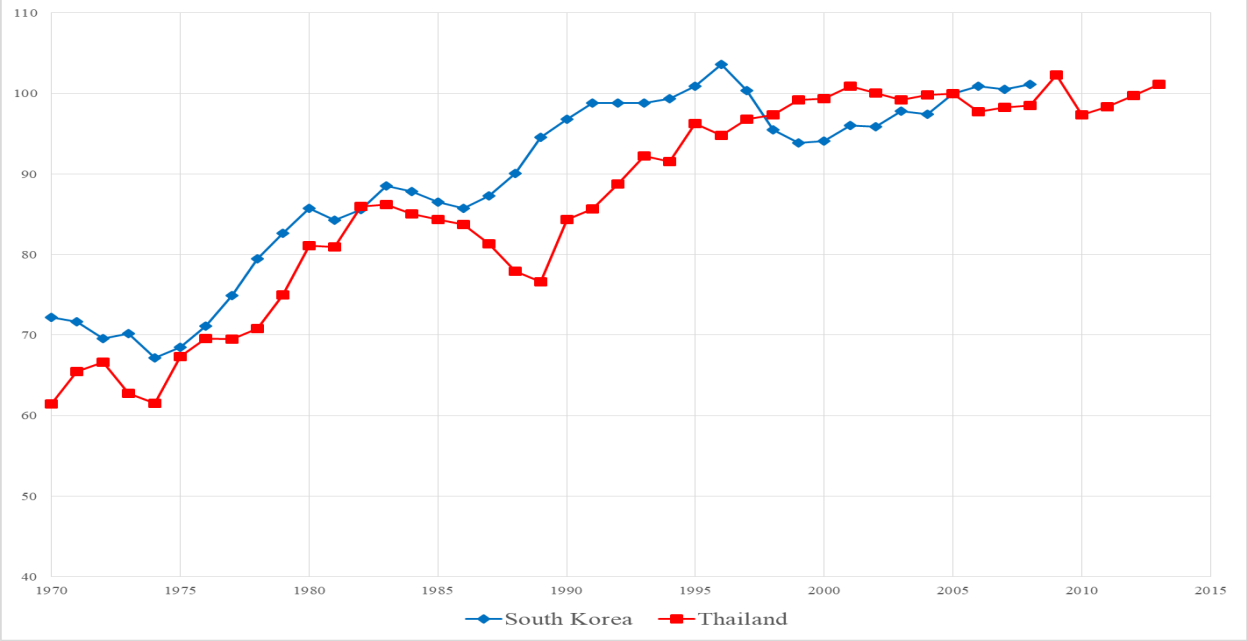

Figure 9: Trajectories from NAIRU

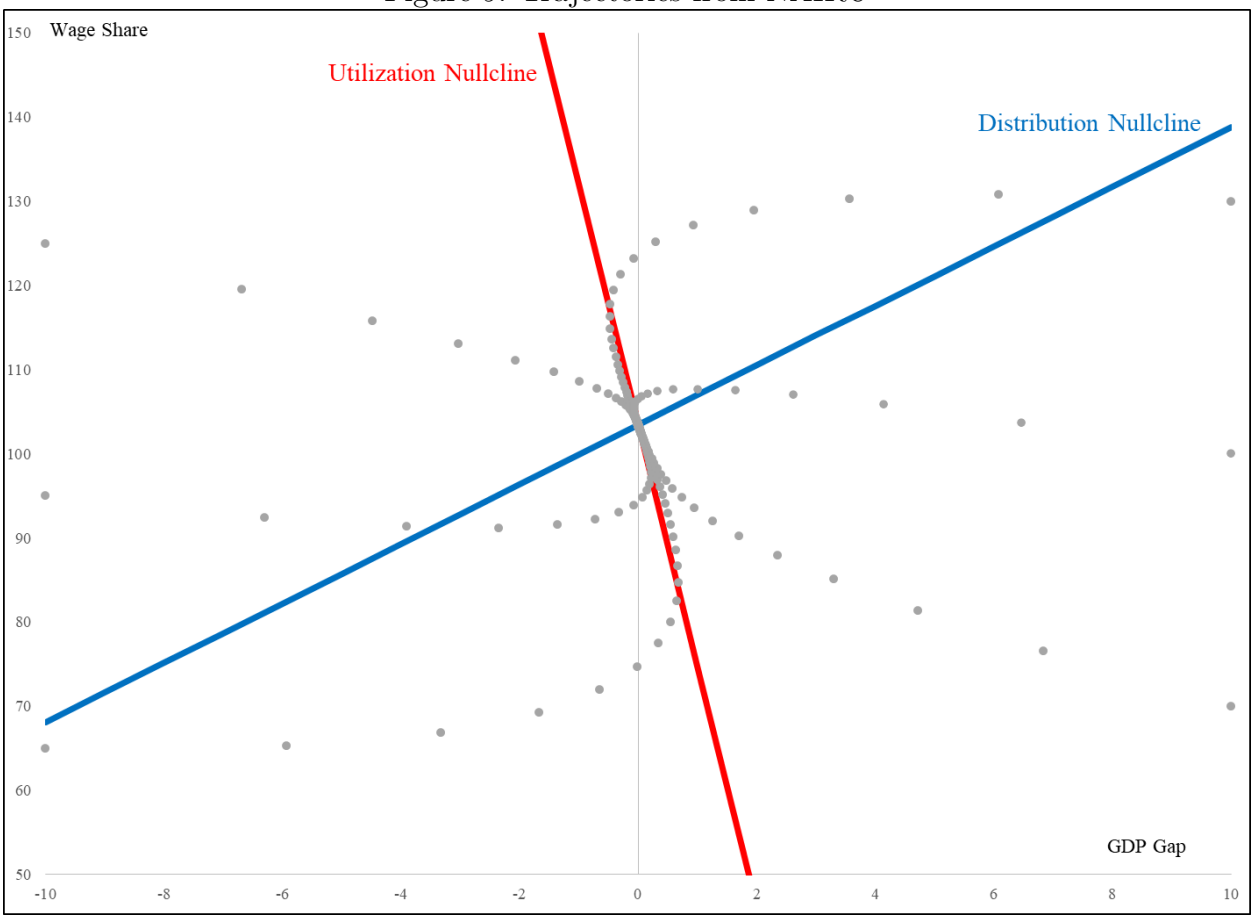

Figure 10: Long run linear Trend estimates of state variables

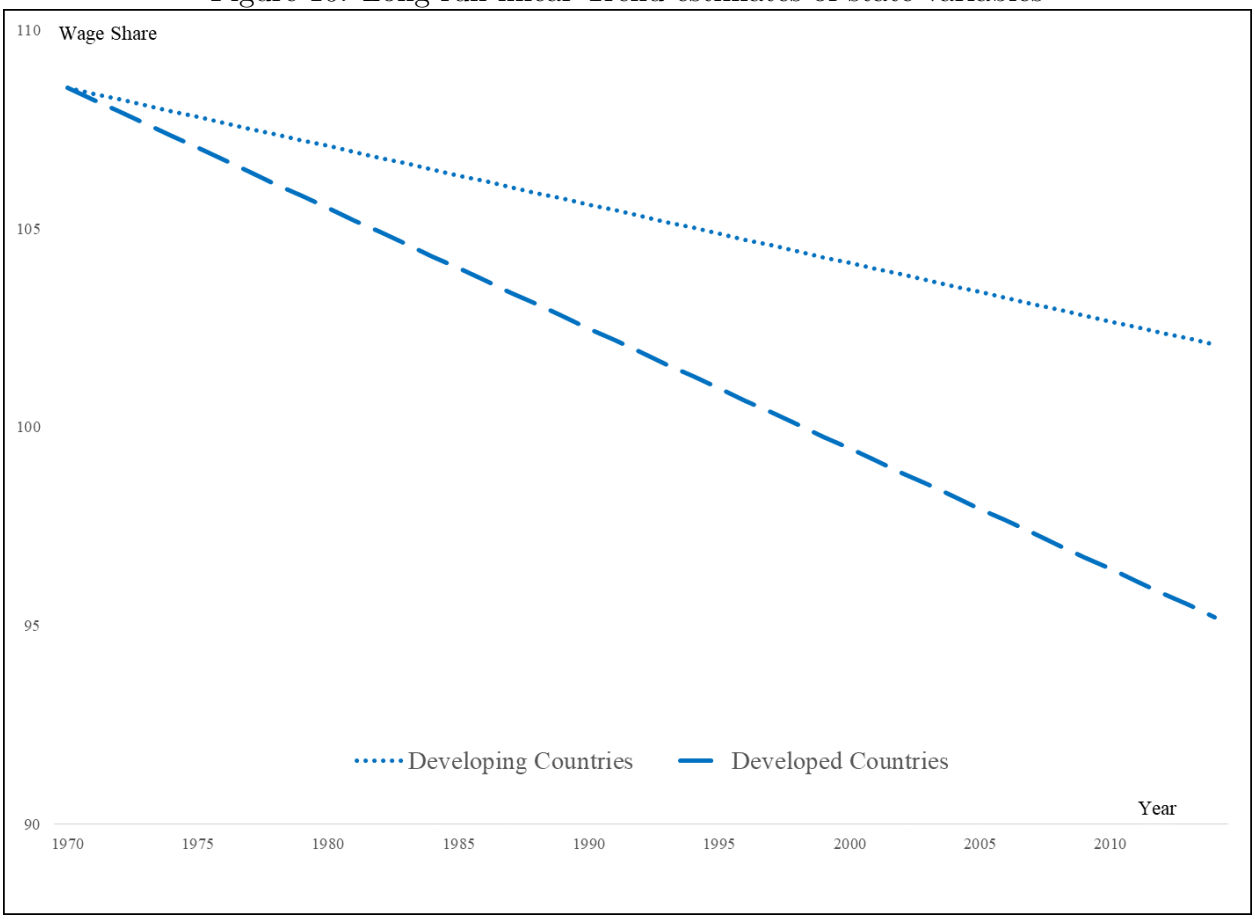

Figure 11: Comparison of NAIRU Developed vs Developing Countries' Regimes

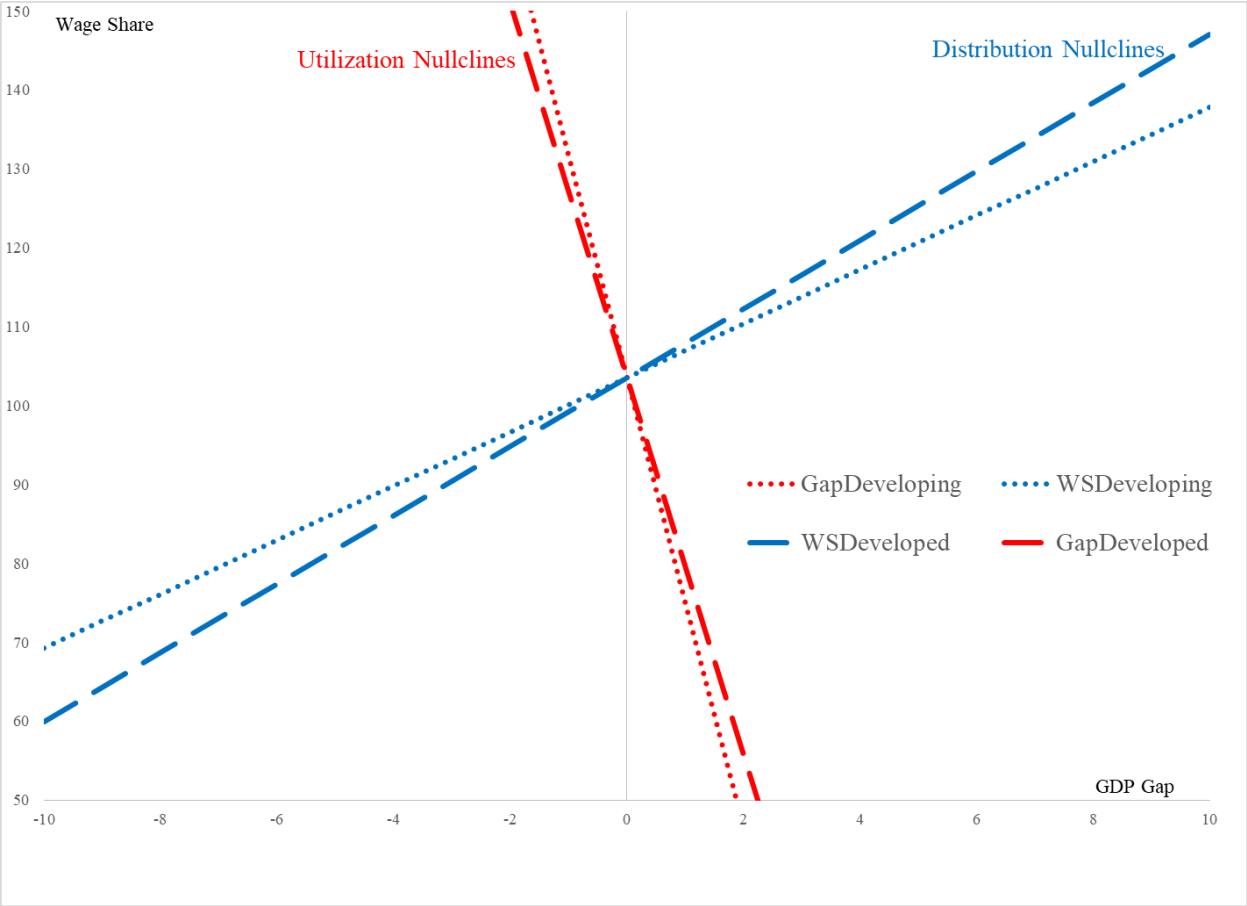

Table 3: Econometric Results (t-statistics in the parentheses)

Coefficients	NAIRU	NAIRU Relaxation	Relaxation with linear trend
Wage Slope (α_1)	3.536	3.626	3.547
	(35.296)	(32.894)	(33.339)
Utilization Slope (β_1)	-28.625	-30.053	-29.365
	(-14.521)	(-13.187)	(-13.286)
Wage Share Scaling (α_0)	-0.095	-0.093	-0.095
	(-44.078)	(-42.109)	(-42.844)
Utilization Scaling (β_0)	-0.013	-0.012	-0.012
	(-14.831)	(-13.239)	(-13.286)
Long Run Wage Intercept (ψ_0^*)	103.419	103.646	107.828
	(511.3)	(397.704)	(205.519)
Long run Utilization intercept (u_0^*)		0.044	0.027
		(0.91)	(0.248)
Long run Wage trend (ψ_1^*)			-0.169
			(-8.76)
Long run Utilization trend (u_1^*)			0.0008
			(0.21)
Schwarz Criterion	2221.427	2197.185	2296.467

Table 4: Econometric Results by Regions (t-statistics in the parentheses)

Region	Wage Share Slope	Utilization Slope	Type	Dynamics
Africa	4.63	-32.322	Profit-Squeeze/Profit-led	Stable
	(14.905)	(-14.656)		
Asia	3.324	-29.067	Profit-Squeeze/Profit-led	Stable
	(21.804)	(-14.146)		
Europe	1.648	-21.921	Profit-Squeeze/Profit-led	Stable
	(4.06)	(-12.283)		
Latin America	3.45	-26.464	Profit-Squeeze/Profit-led	Stable
	(19.423)	(-14.027)		
Middle East	3.884	-34.172	Profit-Squeeze/Profit-led	Stable
	(7.42)	(-12.074)		
Developed Countries	4.372	-23.27	Profit-Squeeze/Profit-led	Stable
	(34.559)	(-14.042)		
Schwarz Criterion	2121.447			

Table 5: Econometric Results of Developed/Developing Countries (t-statistics in the parentheses)

Coefficients	NAIRU	
	Developing Countries	Developed Countries
Wage Slope (α_1)	3.427	4.356
	(28.1)	(34.872)
Utilization Slope (β_1)	-28.314	-23.739
	(-14.976)	(-13.947)
Wage Share Scaling (α_0)	-0.094	
	(-43.921)	
Utilization Scaling (β_0)	-0.013	
	(-15.182)	
Long Run Wage Intercept (ψ_0^*)	103.512	
	(494.821)	
Schwarz Criterion	2135.219	

Table 6: Econometric Results of Developed/Developing Countries with Linear Trends (t-statistics in the parentheses)

Coefficients	Relaxation with Linear Trend	
	Developing Countries	Developed Countries
Wage Slope (α_1)	3.314	4.277
	(27.731)	(33.211)
Utilization Slope (β_1)	-29.625	-28.49
	(-12.904)	(-12.521)
Wage Share Scaling (α_0)	-0.097	
	(-44.368)	
Utilization Scaling (β_0)	-0.012	
	(-12.972)	
Long Run Wage Intercept (ψ_0^*)	108.588	
	(210.9997)	
Long run Utilization intercept (u_0^*)	-0.081	
	(-0.786)	
Long run Wage trend (ψ_1^*)	-0.147	-0.303
	(-7.6)	(-13.186)
Long run Utilization trend (u_1^*)	0.004	0.005
	(0.965)	(1.199)
Schwarz Criterion	2275.98	

Table 7: Econometric Results of Structural Breaks (t-statistics in the parentheses)

Coefficients	Asian Crisis	Latin American Debt Crisis
Wage Slope (α_1)	6.604	5.827
	(2.587)	(2.115)
Utilization Slope (β_1)	97.276	-11.437
	(0.368)	(-2.534)
Wage Share Scaling (α_0)	-0.03	-0.055
	(-3.075)	(-2.227)
Utilization Scaling (β_0)	0.003	-0.025
	(0.369)	(-2.739)
Long run Wage Intercept (ψ_0^*)	117.253	110.619
	(13.633)	(25.962)
Long run Utilization Intercept (u_0^*)	0.949	0.686
	(1.068)	(1.591)
Shift in wage slope (α_{11})	-4.64	-3.44
	(-1.799)	(-1.225)
Shift in Utilization slope (β_{11})	-110.871	-23.65
	(-0.419)	(-1.224)
Shift in Wage Share Scaling (α_{10})	-0.038	0.013
	(-2.492)	(1.176)
Shift in Utilization Scaling (β_{10})	-0.181	-0.063
	(-6.201)	(-2.069)
Shift in Long run Wage (ψ_{10}^*)	-15.763	-9.662
	(-1.827)	(-2.126)
Shift in Long run Utilization (u_{10}^*)	-1.311	-1.135
	(-1.376)	(-2.092)
Schawarz Criterion	1870.598	3469.666