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A Reformulation of Post-Keynesian Model of Effective Demand, Income Distribution, and Endogenous Money

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A Reformulation of Post-Keynesian Model of Effective Demand, Income Distribution, and Endogenous Money

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Abstract

The objective of this paper is to propose an alternative viewpoint of looking at the relationship between functional income distribution and effective demand. This paper tries to analyze this relationship by integrating Kaldor's theory of income distribution (Kaldor, 1966) and the post-Kaleckian growth model (Bhaduri and Marglin, 1990; Kurz, 1990, 1994; and Marglin and Bhaduri, 1990, 1991).

Utilizing the neo-Pasinetti theorem formulated by Araujo (1995), we will modify slightly Lavoie's paper (1998) which tries to integrate the Kaldor's theory of income distribution and the neo-Kaleckian growth model. Introduction of post-Kaleckian growth model shows that both of wage-led and profit-led growth regimes are possible. This paper also tries to consider the endogenous money in the Kaldor's theory of income distribution following the suggestion of Park (2004). We show that the ratio of bank-loan out of investment has a neutral effect to the growth rate of capital stock when the interest rate has an equivalent value as suggested by the Pasinetti theorem, i.e. the growth rate over the retention ratio.

Finally, this paper tries to analyze the growth regime of South Korea by using VAR approach which was proposed by Stockhammer and Onaran (2004). We obtain results which support that further growth can be realized by reducing the profit share in South Korea, as its size of an economy has become larger and the monopolistic markets are still dominant. And we find that the nature of wage-led growth regime in Korea depends on the states of the incomes of the self-employed.

Keywords: Post-Keynesian economics; Income distribution; Neo-Pasinetti theorem; Endogenous money; Kaleckian growth model; Wage-led growth

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1 Introduction

The objective of this paper is to propose the different viewpoint of looking at the relationship between the functional income distribution and economic growth.[1] The concern on this issue is very old since classic economics, but it is not a hot topic until recently. Recently there have been intense debates not only on the current state of income distribution or policies for reducing the inequality (Atkinson, 2015; Eckhard, 2014), but also on the meaning of the inequality concepts and its political impacts (Bauman, 2013). A recent concern of research can be partly attributed to Piketty's work (Piketty, 2014). On the basis of the long-term series of data, he strongly maintains that there is high possibility of the recurrence of patrimonial capitalism.

There is a causal relation linking slower growth to larger profit share in Piketty's framework. Unlike Piketty, we try to view the relation between growth and functional income distribution from the reverse angle linking the larger profit share to slower rate of growth, on the basis of Michal Kalecki's growth model. The most important and distinguishable feature of Kalecki, one of pioneers in the Post-Keynesian macroeconomics, is strong emphasis on the importance of the effective demand in the economy (Harcourt, 2006. p.114). Post-Keynesians believe that the effective demand is strongly related to the functional income distribution and suggest that functional income distribution should be integrated into the growth theory as key variable in order to solve the "knife-edge growth problem" of the model developed by Harrod (1939; 1948). One of results from these attempts is known as neo-Pasinetti theorem derived from Kaldor's theory of income distribution and growth (Kaldor, 1966). This theorem is our starting point.

Section 2 covering a basic Kaleckian model explains the foundational concept of the Pasinetti theorem (Pasinetti, 1962) which is an original result to develop neo-Pasinetti theorem. The Pasinetti theorem tells us that the long-term equilibrium rate of profit is apparently determined independently of the saving behavior of workers. To reject this radical theorem, several neo-classical authors proposed the dual equilibria problem (Meade, 1966; Samuelson and Modigliani, 1966). The neo-Pasinetti theorem was derived by Kaldor so as to deal with the response of the neo-classical economists. We present the neo-Pasinetti theorem by following Araujo (1995) and briefly explain the meaning of its institutional background. However, we should point out that the neo-Pasinetti theorem itself does not fully explicate the endogeneity of growth rate of capital stock (Eckhard, 2014) and the need to take consideration of the endogenous money in the neo-Pasinetti theorem should be mentioned as well (Skott, 1981).

[1] The functional income distribution concerns about how the national income is composed of wage and profit. We should carefully distinguish it from the individual income distribution.

Then, following Lavoie (1998), we integrate the neo-Kaleckian framework of growth into the Kaldor's theory of income distribution based on the neo-Pasinetti theorem. This integration can shed light on the relation between the growth rate of capital stock and the profit share more clearly. It is because the integration of neo-Kaleckian growth model allows the growth rate to be determined within the model. However, it should be noted that this integration has a critical drawback, in that it only results in the wage-led growth regime, implying that the lower profit share always leads to higher growth rate.

Section 3 introduces the endogenous money into the Kaldor's theory of income distribution following the work of Park (2004). By introducing endogenous money, we find that the implication of the neo-Pasinetti theorem is still valid, even when we accept an alternative view of money, i.e. the accommodationist view in which the total amount of money is fully accommodated endogenously according to the demand of money necessary for economic activities. However, we also admit that the introduction of endogenous money itself does not drastically change how the characters of growth regimes are determined. Thus, we check out that the possibility of the profit-led growth regime by introducing the post-Kaleckian investment function into the Kaldor's theory of income distribution with endogenous money and show that the profit-led growth regime can be observed when the profit share is high enough. The result of this section also shows that the increase in the proportion of investment financed through bank loans may decrease or increase the growth rate depending on both values of the loan interest rate and the retention ratio.

Section 4 deals with empirical analysis on the South Korean economy. After reporting summary results of recent empirical works, we conduct another empirical analysis to see if the Korean economy fits the pattern of either wage-led or profit-led growth. Several results of the analysis based on single equation approach show that South Korea has a wage-led growth regime. We follow the VAR approach to analyze whether or not South Korea is wage-led growth regime, following such as Stockhammer and Onaran (2004); Onaran and Stockhammer (2005). The results of VAR analysis suggest that Korea has the wage-led growth regime especially when we consider a part of the incomes of the self-employed as a labor income.

Section 5 summarizes several results of the models and concludes that the nature of the wage-led growth regime in Korea depends on the incomes of the self-employed.

2 A basic Kaleckian model

2.1 Harrod-Domar growth model and Pasinetti theorem

The principle of effective demand suggested by Keynes (1936) and Kalecki (1971) in the 1930s is that the performance of the capitalism economy is limited by the constraints of demand side not only in the short run but also even in the long run (Eckhard, 2014. p.225). In particular, the level of the investment is one of the most important elements that determines the general amount of production and employment in the whole economy. In this context, there were attempts to justify this principle in the long term, and its result is known as the Harrod-Domar growth model. Their conclusion is that the golden age growth rate which satisfies the full employment and full operation of capital capacity simultaneously can be achieved by only a chance. The condition for the golden age growth rate which guarantees the equality of saving and investment must be equal to given rate of technical progress and population:

$$\lambda + \theta = \frac{s}{\beta} \qquad (1)$$

where λ, θ, s, and β are the growth rate of population, the rate of technical progress, the total propensity to save and the capital-output ratio respectively.

In order to achieve full employment, the growth rate of the economy must be equal to the left-hand side of the equation (1). When this condition is satisfied, the growth rate is called as the natural rate of growth. The right-hand side of the equation (1) indicates the propensity to save over the capital-output ratio. If the growth rate is equal to this right-hand side, total investment must be identical to total saving (See footnote 29 for the proof). This is called as the warranted rate of growth, because the economy achieves the full utilization of capacity under this rate of growth. Harrod and Domar thought, however, that maintaining the golden age growth rate which can be achieved under the equation (1) would be possible only by a chance, since they regard these four variables as exogenously given.

After Harrod's formulation, there were several solutions to make one of the four variables be endogenously determined in the model. In contrast to the choice of the capital-output ratio made by neo-classical growth (Solow-Swan) model (Solow, 1956; Swan, 1956), many Post-Keynesian authors choose the total propensity to save as an endogenous variable in their growth model (Kaldor, 1956). Given the natural rate of growth and fluctuations in the decision of making investment, the long term steady-state growth can be obtained through the change in the income distribution between profit and wage in the Post-Keynesian growth

models.[2] The most famous and simple example of the Post-Keynesian growth model's result is the Pasinetti theorem (Pasinetti, 1962) and the theorem is also known as Cambridge saving equation:

$$g = s_c r \quad \text{or} \quad r = \frac{g}{s_c} \qquad (2)$$

where s_c is the capitalists propensity to save, g and r are growth rate of capital stock and the profit rate respectively.

The long-run steady-state growth rate of capital stock is apparently equal to the rate of profit multiplied by capitalist's propensity to save, which is higher than worker's, even though there exists worker's saving. To refute against the dramatic implication of Pasinetti's equation, several neo-classical economists make an assumption that workers' propensity to save is equal to the capitalists'. In this case, steady-state equilibrium of the model should be achieved by adjustment of the capital-output ratio (Samuelson and Modigliani, 1966; Meade, 1966). The co-existence of two equilibria, i.e. the Cambridge saving equation and the neo-classical anti-Pasinetti theorem, is called as the dual path of long-term growth. We will introduce one of solutions to the dual path problem following the Cambridge tradition known as the neo-Pasinetti theorem in the next section.

2.2 Kaldor's theory of income distribution with neo-Kaleckian growth model[3]

Kaldor suggested the distribution and growth model based on class division framework for the first time (Kaldor, 1956), and tried to overcome the dual path problem by adopting the institutional distinction of agents between household and corporation. In other words, he replaced the saving propensity of capitalists with the retention ratio of corporation. He wanted "to clarify the reasons why the savings propensity out of profits must be considerably greater than the savings propensity out of wages and salaries, or of household incomes in general." (Re-cited from Lavoie, 1998. p.418) By replacing the retention ratio, he can explain why $s_c > s_w$ can be observed in terms of empirical analysis. Then the possibility of anti-Pasinetti equilibrium implied by some neo-classical authors can be refuted. Following Araujo (1995), we

[2] We can point out that the Post-Keynesian growth theory is dependent on the class conflicts.

[3] This section refers to Lavoie, Marc. "The neo-Pasinetti theorem in Cambridge and Kaleckian models of growth and distribution." Eastern Economic Journal (1998): 417-434.

will derive the neo-Pasinetti theorem with assumptions of no fiscal and foreign sectors.

Derivation of the effective demand curve and financial market curve

The equation (3) represents the condition for equating the savings with the investments. From the equality between saving and investment, we can derive one basic equation of the model. More specifically, the growth rate can be divided into three parts. First square brackets term indicates the savings out of wage and dividend distributed from corporations. Note that wage is expressed as the utilization ratio ($u \stackrel{\text{def}}{=} \frac{Y}{Y^p}$) over the capital-potential output ratio ($k \stackrel{\text{def}}{=} \frac{K}{Y^p}$) minus profit rate ($r$). The second term represents consumption out of capital gains[4] and the last term is the savings out of the retained profits in the corporations:

$$g = s_h\left[\left(\frac{u}{k} - r\right) + \left(1 - s_f\right)r\right] - (1 - s_h)(v - x)g + s_f r \qquad (3)$$

where s_h stands for the saving propensity of household and s_f is the retention ratio of corporations.

Note that both sides are normalized by capital stock (K). This implies that all variables expressed as the ratio over K. Hence, the equation (3) means that the growth rate of capital stock ($g = \frac{I}{K}$) must be equal to the total savings rate. If we express the profit rate (r) as a function of the valuation ratio (v), then we obtain the following result:

$$r = \frac{g[1 + (1 - s_h)(v - x)] - s_h\frac{u}{k}}{s_f(1 - s_h)}. \qquad (4)$$

[4] The propensity to consume out of capital gains is assumed to be equal to one minus the propensity to save out of household income here. But, Kaldor (1966) himself designated the propensity to consume out of capital gains in his argument. No matter how we choose it, the results are the same.

The capital gain (G) equation can be obtained by considering the definition of valuation ratio ($v = \frac{pN}{K}$). This can be rewritten as $vK = pN$. If we calculate the total derivative of this equation,

$$dvK + vdK = dpN + pdN$$

can be obtained. In the steady-state growth, dv must be zero. And by definition $G = dpN$, $xgK = pdN$. By using this definition, capital gain (G) equation

$$\mathrm{G} = (v - x)gK$$

is obtained.

Because this curve represents the locus of the profit rates and the valuation ratio satisfying the condition for the equation between savings and investments, it can be named as the effective demand curve. And we can confirm that the slope of this curve is positive since $1 - s_h$ is larger than 0.[5] Since larger consumption out of capital gains means that the larger demand of equities in the stock market, its price and the valuation ratio should be higher.

Likewise, we can derive an equation which represents the condition for the equilibrium in the stock market. That is because there are transactions for equities of corporations in this model and its supply and demand must be same to achieve an equilibrium. The left-hand side of the equation (5) represents the supply side of equity. The corporation will issue new equities for their accumulation or new investment, which means that they have to sell newly issued equities in the stock market. Wage earners also should sell their equities in order to use capital gains for consumptions, which is represented by the second term in the left-hand side of the equation (5). And the right-hand side of the equation (5) expresses saving part from household, which absorbs the supply of equities:

$$xg + (1 - s_h)(v - x)g = s_h\left[\left(\frac{u}{k} - r\right) + \left(1 - s_f\right)r\right]. \qquad (5)$$

In a similar way adopted in the derivation of equation (4), we can derive the locus of the profit rate and the valuation ratio, which satisfies the equilibrium condition of the stock market. And this is why the result is called as the financial market curve. Note that it shows a negative relation between the profit rate and the valuation ratio, because $-g(1 - s_h)$ is lower than zero.[6]

$$r = \frac{-g[(1 - s_h)v + xs_h] + s_h\frac{u}{k}}{s_h s_f}. \qquad (6)$$

By the equations (4) and (6), we can derive the two equilibrium variables $(r*, v*)$

[5] The positivity of this curve is also confirmed by Lavoie. "In the product market, a higher profit rate, associated with higher savings, must be compensated by a higher valuation ratio, associated with larger dissavings out of capital gains." (Lavoie, 1998. p.420)

[6] The negative slope of the financial market curve can be explained as follows. "An increase in the rate of profit diminishes the share of output left to households: hence it diminishes the demand for equities. This must be compensated by a decrease in the supply of equities." (Lavoie, 1998. p.420)

which fulfill the both conditions of effective demand and the financial market clearing of supply and demand. Especially, the equilibrium level of the profit rate is determined by solely the behavior of the corporations such as the accumulation rate (g), the share of issuing equity in new investment (x), and their retention ratio (s_f):

$$r * = \frac{(1-x)g}{s_f}. \qquad (7)$$

When x is zero, (7) is reduced to $r * = \frac{g}{s_f}$ which is very similar with Pasinetti theorem (2). This is why the result of the Kaldor's theory of income distribution is called as the neo-Pasinetti theorem. In addition, the valuation ratio also is determined at the intersecting point between two curves (4), (6), and the result is given equation (8).[7]

$$v * = \left[\frac{s_h}{(1-s_h)k}\frac{1}{g}\right]u - \left(\frac{s_h}{1-s_h}\right). \qquad (8)$$

By introducing the valuation ratio in the Post-Keynesian growth model, Kaldor could make it more realistic than growth models previously developed among the Post-Keynesians. That is because the model is based on the institutional distinction and has the balancing mechanism such as a change in the valuation ratio. Many authors, however, cast doubt on the fact that the valuation ratio can be any number but unity even in the long run (Moss, 1976; Lavoie, 1987; Crotty, 1990). If we set the valuation ratio to be unity in the long run, the result of neo-Pasinetti theorem will not be held on. Some authors analyze the meaning of the valuation ratio determined within the model (Moss, 1978). There were also a criticism that the model did not contain the endogenous money that is strongly supported by many Post-Keynesians and even Kaldor himself (Davidson, 1978. chap12; Park, 2004). And it is also pointed out that the model implicitly assumes the exogenous accumulation rate with the state of full employment (Eckhard, 2014. p.136; Lavoie, 1996a).

From now on, we will show that Kaleckian idea can be integrated into the Kaldor's theory of income distribution with the endogenous valuation ratio. This integration can

[7] And Eckhard points out that "this 'valuation ratio' is the balancing mechanism, which makes sure that spending out of capital gains is just equal to saving from current income minus new issues of securities by corporations." (Eckhard, 2014. p.136)

determine the growth rate of capital stock within the model and be a solution to the criticism about the implicit assumption of exogenously given growth rate of capital stock in Kaldor's theory of income distribution.

The extension to neo-Kaleckian growth model

Firstly, we have to understand the so-called profit-cost function (9). This is a simple separation from the definition of the profit rate itself (Weisskopf, 1979). The term, m represents the profit share of the economy and u is the utilization ratio which is defined as $\frac{Y}{Y^p}$, where Y^p stands for the potential output. And capital-potential output k is defined as $\frac{K}{Y^p}$.

$$r \stackrel{\text{def}}{=} \frac{P}{K} = \frac{P}{Y}\frac{Y}{Y^p}\frac{Y^p}{K} = \frac{mu}{k}. \qquad (9)$$

And if we use the concept of mark-up (h)[8] that indicates the pricing power of firms, the profit share can be rearranged as follows. The term, p stands for the average price of a commodity and W is a total wage.

$$m \stackrel{\text{def}}{=} \frac{P}{pY} = \frac{pY - W}{pY} = \frac{h}{1+h}. \qquad (10)$$

As firms have larger pricing power, the profit share must increase following one-to-one relationship as given in the equation (10).

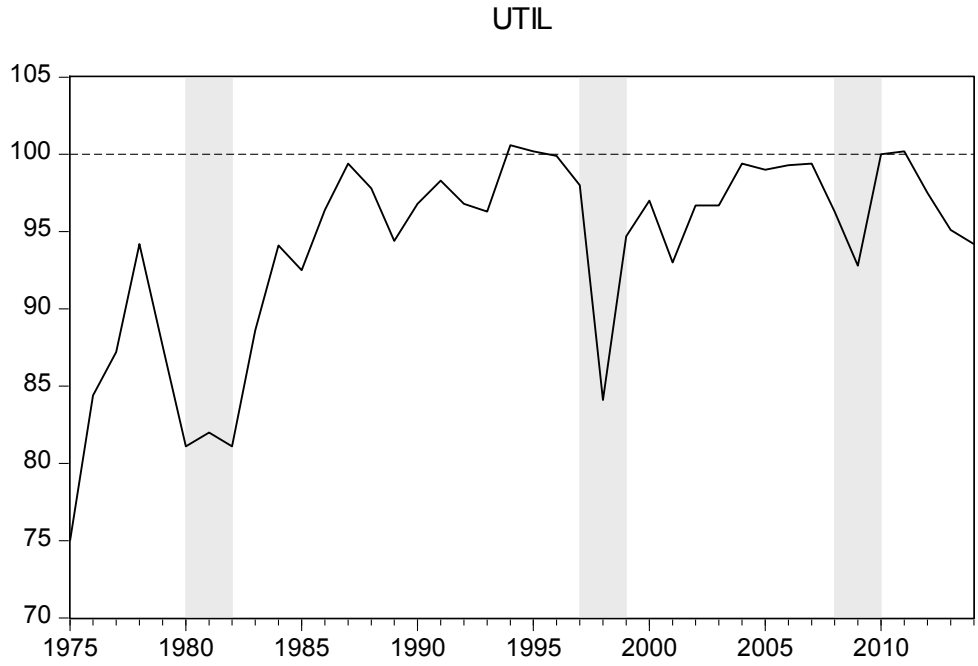
The important feature of the Kaleckian growth model is the introduction of the utilization ratio and they do not assume that the utilization ratio should be unity or normal level even in the long run. The assumption of endogenous utilization ratio less than one comes from the fundamental uncertainty in the capitalism economy, on which is strongly emphasized by

[8] The overall mark-up level is determined by the pricing power of firms, ratio of raw material costs to labor costs, industrial sector composition (Eckhard, 2014. p.191). Even though Eckhard takes the bargaining power of labor unions as one element composed of the pricing power of firms, we can argue that the union trade power should be distinguished. That is because firms can decide the price of commodities when labor unions strongly demand the raise of their real wage.

many Post-Keynesians. In general, firms want to prepare against the economic shocks, in particular demand-side, by making spare capacity sufficiently in their production process. This utilization ratio less than the unity can be explained by the structural element of market; when there is bigger monopoly power for only fewer firms, they want to repel a potential entry by strategically decreasing the ratio of their utilization (Steindl, 1952).

Figure 1 shows that the overall utilization ratio in the manufactural industry of Korea is less than the unity during 1971~2014 except for some period (1986, 1994, 2005, and 2011) and the ratio is fluctuating. The 44 years average level of the utilization ratio in Korea is about 92.28% which is surely lower than the 100% (dotted line). In addition, it seems that trough points are related to the recession period of business cycle (shaded periods). During the recovery from the recession, we can observe that the utilization ratio increases. That is the reason why the Kaleckian growth model introduce the utilization ratio as endogenous variable that makes both level of investment and savings be equal in the steady-state growth path.[9]

Figure 1. The utilization ratio in the manufacture industry of Korea (1971~2014; BOK statistics)



[9] Some authors (Committeri, 1986; Auerbach and Skott, 1988; Duménil and Lévy, 1995, 1999; Skott, 2010, 2012) "have argued that such a deviation is not acceptable for a long-peiod equilibrium, that it will trigger responses by firms' investment, and that therefore the Kaleckian models are prone to 'Harrodian instability', which then requires other mechanism to keep the long-run equilibrium stable."(Eckhard, 2014. p.243) In our perspective, the deviation of utilization ratio from unity may be justified by the suggestion that the target rate of utilization could be a range and not as a single value (Dutt 1990a; Lavoie, 1992).

Let us derive the endogenously determined utilization ratio in the neo-Pasinetti theorem: first, from the equation (9), we can express the utilization ratio as the function of the profit rate.

$$u* = \frac{k}{m} r*.$$

If we substitute $r*$ as the result of neo-Pasinetti theorem (7), we obtain the equilibrium level of the utilization ratio:

$$u* = \frac{k}{m} \frac{(1-x)g}{s_f}. \qquad (11)$$

Considering the profit-cost function and an endogenous variable $u*$, we can understand that there is a mechanism for the positive relation between the growth rate of capital stock and the profit rate in Kaldor's theory of income distribution as follows: when exogenously growth rate of capital stock increases, the profit rate must go up through the increase in the utilization ratio because of the fixed profit share, which means that the Kaleckian model includes the quantitative balancing mechanism. This can be easily checked in the equation (11). It is worth noticing the following mention of Kalecki.

> "Even on the average the degree of utilization throughout the business cycle will be substantially below the maximum reached during the boom. Fluctuations in the utilization of available labour parallel those in the utilization of equipment. Not only is there mass unemployment in the slump, but average employment throughout the cycle is considerably below the peak reached in the boom. The reserve of capital equipment and the reserve army of unemployed are typical features of capitalist economy at least throughout a considerable part of the cycle. (Kalecki, 1954. p. 131)"

We can summarize the general features of Kaleckian model as follows.

First, by introducing the mark-up, they explain the economy dominated by a few monopolistic industries. The mark-up adopted by the monopolistic industries that reflects the

structural features of the economy, uniquely determines the profit share which represents the overall distribution of functional income as well.

Second, they introduce the endogenous utilization ratio in their model in order to reflect the fundamental uncertainty of the production process in the capitalism. The utilization ratio no more need to be unity or normal level even in the long period, and it is used as quantitative balancing mechanism in a growth model.

Third, the investment decision process is introduced by putting an investment function in the model, so that the accumulation rate can be determined within models. This is the point which we did not mention yet. Now we show that how the introduction of the investment function works in Kaldor's theory of income distribution. The investment function g^i (12) represents how the growth rate of capital stock is determined in the economy and it assumes that a decision making for investment is affected by the utilization ratio (Rowthorn, 1981; Dutt, 1984, 1987). Since firms want to have a spare capacity for their production process, they will make more accumulation when the utilization ratio being close to unity. If this is the case, g_u must be larger than zero. The parameter γ represents the "animal spirits (Keynes, 1936)".

$$g^i = \gamma + g_u u. (\gamma, g_u > 0) \qquad (12)$$

where all parameters γ and g_u are positive.

Integrating this kind of investment function, we call it as the neo-Kaleckian growth model. The equation (13) represents the saving function. We obtain the saving function when making use of the profit-cost function (9) with the steady-state level of profit rate (7). These two equations yield the following savings function.

$$g^s = \frac{s_f m u}{k(1-x)}. \qquad (13)$$

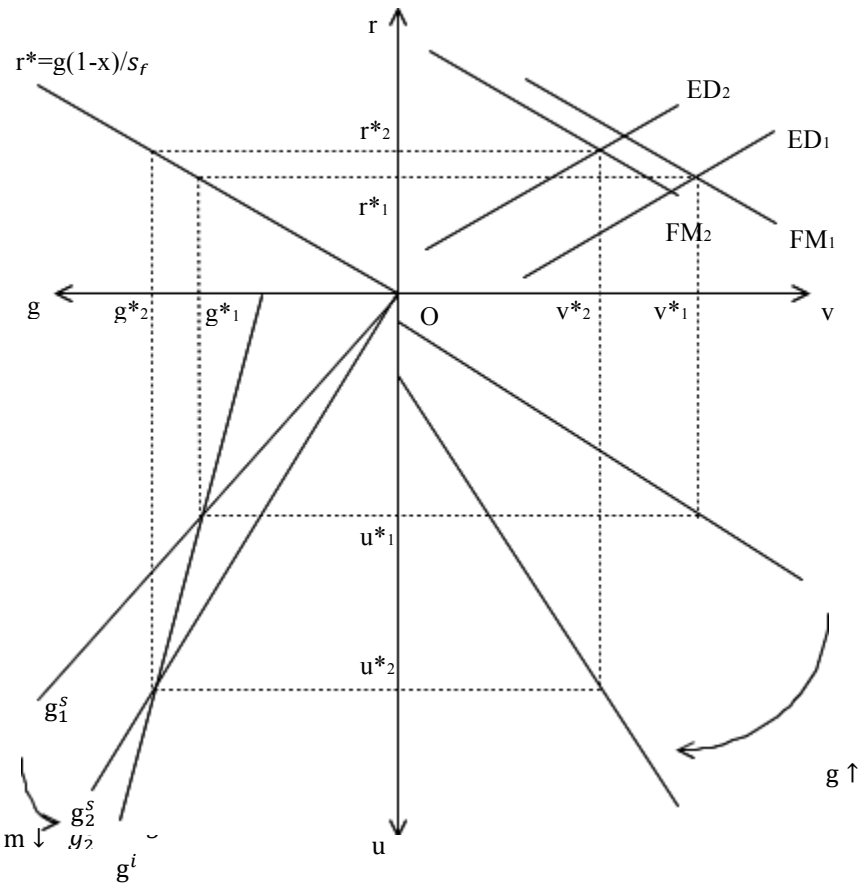
In saving function (13), the utilization ratio (u) should be adjusted to growth rate of capital stock (g^s). Finally, using (12) and (13), we obtain the equilibrium growth rate of capital stock in the economy. The result (10) represents that the endogenously determined growth rate of capital stock is positively related with animal spirits (γ), capital-potential output ratio (k) and the responsiveness of investment to utilization ratio (g_u). And it has negative relation between the equilibrium growth rate of capital stock and the retention ratio (s_f), the proportion of

investment through issuing equities (x) and the profit share (m).

$$g * = \frac{\gamma s_f}{s_f - \frac{k}{m}(1-x)g_u}. \qquad (14)$$

Especially, we can point out that the retention ratio has a negative impact on the accumulation rate. This negative relationship is called as a paradox of thriftiness which means that the more savings or retention of the profit, there must be a slower pace of capital accumulation in the long run. In addition, we can find that there is not an impact of the saving propensity of household on the accumulation rate: the paradox of thriftiness is valid only for the saving behavior of the corporation in our model, since the result (14) is based on neo-Pasinetti theorem (7).

Figure 2. The core mechanism of neo-Pasinetti theorem with neo-Kaleckian model



And the neo-Pasinetti theorem with neo-Kaleckian growth theory proposed by Lavoie can be summarized the quadrantile graph in Figure 2. The first quadrant expresses the relationship between the profit rate and the valuation ratio. This reflects two locus, effective demand curve and financial curve respectively. The second quadrant shows the relationship between the valuation ratio and the utilization ratio. We have to keep in mind that the slope of the curve should be changed when the growth rate of capital stock has been changed. The third quadrant expresses the saving function and the investment function. In this quadrant, growth rate of capital stock is determined within the behavior of corporations. The stability condition for this model should be noted here. Only if the slope of the savings function is larger than the slope of investment function, there could be a steady-state growth rate. This inequality condition for stability is as follows:

$$s_f > \frac{k}{m}(1-x)g_u. \qquad (15)$$

Lastly, the fourth quadrant is composed of the accumulation rate and the profit rate. In the fourth quadrant, we can observe the result of the neo-Pasinetti theorem, where the profit rate is expressed as a function of growth rate of capital stock.

Let us assume that there is a decrease in profit share. This can happen whenever the bargaining power of trade union has increased or the monopoly power has decreased. First of all, the savings function rotate toward the axis of utilization ratio, u. In the given investment function, the utilization ratio and growth rate of capital stock both will increase in the long run. That is because that firms want to compensate the decrease in profit share by using the spare portion of their capacity more than before. There must be more incentive to accumulate capital stock by achieving higher level of utilization ratio to make up for the decrease in the profit share. On the other hand, the increased accumulation rate leads to the increase of the profit rate by the neo-Pasinetti theorem in the first quadrant. This adjustment is achieved in the second quadrant by simultaneous movement of both effective demand curve and financial market curve. These two curves yield new level of the valuation ratio. Note that the relation between the valuation ratio and the utilization ratio is varied with different level of long-run growth rate.

Taking account for this instance, we find that there is unambiguously a negative relation between the profit share and the growth rate or growth rate of capital stock. This result is called as the paradox of costs and it is the basic reasoning for the wage-led growth regime. However, the so-called paradox of costs is deeply dependent on the form of the investment

function. In section 3, we will try to expand the form of investment function following the idea of the post-Kaleckian growth model. When we consider the post-Kaleckian investment function, we may find some conditions of the positive relationship between the profit share and the growth rate even in the Kaldor's theory of income distribution.

Before taking different investment function into the model, we want to integrate the concept of money first. Skott (1981) points out that we have to consider money market condition because there is transactions of corporation's equities in the Kaldor's theory of income distribution, and the transactions must be supported by money. In the next section, we will take considerations of endogenous money in the Kaldor's theory of income distribution. It is worth pointing out that Kaldor (1982) also emphasizes that the total amount of money is endogenously determined within the economy's demand. Following Park (2004), we will briefly explain the endogenous money and try to integrate it into the Kaldor's theory of income distribution with neo-Kaleckian framework.

3 An extension of Kaleckian model

3.1 Kaldor's theory of income distribution with endogenous money[10]

Park (2004) considers the situation where bank loans is another main financing source of investment of corporations in Kaldor's theory of income distribution. The reason why Park tries to integrate another financing source into the Kaldor's theory of income distribution is that he wants to show that the neo-Pasinetti theorem and consideration of endogenous money are compatible. His paper considers the case where total amount of money stock is endogenously determined. Endogenous money suggested by many Post-Keynesians means that the supply of money basically comes from the demand for bank loan, the fiscal deficit of government or foreign sectors.[11] Because Park assumes that there is no fiscal activity and no foreign sectors to simplify the discussion as we have assumed in this paper, granted bank loan is simply money in his model. The money stock is held in a form of deposit in the bank account of household, because only household is assumed to demand money.

The consideration of bank loan along this line can be an alternative response to the argument of Skott (1981) that "the money market must be taken into consideration in the neo-Pasinetti framework." (Park, 2004, p. 80) In the present subsection, we will summarize the result of Park's work, and try to integrate neo-Kaleckian growth framework and interpret the meaning of results as well.

The goods market

Park assumes "that no interest is paid on deposits and that an interest rate i is charged on loans." (Park, 2004, p. 84) And this interest payment by borrowers i.e. corporations, is the source of income for bankers. To specify banker's income in equality between saving and investment, we introduce the ratio between loan capital and total capital stock, a. The consideration of loan capital and interest payment changes the equation (3). Note that bankers' income is assumed

[10] The main idea of this subsection depends heavily on Park, Man-Seop. "Credit money and Kaldor's 'institutional' theory of income distribution." Review of Political Economy 16.1 (2004): 79-99.

[11] "Loans are demanded by firms and granted by banks. In deciding how much credit to extend, banks take account of the existing deposits; however, according to the endogeneity view of money, modern commercial banks are normally not strictly constrained by the reserve requirements corresponding to the amount of *currently availabl*e deposits." (Park, 2004, p. 84)

here as a part of household income and the equation of capital gain has to be changed.[12] The exact formula for the equality between investment and saving is given in the equation (16). In equation (16), three terms in the first bracket are wage, dividend and interest payment respectively. And banker's income is also introduced on the first bracket, since we assume that the saving propensity of bankers is the same as s_h. The second bracket is consumption out of capital gains. The last term indicates the saved profit of corporations. Note that all variables expressed as the ratio over capital stock (K).

$$g = s_h\left[\left(\frac{u}{k} - r\right) + \left(1 - s_f\right)r(1-a) + ia\right] - (1 - s_h)[vg(1-a) - xg] + s_f r(1-a). \qquad (16)$$

It is noteworthy that in equation (16), r is "for the 'pure' rate of profit that is the ratio which the amount of profit remaining after interest is paid at the rate of i on loans bears to own capital." (Park, 2004, p. 84)

The stock market

Now we have to take household's demand for money into consideration, when we construct the equilibrium condition of stock market. Because the stock market is only way to save a part of income in the economy, hoarding money is simply considered as a withdrawal from savings. The proportion of investment financed by issuing new equities is equal to the savings from household minus the change in money demand as is expressed in equation (17):

$$xg = s_h\left[\left(\frac{u}{k} - r\right) + \left(1 - s_f\right)r(1-a) + ia\right] - (1 - s_h)[vg(1-a) - xg] - \Delta m_d. \qquad (17)$$

The change in money demand in an accounting period Δm_d is considered here, because xg means that flow of investment financed by issuing new equites in an accounting

[12] "Let us note that the replacement cost of a firm in calculating its valuation ratio covers its own capital only, not the total capital. This implies that changes in the total value of shares are calculated by multiplying the valuation ratio to changes in the size of *own capital* only." (Park, 2004, p. 85)

period. Note that $\Delta m_d \stackrel{\text{def}}{=} m_d - a$, because the present demand for money minus existing loan is the change in money demand.

The loan market

In the economy we consider in this section, there is another source of financing for investment of corporations, which is bank loan. Let us denote Ψ is a proportion of investment financed through bank loan. Flow of investment financed by borrowing bank loan should be equal to the net supply of loans. Money supply (m_s) is assumed to be endogenously determined in the economy, and we will denote it zy following Park (2004, p.86) where z is a kind of money multiplier and y stands for the total income per unit of total capital stock. In the view of accommodationists, z should be an endogenous variable since the money supply is fully accommodative. Namely, we have $zy = m_s$.[13] To obtain the net money supply, we have to calculate $zy - a$, which means the difference between money supply per unit of capital stock and existing loan capital per unit of total capital stock. The equation (18) states that the demand of corporations for money should be equal to the net money supply to obtain the equilibrium in the loan market:

$$\Psi g = zy - a \qquad (18)$$

where $y = \left(\frac{u}{k} - r\right) + r(1 - a) + ia.$

Park suggests that the long-term equilibrium conditions be satisfied as $\Psi g = ag.$ In a steady-state growth path, the ratio of loan capital to total capital must be the proportion of investment financed through bank loan when the growth rate of capital stock is larger than zero. Note that money demand is equivalent to money supply in the perspective of accommodationist:

$$m_d = m_s. \qquad (19)$$

[13] "The 'accommodationist' approach holds that banks grant, at a constant rate of interest, any amount of loans requested by firms that banks consider to be creditworthy … In contrast, the 'structuralist' approach argues that bank are constrained in meeting the demand for loans because of the reserve restrictions …" (Park, 2004, p. 86) The debate between accommodationists and structuralists on endogenous money is briefly explained in Lavoie (2014, chap. 4).

The revised neo-Pasinetti theorem when integrating endogenous money

Considering four equations (16) – (19) and interest payment, we can revise the neo-Pasinetti theorem for the rate of gross profit (r')[14], from the steady-state condition of $\Psi g = ag$.

$$r' *= (1-\Psi)[\frac{(1-x-\Psi)g}{(1-\Psi)s_f}] + \Psi i. \qquad (7')$$

The rate of gross profit is weighted average of pure profit rate and interest rate. The gross profit rate is determined not only by behavior of corporations such as the proportion of financing sources (x, Ψ), the retention rate (s_f) and the growth rate of capital stock (g), but also by the interest rate (i) of bank loan. When $\Psi = 0$, we know that the revised neo-Pasinetti theorem is the same, as is expressed in (7).

The extension to neo-Kaleckian growth model

Now by adopting the neo-Kaleckian framework, we will make the growth rate of capital stock determined within the model. From (7') and (9), we have saving function (13'). Considering the equation (9), (13') can readily be obtained by rearranging (7') with respect to g.

$$g^s = \frac{s_f}{1-x-\Psi}(\frac{mu}{k} - \Psi i) \qquad (13')$$

where the profit share (m) denotes the ratio of total profit over the capital stock.

Using (13') we obtain the equilibrium growth rate of capital stock with the neo-Kaleckian investment function (12).

[14] The gross profit includes interest payment as well. We could consider the pure rate of profit as another candidate for the neo-Pasinetti theorem. This consideration is reported in Appendix I.

$$g * = \frac{s_f(m\gamma + \Psi i g_u k)}{m s_f - k(1 - x - \Psi) g_u}. \qquad (14')$$ [15]

The equation (14') shows that $g *$ is determined not only by the corporation's behavior but also by the loan interest rate which is determined by bankers. And we can find that there are two differences from the equation (14). First, the region for the stability condition to be satisfied is larger provided that endogenous money is taken into consideration and Ψ is not zero.

$$s_f > \frac{k(1-x)}{m} g_u > \frac{k(1-x-\Psi)}{m} g_u. \qquad (15')$$

Second, the derivative of growth rate with respect to Ψ can be both negative and positive. Unlike the result in Appendix II.[16]

$$\frac{\partial g *}{\partial \Psi} = \frac{s_f i g_u k\big(m s_f - (1 - x - \Psi) k g_u\big) - g_u k(s_f m\gamma + s_f \Psi i g_u k)}{[m s_f - (1 - x - \Psi) k g_u]^2}. \qquad (20)$$

The sign of the above derivative is indeterminate, since it can be either negative or positive depending on how large s_f and i are; the derivative of the growth rate of capital stock with respect to the ratio of loan out of investment indicates that when firms getting more dependent on bank loans, the growth rate of capital stock is larger under following conditions:

$$i\big(\mathrm{m} s_f - (1 - x - \Psi) k g_u\big) > (m\gamma + \Psi i g_u k). \qquad (21)$$

This inequality (21) can be rearranged using the result of equilibrium growth rate of capital stock (14').

[15] We will briefly introduce the labor productivity into (14') and discuss its implications in Appendix II.

[16] In contrast to this, the proportion of investment through issuing new shares (x) has always negative impact on the growth rate of capital stock.

$$\frac{g*}{s_f i} = \frac{(m\gamma + \Psi i g_u k)}{i[ms_f - (1 - x - \Psi)kg_u]} < 1. \qquad (21')$$

From the (21'), we find that $\frac{\partial g*}{\partial \Psi}$ can be positive when the inequality $g* < s_f i$ holds; the proportion of investment through bank loan has positive impact when the equilibrium growth rate of capital stock is lower than $s_f i$. Considering (21) and (21'), we can argue that the proportion of investment through bank loan has negative impact on the growth rate of capital stock when $g* > s_f i$. If $g* = s_f i$, the proportion of investment through bank loan has no impact on the growth rate of capital stock. In other words, the proportion of loan capital over total capital is neutral to steady-state growth rate of capital stock, when the equation $i = \frac{g*}{s_f}$ holds. This result looks similar to Pasinetti's Cambridge saving function (2). In a sense, the neutrality of ratio of bank loan can be observed when interest rate is equal to $\frac{g*}{s_f}$. We may call it as the revised Pasinetti-theorem. To sum up, we find that loan-led growth regime is possible when the equilibrium growth rate of capital stock is lower than the multiplication of the corporation's propensity to save and interest rate, if the loan-led growth means $\frac{\partial g*}{\partial \Psi} > 0$.

Lastly, we find that the paradox of costs, i.e. wage-led growth regime and the paradox of thriftiness are still valid in the result (14'). We can argue that the introduction of endogenous money does not change the region of wage-led growth, in that equilibrium growth rate of capital stock (g) is negatively related to the profit share (m):

$$\frac{\partial g*}{\partial m} = \frac{-s_f[(1 - x - \Psi)kg_u + \Psi i g_u k s_f]}{[ms_f - (1 - x - \Psi)kg_u]^2} < 0.$$

3.2 Kaldor's theory of income distribution with post-Kaleckian growth model

The extension to post-Kaleckian growth model

In this subsection, we will try to find the conditions that the paradox of costs is not valid by

adopting the ideas of post-Kaleckian growth model into the revised neo-Pasinetti theorem framework. The equation (22) represents the post-Kaleckian investment function which includes the profit share explicitly when making the decision of capital accumulation. We observe that the profit share (m) is added to the investment function of (12). The term g_m reflects how sensitively corporations respond to the change in profit share.

$$g^i = \gamma + g_u u + g_m m. (\gamma, g_u, g_m > 0) \qquad (22)$$

where all parameters $\gamma, g_u,$ and g_m are positive.[17]

Marglin and Bhaduri argue that a "higher profit share and a higher rate of capacity utilization can each be argued to induce higher profit expectations, the first because the unit return goes up, the second because the likelihood of selling extra units of output increases." (Marglin and Bhaduri, 1990, p.163) This means that higher level of both the utilization ratio (u) and the profit share (m) can be regarded as signals for higher profit expectation.

We derive the equilibrium growth rate of capital stock under the post-Kaleckian investment function by using the result in (14'):

$$g * = \frac{s_f[m(\gamma + g_m m) + \Psi i g_u k]}{m s_f - k(1 - x - \Psi) g_u}. \qquad (14'')$$

The equation (14'') indicates the steady-state growth rate of capital stock when considering not only the investment function with the effect of profit share but also endogenous money from bank loan. Two points are worthy of being mentioned. First, the partial effect of the proportion of investment financed through bank loan to growth rate does not change. It can be either negative or positive depending on the inequality (21), although we introduce the different investment function suggested by post-Kaleckian.[18]

Second, checking out the possibility of profit-led growth, we find that it is possible under a certain condition. To find this new possibility, let us examine the effect of a change in the profit share (m) on the equilibrium rates of growth. By differentiating the formula (14'')

[17] We may argue that the investment function should consider the effect of the loan interest rate as well. However, the total profit share includes the interest payment. Considering this fact, we just mention that g_m reflects the impact of interest rate to investment decision too.

[18] To obtain $\frac{\partial g*}{\partial \Psi} > 0$, inequality $i(\mathrm{m}s_f - (1 - x - \Psi)kg_u) > (m(\gamma + g_m) + \Psi i g_u k)$ should be satisfied. This can be rearranged to obtain the condition (21') by using the result of (14'')

with respect to the profit share, we have:

$$\frac{\partial g*}{\partial m} = \frac{s_f m g_m \left(s_f m - 2(1-x-\Psi)k g_u\right) - s_f(\gamma(1-x-\Psi)k g_u + s_f \Psi i g_u k)}{\left[m s_f - (1-x-\Psi)k g_u\right]^2}. \qquad (23)$$

The derivative of equilibrium growth rate with respect to profit share is not always negative depending on the sign of numerator. Rearranging the numerator of (23), we obtain the following condition for the profit-led growth regime:

$$m g_m \left[s_f m - 2(1-x-\Psi)k g_u\right] > \gamma(1-x-\Psi)k g_u + s_f \Psi i g_u k. \qquad (24)$$

With the inequality of (24), we can derive two necessary conditions for the existence of the profit-led regime:

(i) The retention rate is higher than twice of $\frac{k(1-x-\Psi)}{m(1-\Psi)} g_u$, which is the least level of s_f for the stability: $s_f > 2\frac{k(1-x-\Psi)}{m(1-\Psi)} g_u$.

(ii) The responsiveness of investment to profit share (g_m), and profit share (m) should be high enough to satisfy the inequality (24).

The first necessary condition is a stronger requirement than the stability condition of (15'). With others being equal, this strong stability condition can be achieved by the increase in profit share. If the first condition is satisfied, the stability condition of the model is also achieved. The second necessary condition implies that profit share and the coefficient of the profit share in the investment function also should be relatively high enough. This is congruent with intuition that there could be a profit-led growth regime, when the profit share is relatively high enough and firms sensitively invest more when the profit share increases.

The possibility of the profit-led growth regime can be explained partly by the feature of neo-Pasinetti theorem itself. There is a strictly positive relationship between the profit rates and the growth rate of capital stock in the neo-Pasinetti theorem, and thus the coefficient g_m should be considerably high enough to bring about profit-led regime. In spite of these strict restrictions, the profit-led growth regime can exist even in the neo-Pasinetti theorem along with a post-Kaleckian investment function.

3.3 Policy implications

The inequality r>g and the higher profit share

The first point that we want to emphasize on is about the inequality $r > g$ which is argued by Piketty (2014). We suggest that $r > g$ can be an outcome of our growth and income distribution model. In other words, this result may depend on the feature of the neo-Pasinetti theorem and the stability condition of the Kaleckian growth model. Let us remind of the stability condition for the inequality (15) again and we assume that $\Psi = 0$ here for simplicity. This one can be rewritten as the following inequality. It is derived by dividing $(1 - x)$ both sides of the inequality (15).

$$\frac{s_f}{1-x} > \frac{k}{m} g_u.$$

Now let us define $\alpha \stackrel{\text{def}}{=} \frac{s_f}{1-x}$ as the left-hand side of the inequality. Rearranging the above inequality, we can derive the following stability condition:

$$\frac{k g_u}{\alpha} < m. \qquad (15'')$$

In the neo-Pasinetti theorem, the inequality $r > g$ could be obtained when the $s_f + x$ is lower than the unity, which means α should be lower than the unity. Then, there will be bigger gap between r and g, when the minimum level of sustaining the stability of the economy should be higher. That is because considering the inequality (15''), the value of α should be much lower with higher gap between r and g. Even though this cannot be an explanation for the tendency of increase in the profit share, at least we can understand that the inequality $r > g$: A higher profit share and the stability of economy are compatible under the model we have developed.

There is not any conversion mechanism of the profit share to sustain the stability in this model since profit share is just given exogenously. In spite of this, we can expect that the presence of inequality $r > g$ is one of the signals for the higher level of the profit share theoretically. If $r > g$ is only a theoretical result in our growth and income distribution model,

our framework implies that the Piketty's policy suggestion of global capital taxation to reverse the inequality $r > g$ to $r < g$, can be an inappropriate approach to moderate the profit share.

The wage-led growth strategy

The Kaleckian growth model we have developed with Kaldor's theory of income distribution, is mainly based upon the economy dominated by monopolistic corporations in goods and service market. A monopolistic market structure determines how large the mark-up is. When the mark-up is higher, the profit share goes up and the bargaining power of labor decreases. We may argue that the functional income distribution is mainly determined by the institutional features or the class conflicts in Kaleckian growth model. To improve the deteriorating income distribution, economic policies to reduce the profit share can be suggested. Such policies include a reform of monopolistic market structure, an introduction of unemployment insurance and so on. To sum up, policies to reduce the profit share have to take consideration of the institutional features and the class conflicts in the viewpoint of Kaleckian framework.

In the perspective of the Kaleckian growth model, there are some benefits in terms of the economic growth rate of capital stock by decreasing the profit share with proper economic policies. Their logic and idea are simple. Because there is always a spare part of production capacity for the producers to prepare the demand shock uncertainty[19], producers will respond to increase the utilization ratio in order to compensate the decrease in unit return, i.e. profit share. This happens when a government intentionally and elaborately implements the policies to decrease the profit share.

This makes sense all the time in the case of the neo-Pasinetti theorem with neo-Kaleckian growth model, since the investment function does not explicitly include the effect of the profit share on investment. Using the post-Kaleckian idea, we find the possibility of the profit-led in the neo-Pasinetti theorem as well. However it is noteworthy that the conditions for the profit-led regime are quite strict. They include not only higher profit share but also sensitive responsiveness of firms to change in profit share with far stronger condition for the stability. In this sense, the area for profit-led growth may be narrower, and more empirical analysis is needed.[20]

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[19] Of course, we assume that the monopolistic market situation is dominating. Otherwise, the Kaleckian argument may be inapplicable. For example, the Kaleckian framework is not proper in the case of perfect competitive market system.

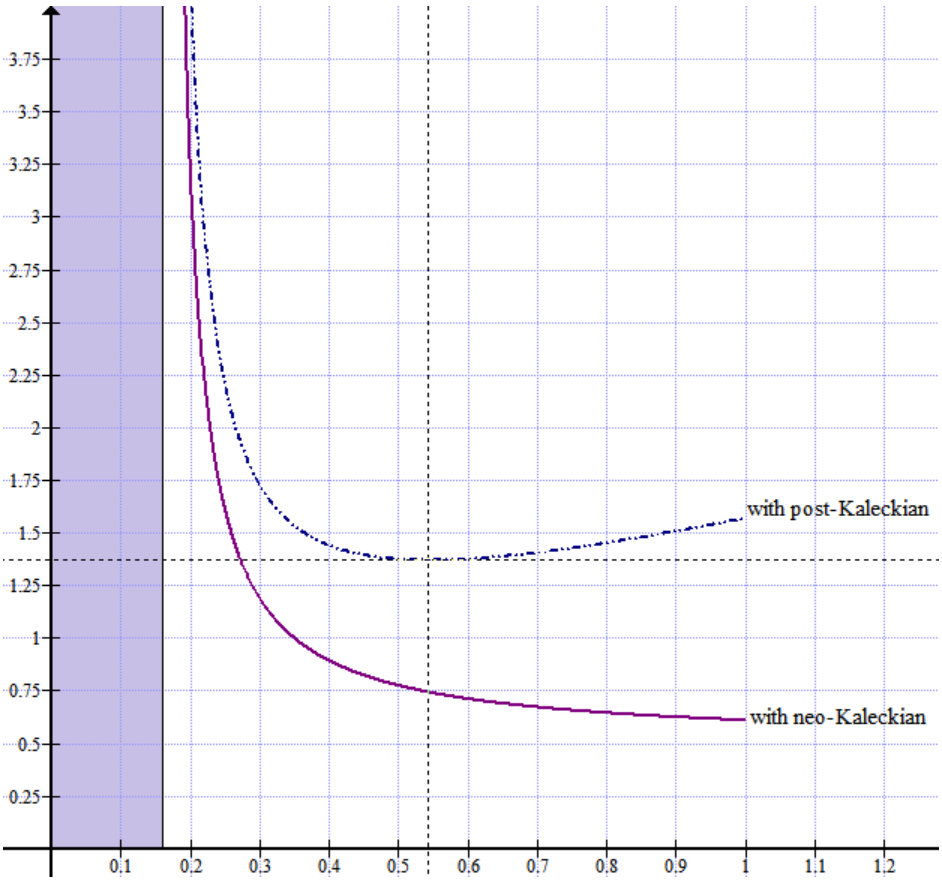
[20] In Appendix III, empirical results based on single equation approach will be reported. (Eckhard, 2014.

Calibration

We want to specify the values of (14') and (14'') with simple calibration. With arbitrary calibration, we present the trace of equilibrium growth rate of capital stock (g) depending on the change in profit share (m).

From Figure 3, we find that there could be a profit-led growth regime with consideration of post-Kaleckian growth model (dotted line) if the value of profit share is larger than approximately 0.5434. Unlike the case of post-Kaleckian (14''), there is not a profit-led growth regime in case of neo-Kaleckian (14') irrespective of a value of profit share. Note that the shaded area shows the region of the unstable growth regime in which the profit share is lower than approximately 0.1667. In addition, the graph of neo-Kaleckian implies that the higher is the profit share, the nature of wage-led growth regime will be dwindled.

Figure 3. The relationship between steady-state growth rate and profit share



p.302- 303) We find that most countries seem to have wage-led growth regime in terms of domestic demand, even though some studies show that profit-led growth regime as well.

(*Note*: $s_f = 0.3, \gamma = 0.5, x = 0.1, \Psi = 0.8, i = 0.02, g_u = 0.1,\ g_m = 0.8,$ and $k = 5$ are assumed. X-axis is profit share (m), and y-axis stands for the steady-state growth rate of capital stock ($g*$).)

Lastly, from this result, we can argue that either wage-led or profit-led growth regime can be possible depending on the level of profit share which reflects the institutional and socio-economic states of an economy.

4 Empirical analysis

4.1 Survey of empirical literatures on Korea

Recently there have been several attempts to analyze the growth regime of Korea with a single equation approach. The single equation approach is a popularly used empirical method on the basis of the post-Kaleckian model. (Eckhard, 2014. p.297) The estimation strategy of the single equation approach is to sum up the respectively estimated effects of change in profit share on consumption (C), investment (I) and net export (NX).[21] In other words, the single equation approach is to estimate the following equation.

$$\frac{\partial Y/_{Y}}{\partial m} = \frac{\partial C/_{Y}}{\partial m} + \frac{\partial I/_{Y}}{\partial m} + \frac{\partial NX/_{Y}}{\partial m}.$$

Table 1 presents recently reported estimation results of $\frac{\partial Y/_{Y}}{\partial m}$ in Korea. From these empirical researches, we find that the aggregate demand would decrease by 0.063%p~1.09%p when the profit share (m) increases by 1%p. The results of Table 1 support the argument that Korea is under the wage-led growth regime.

Table 1. Empirical analysis on Korea by the single equation approach

	Analyzing Period	The effect of a 1%p increase in Profit share on Aggregate demand	Remarks
TaeHee Hong (2009)	1970:2008	-0.3338%p	*Unadjusted wage share* (self-employed income is not considered)
Onaran and Galanis (2012)	1970:2007	-0.063%p -0.115%p -0.864%p	Adjusted wage share without multiplier effect with multiplier effect *Simultaneous 1%p increase*
JangPyo Hong (2014)	1981:1997 1999:2012	-0.39%p -1.09%p	Adjusted wage share and quarterly data
SooMin Jeon (2015)	1982:1996 1999:2013 1982:2013	-0.080%p -0.263%p -0.089%p	Adjusted wage share and quarterly data

Even though the single equation approach is intuitive and simple, it assumes that the profit share, i.e. functional income distribution is exogenously given. Then "feedbacks of

[21] See Onaran and Galanis (2012, p.8) and Eckhard (2014, p.298-306) for more details.

changes in aggregate demand and in its components on functional income distribution are thus ignored." (Eckhard, 2014. p.298) To consider the feedback impact of aggregate demand on functional income distribution, VAR approach could be an alternative solution. Since the VAR approach is systematic approach, we can also confirm the dynamics of the model more explicitly unlike the single equation approach.

4.2 Recursive VAR analysis on Korea[22]

The choice of variables

We will analyze whether or not Korea is wage-led growth regime by using VAR approach. The VAR approach has the advantage since it concerns about the feedback effect of variables. "It is a system approach that takes into account the interaction of variables." (Stockhammer and Onaran, 2004. p.430) After we estimate coefficients of lagged values and errors, we can obtain the accumulated impulse response functions with standard Cholesky decomposition. The estimated results of impulse response functions report how exogenous shocks affect the steady-state equilibrium. On the basis of VAR approach, we can analyze the effects of exogenous shocks to steady-state equilibrium growth rate of capital stock (14'') which is derived by integrating neo-Pasinetti theorem revised with endogenous money (7') and post-Kaleckian investment function (21).

We will use annual data (Korea during 1975~2014) of the growth rate of GDP (GDPR; g), the utilization ratio in the manufactural industry of Korea (UTIL; u), the amount of bank loan (LOAN; Ψ[23]), and adjusted wage share (WSC; w, i.e. 1-m) so as to estimate VAR.

It is noteworthy that the BOK reports the wage share (WS) without considerations of the incomes of the self-employed. Because of high level of self-employment in Korea, we use the adjusted wage share which defines wage share as the income of employed workers and the comparable portion of the self-employed, i.e. part of their income proportional to the share of labor income in the non-self-employed sector. (See Jeon, 2015. p.29-30)[24] Figure 4 shows

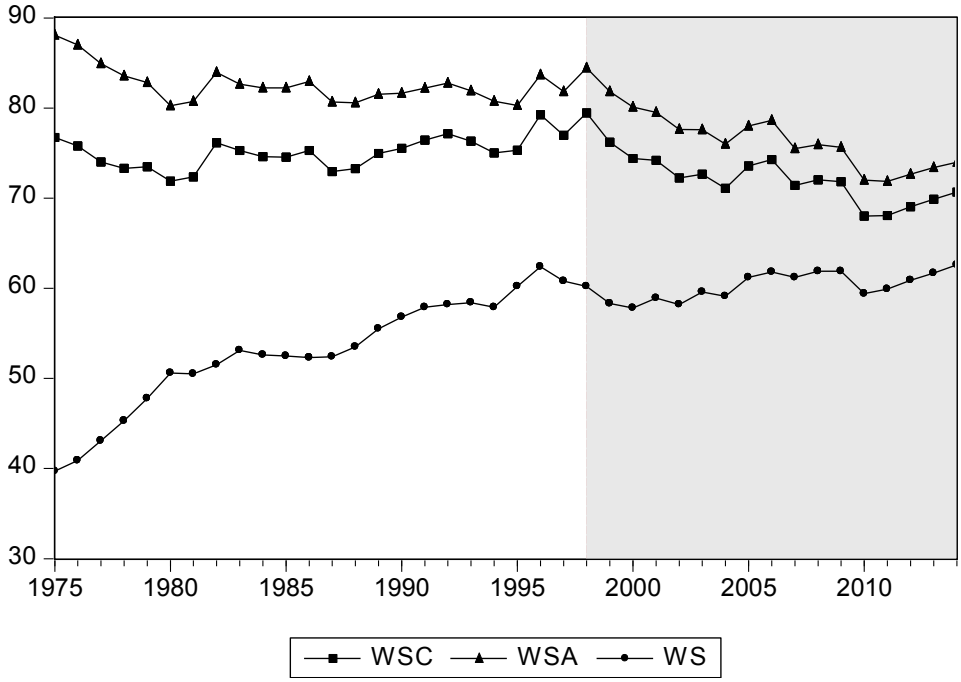
[22] This section refers to Stockhammer, E. and Ö. Onaran (2004). "Accumulation, distribution and employment: a structural VAR approach to a Kaleckian macro model." Structural Change and Economic Dynamics 15(4): 421-447.

[23] The amount of bank loan is a proxy for the ratio of bank loan over investment (Ψ). We will use the differentiated value of the amount of bank loan since the amount of bank loan is a stock variable.

[24] Gollin (2002) suggests that wage share can be defined as the income of employed workers and part of

unadjusted wage share and two kinds of adjusted wage share. WSA reports the wage share which considers all income of the self-employed as a labor income. We use the WSC as a wage share in the following analysis, since WSA may overestimate the labor income. Figure 4 shows that the adjusted wage shares (WSA, WSC) decrease after 1998 IMF financial crisis.

Figure 4. Wage share with/out consideration of the incomes of the self-employed



Because these variables are estimated as I(1)[25] at significance level 1%, except the growth rate of GDP, we use the differentiated variables to avoid spurious relations.

The recursive VAR estimation result with adjusted wage share

First, we have to regress the standard VAR which estimates "all variables on its own lags and the lags of all other variables. No contemporaneous effects are treated explicitly." (Stockhammer and Onaran, 2004. p.430) We estimate one lag, because several lag tests indicate that one lag is appropriate.[26]

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the income of the self-employed proportional to the share of labor income in the non-self-employed sector.

[25] The results of unit root test will be reported in Appendix IV.

[26] The results of lag criterion tests will be reported in Appendix IV.

$$\begin{bmatrix} g \\ dlog(u) \\ dlog(w) \\ dlog(\Psi) \end{bmatrix} = \begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} \\ c_{21} & c_{22} & c_{23} & c_{24} \\ c_{31} & c_{32} & c_{33} & c_{34} \\ c_{41} & c_{42} & c_{43} & c_{44} \end{bmatrix} \begin{bmatrix} g_{-1} \\ dlog(u_{-1}) \\ dlog(w_{-1}) \\ dlog(\Psi_{-1}) \end{bmatrix} + \begin{bmatrix} c_{15} \\ c_{25} \\ c_{35} \\ c_{45} \end{bmatrix} + \begin{bmatrix} v_1 \\ v_2 \\ v_3 \\ v_4 \end{bmatrix}$$

, which can be expressed as vectors:

$$x_t = Cx_{t-1} + d_t + v_t \qquad (25)$$

where x_t is $\begin{bmatrix} g_t \\ dlog(u_t) \\ dlog(\mathrm{w}_t) \\ dlog(\Psi_t) \end{bmatrix}$, C is $\begin{bmatrix} c_{11} & c_{12} & c_{13} & c_{14} \\ c_{21} & c_{22} & c_{23} & c_{24} \\ c_{31} & c_{32} & c_{33} & c_{34} \\ c_{41} & c_{42} & c_{43} & c_{44} \end{bmatrix}$, d_t is composed of constants, and v_t is innovation vector. We call equation (25) as the standard VAR. Table 2 reports the result of standard VAR estimation.

Table 2. The standard VAR estimates

Sample (adjusted): 1977 2014
Included observations: 38 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	GDPR	DLOG(UTIL)	DLOG(WSC)	DLOG(LOAN)
GDPR(-1)	0.229950	-0.002944	0.001446	0.005658
	(0.25357)	(0.00325)	(0.00159)	(0.00367)
	[0.90684]	[-0.90509]	[0.90720]	[1.53988]
DLOG(UTIL(-1))	16.86532	0.231372	-0.089924	-0.221517
	(21.0165)	(0.26962)	(0.13210)	(0.30454)
	[0.80248]	[0.85814]	[-0.68075]	[-0.72738]
DLOG(WSC(-1))	60.56182	0.624636	-0.196235	-0.016693
	(31.1954)	(0.40020)	(0.19607)	(0.45204)
	[1.94137]	[1.56079]	[-1.00082]	[-0.03693]
DLOG(LOAN(-1))	3.696603	-0.023118	0.003552	0.645304
	(8.72772)	(0.11197)	(0.05486)	(0.12647)
	[0.42355]	[-0.20647]	[0.06474]	[5.10242]
C	4.585724	0.027260	-0.012440	0.013671
	(1.82603)	(0.02343)	(0.01148)	(0.02646)
	[2.51130]	[1.16368]	[-1.08389]	[0.51667]
R-squared	0.206332	0.094159	0.056497	0.562676
Adj. R-squared	0.110130	-0.015640	-0.057867	0.509667
Sum sq. resids	490.2572	0.080688	0.019368	0.102944
S.E. equation	3.854384	0.049448	0.024226	0.055852
F-statistic	2.144776	0.857560	0.494008	10.61471
Log likelihood	-102.5092	63.02070	90.13312	58.39239
Akaike AIC	5.658379	-3.053721	-4.480690	-2.810126
Schwarz SC	5.873851	-2.838249	-4.265219	-2.594654
Mean dependent	6.739474	0.002891	-0.001837	0.154587

S.D. dependent	4.085938	0.049066	0.023554	0.079762

Determinant resid covariance (dof adj.)	1.44E-08
Determinant resid covariance	8.21E-09
Log likelihood	138.0692
Akaike information criterion	-6.214167
Schwarz criterion	-5.352280

However, we cannot use the estimation results of standard VAR (25) to obtain impulse response functions. That is because that innovation vector v_t is cross-correlated. Note that the impulse response functions can be obtained with *ceteris paribus*. Since the innovations in v_t is contemporaneously correlated, we have to introduce the matrix B which captures these contemporaneous interactions explicitly. With consideration of matrix B, we can obtain the "primitive VAR." (Enders, 1995)

$$Bx_t = Ax_{t-1} + d_t + \varepsilon_t \qquad (26)$$

where $\mathrm{C} = B^{-1}A$ and $v_t = B^{-1}\varepsilon_t$ (26). After capturing the contemporaneous effects by matrix B, we can argue that ε_t is not cross-correlated. By using ε_t, we can obtain the impulse response functions which give the partial effect of exogenous shocks to variables, since ε_t is not cross-correlated. To obtain unique result of impulse response functions, we have to impose a certain structure to matrix B. "The standard Cholesky decomposition … imposes a triangular structure on B." (Stockhammer and Onaran, 2004. p.430)

$$\begin{bmatrix} v_g \\ v_{dlog(u)} \\ v_{dlog(\mathrm{w})} \\ v_{dlog(\Psi)} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_g \\ \varepsilon_{dlog(u)} \\ \varepsilon_{dlog(\mathrm{w})} \\ \varepsilon_{dlog(\Psi)} \end{bmatrix} \qquad (27)$$

where we impose a lower triangular restrictions on B($=\begin{bmatrix} b_{11} & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} \end{bmatrix}$).

Since lower triangular matrix B implicitly assumes a specific contemporaneous interaction, the ordering of variables is crucial when we estimate the impulse response functions. In our case, the matrix B in (27) implies that there is a contemporaneous effect from the growth rate of GDP (g) and the utilization ratio (u) to the adjusted wage share (w), not vice versa. This ordering is selected to capture the feedback effect of aggregate demand to the adjusted wage share. In addition, since we have adopted the endogenously determined money within model, all variables have a contemporaneous effect to the amount of bank loan (Ψ).

Figure 5. Impulse response function (Cholesky decomposition)

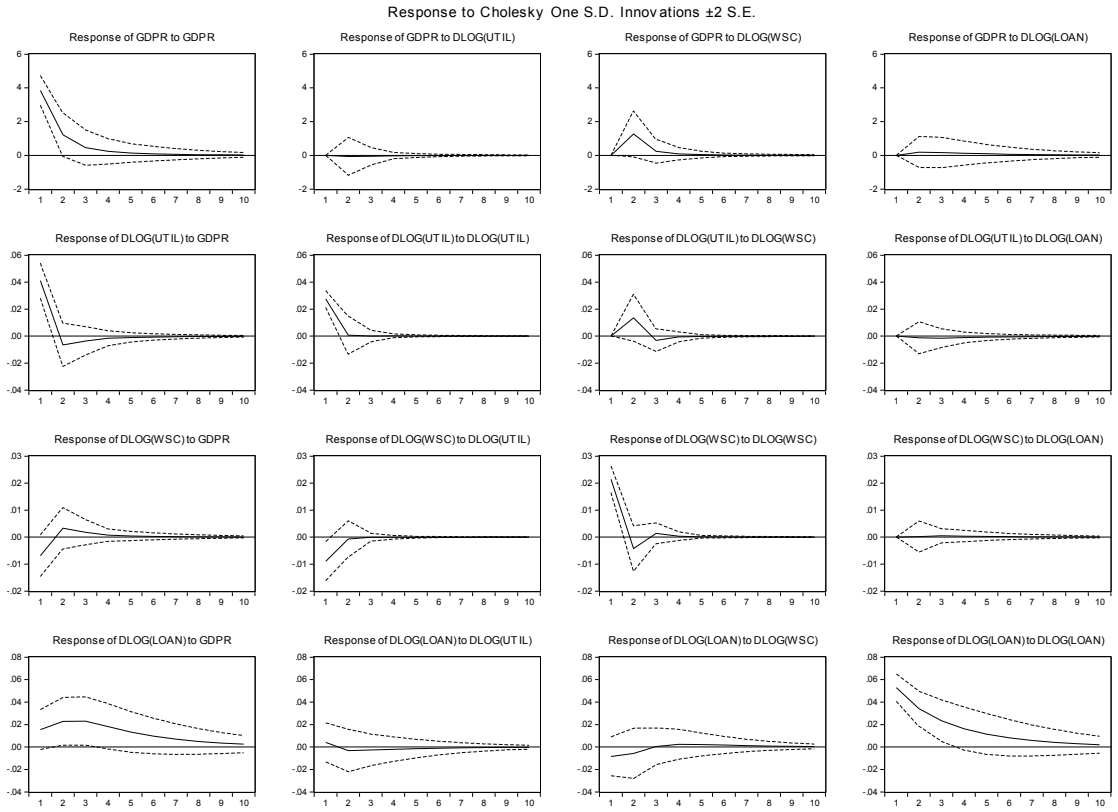
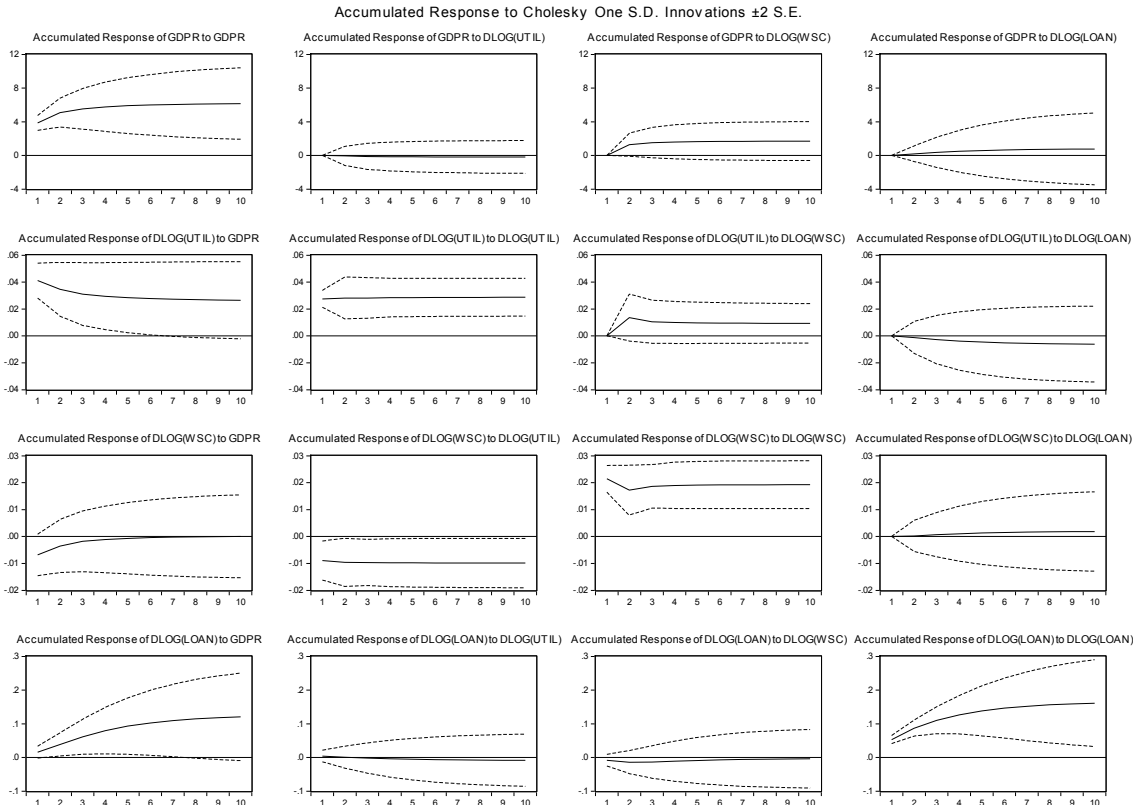


Figure 6. Accumulated impulse response function (Cholesky decomposition)



Since we have assumed a specific formulation of matrix B, we can calculate the impulse response functions. Figure 5 and 6 present estimation results of the impulse response functions and the accumulated impulse response functions on the basis of the result in Table 2 with recursive orderings of variables.

First, we can argue that the shock in adjusted wage share has positive impact on both of the growth rate of GDP and the utilization ratio. This result implies that Korea has lain in the wage-led growth regime during 1975~2014 and the Kaleckian growth framework with monopolistic structures can be an appropriate model to explain the economic situation of Korea.

Second, it is shown that the shock of demand side may have a negative impact on the adjusted wage share. Especially, Figure 6 reports that the shock in utilization ratio has a negative impact significantly on the adjusted wage share.

Third, the results of Figure 5 and 6 show that the shock in amount of bank loan might have no impact on the growth rate of GDP, which may imply our revised Pasinetti theorem, i.e. $i=\frac{g^*}{s_f}$ holds. Conversely, we find that the shock in the growth rate of GDP may have a positive impact on the amount of bank loan, which can be interpreted that money is endogenously determined as expected by many accommodationists.

The recursive VAR estimation result with unadjusted wage share

Finally, we want to compare the results of Figure 5 and 6 with the estimated impulse response functions using unadjusted wage share.

Figure 7 and 8 present the impulse response functions and accumulated impulse response functions respectively, and these are estimated by using unadjusted wage share. There are no differences except that we have used unadjusted wage share (WS) rather than adjusted wage share (WSC). For simplicity and the purpose of brief comparison, we do not report the details for the results of lag test here.[27]

[27] When considering 5 lags, LR and HQ criterion indicate 1 lag is selected for the proper lag order.

Figure 7. Impulse response functions with unadjusted wage share

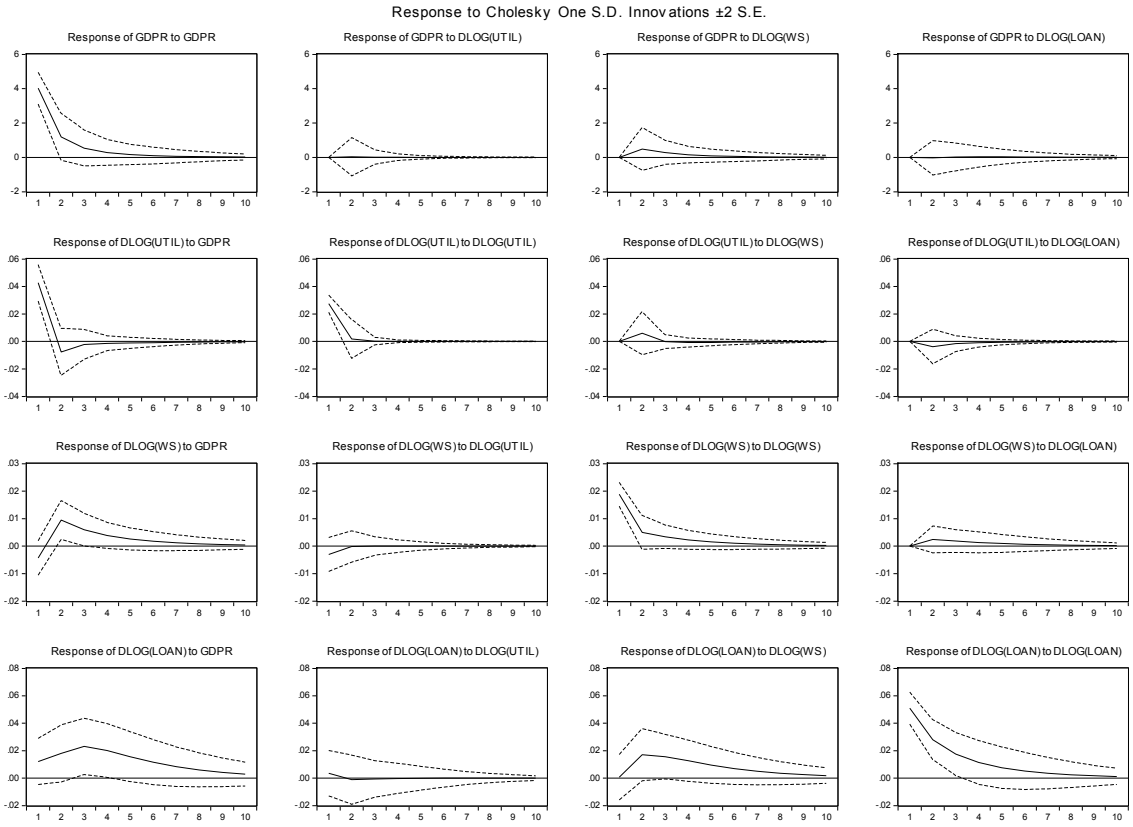
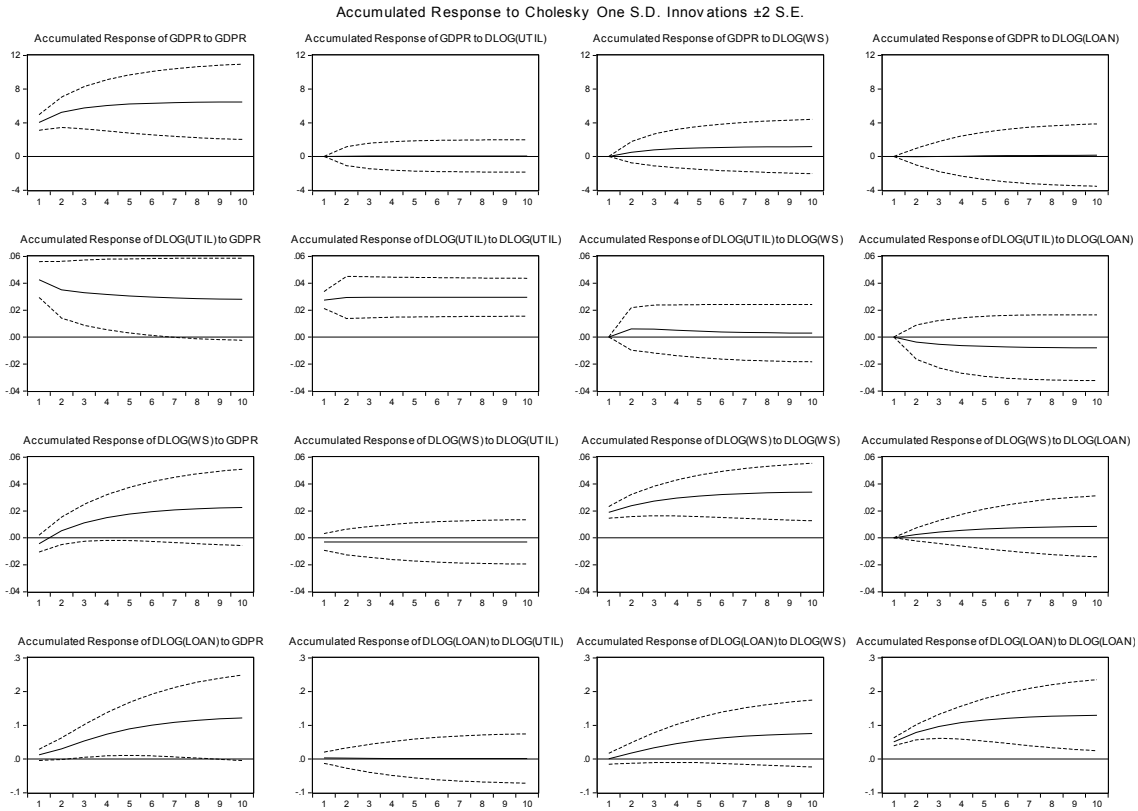


Figure 8. Accumulated impulse response functions with unadjusted wage share



First, we can confirm that unadjusted wage share may have no significant effect to both of GDP growth rate and the utilization ratio. In other words, we cannot observe the wage-led growth regime when considering the unadjusted wage share which is sharply contrast to the results of Figure 5 and 6. Second, Figure 8 shows that the shock in GDP growth rate has positive impact on the unadjusted wage share. It suggests that the GDP growth rate affects wage share of employed workers in a positive way, which is different result from Figure 6. Lastly, the results of Figure 5 and 6 show that the shock in the amount of bank loan might have no impact on the growth rate of GDP, although the reverse causality from GDP growth rate to the amount of bank loan is still observed.

In order to explain the differences, we have to keep in mind the facts that the unadjusted wage share does not consider the incomes of the self-employed, and also the level of the self-employment is considerably high in Korea. To sum up, Figure 7 and 8 imply that the nature of wage-led growth regime of Korea observed in Figure 5 and 6 may be attributed to the consideration of the incomes of the self-employed.[28] This may partially explain why Onaran and Stockhammer (2005) have concluded that a shock in the profit share does not seem to have a significant negative impact on both of the accumulation rate and effective demand, even though they use the VAR approach as well. That may be because the profit share they used "includes the incomes of the self-employed as profits". (Onaran and Stockhammer, 2005)

On the basis of these results, we may maintain that policy makers should especially pay more attention to the states of the self-employed when they want to moderate the deteriorating states of functional income distribution.

[28] The robustness of the nature of wage-led growth in Korea will be checked in Appendix V by choosing an alternative ordering to derive accumulated impulse response functions.

5 Concluding remarks

This paper proposes an alternative way of examining the relationship between functional income distribution and economic growth by integrating Kaldor's theory of income distribution, the Kaleckian growth model, and endogenous money in the Post-Keynesian framework. We bring the functional income distribution to the main theme of this paper so as to shed light on the relationship between the economic growth and income distribution. The functional income distribution means the division of national income between labor and capital, which is represented as the wage and profit share in this paper. Our theoretical model and empirical results support the ideas of Post-Keynesians that the effective demand is strongly related to the functional income distribution and should be integrated into the growth theory as one of the key variables.

In section 2, we find that the increase in profit share has always a negative impact on the economic growth, which implies the wage-led growth regime in Kaldor's theory of income distribution with neo-Kaleckian growth model. We confirm that the introduction of endogenous money into Kaldor's theory of income distribution does not change the nature of wage-led growth regime in neo-Kaleckian growth model.

On the other hand, section 3 shows that the profit-led growth regime can be possible even in Kaldor's theory of income distribution. To be specific, the investment function suggested by post-Kaleckians assumes the change of profit share affects the investment decision of corporations. By considering the effect of the profit share to the investment, we find that the profit-led growth regime is possible in our theoretical framework.

In section 4, the reformulated model of income distribution and growth is applied to test its relevance to the South Korean case, using VAR approach. More specifically, the test is done to find which one out of two growth regimes Korea belongs to. Our result of empirical analysis through VAR approach indicates that the growth regime of Korea is wage-led, which is also supported by several empirical results of the single equation approach conducted by several authors. In addition, it implies also that the amount of bank loan is endogenously determined by the size of effective demand as many Post-Keynesians predict.

The overall results of this paper shed some light on recent discussion surrounding the work of Piketty (2014). In <Capital in the 21st Century>, Piketty strongly warns the recurrence of patrimonial capitalism by showing that the slower economic growth than the profit rate may lead to a higher profit share on the basis of long-term data. This argument depends on a simple theoretical framework which is related to basic Keynesian macroeconomics. This framework

consists of three fundamental relations. The first principle is an identity about the relationship between the ratio of capital-output (β) and the profit share (m). By definition, the profit share (m) can be derived by the multiplication of the profit rate (r) and the capital-output ratio (β): $m = r \times \beta$.

The second principle is based on the equality between saving (S) and investment (I) in the long run. From this equality condition, we obtain that the capital-output ratio (β) is equal to the saving propensity (s) over the growth rate of capital stock (g): $\beta = \frac{s}{g}$.[29]

The third principle is the inequality of the profit rate (r) and the growth rate of capital stock (g) which is very crucial in his work and yet controversial. The inequality tells us that the profit rate (r) is larger than the growth rate of capital stock (g): $r > g$.

Based on these three principles, a simple story of deteriorating income distribution is derived: A higher profit rate over the growth rate of capital stock makes the capital-output ratio increase. By the first principle and the assumption of the elasticity of substitution that is larger than unity, the profit share will go up. In other words, lower growth rate of capital stock leads to the high level of concentration of profit share in favor of capital owners.

Unlike Piketty's approach, this paper tries to look into the relation between economic growth and functional income distribution from the reverse viewpoint on the basis of Kaleckian growth model. The Kaleckian growth model mainly maintains that the higher profit share may depress the growth rate of capital stock, and the profit share is determined by institutions or market structure. In terms of Kaleckian framework, the argument of Piketty examines the relationship between economic growth and functional income distribution in a reverse way. In section 3.3, we point out that the inequality $r > g$ can be merely an outcome of deteriorated functional income distribution in the neo-Pasinetti theorem developed on the basis of Kaldor's theory. If the inequality $r > g$ is a consequences of an economic situation, Piketty's controversial proposal, i.e. the global taxation on capital owners for lowering the profit rate than economic growth rate could not be justified.[30] In contrast to this, including Kaleckians, many Post-Keynesians argue that we have to make policies to mitigate higher profit share more directly, to boost up the effective demand and thus growth, focusing on the specific institutional characteristics forming the profit share.

[29] Because the growth rate of capital stock (g) is investment (I) over the capital stock (K), investment can be expressed as gK. And the total saving (S) is equal to the saving propensity (s) times national income (Y). By these relations, we can rewrite the equality of investment (I) and saving (S) as $gK = sY$. We can easily obtain the second principle of Piketty by reorganizing as $\frac{K}{Y} = \frac{s}{g}$.

[30] Steedman (1972, 1973) even shows that the taxation on capital owners can increase the equilibrium profit rate paradoxically. This result is derived on the basis of Pasinetti theorem.

The empirical analysis of this paper shows that Korea has the wage-led growth regime even though the integration of post-Kaleckian derives the possibility of profit-led regime theoretically. Including the results obtained by using single equation approach, these results imply that the appropriate income policies are required in order to moderate the higher level of profit share and simultaneously to raise the growth rate of capital stock as well. Besides, accumulated impulse response functions show that the Kaleckian framework is suitable for the Korean economy. One caveat is that the nature of wage-led growth regime in Korea depends on the states of the self-employed, since we could not confirm the wage-led growth regime using wage share which does not consider the incomes of the self-employed.

Considering all these results, we suggest that economic growth in Korea can be improved by mitigating the states of functional income distribution, and such redistribution policies should be based on the specific institutional structure of its economy. Out empirical results also imply that researchers have to pay more attention to the states of the self-employed to find their role and economic impacts in the Korean economy.

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Appendix I : Alternative choice of neo-Pasinetti theorem

Using four equations (16) – (19), we can obtain the revised neo-Pasinetti theorem about the pure rate of profit when we accept the steady-state conditions that $\Psi g = ag$.

$$r * = \frac{(1 - x - \Psi)g}{(1 - \Psi)s_f}. \qquad (7'')$$

When $\Psi = 0$, the revised neo-Pasinetti theorem returns to (7). And (7'') becomes the Pasinetti theorem (2) whenever $x = 0$. Still, the pure rate of profit is determined by behavior of corporations such as the proportion of financing sources, the retention rate and the growth rate of capital stock. By adopting the neo-Kaleckian framework, we will make the growth rate of capital stock determined endogenously.

The extension to neo-Kaleckian growth model

In the revised neo-Pasinetti theorem, we can obtain the changed saving function by using (7) and (9).[31] In here, we assume that the profit share is ratio of pure profit over the capital stock. Pure profit is remaining part of profit without interest payment.

$$g^s = \frac{s_f(1 - \Psi)mu}{k(1 - x - \Psi)}. \qquad (13'')$$

With using (13'') we can obtain the equilibrium growth rate of capital stock when we accept the neo-Kaleckian investment function (12).

$$g * = \frac{\gamma s_f}{s_f - \frac{k(1 - x - \Psi)}{m(1 - \Psi)} g_u}. \qquad (14''')$$

From the result (14''), we can find that there are two different points with (14). First, the stability condition becomes more moderated when we take endogenous money into consideration and Ψ is not zero.

[31] Because the revised neo-Pasinetti theorem considers the 'pure' rate of profit, we keep in mind the profit share (m) should be a share of profit remaining after interest payment is paid to bankers.

$$s_f > \frac{k(1-x)}{m} g_u > \frac{k(1-x-\Psi)}{m(1-\Psi)} g_u. \qquad (15'')$$

Second, the derivative of growth rate with respect to Ψ is negative in (14''). Intuitively, the negative sign of $\frac{\partial g*}{\partial \Psi}$ does not make sense that much. This unpersuasive result may be explained since the pure rate of profit does not contain the interest payment. That is why we adopt the gross rate of profit for deriving the neo-Pasinetti theorem in the section 2.3. Park points out that "the gross rate of profit … is relevant to the choice of technique." (Park, 2004. Section 6.1)

Appendix II : Simple introduction of labor productivity

In this Appendix, we want to briefly mention the implication of labor productivity growth in the perspective of our model we have developed in this paper. We should specify how the labor productivity growth is determined. The first determinant of the labor productivity growth is output or aggregate demand, which is known as Kaldor-Verdoon effect. "This arises because aggregate demand growth leads to an economy-wide deepening of the division of labour as well as more rapid learning-by-doing (in firms) – and both these processes are eventually reflected in higher labour productivity growth." (Storm and Naastepad, 2013) Second, the increase in labor productivity growth may be caused by the increase in wage share. "Higher wages stimulate capital deepening, drive inefficient firms off the market and encourage structural change, increase the proportion of high-skilled workers in the labour force, and, in general, promote labour-saving technological progress." (Storm and Naastepad, 2013) With consideration of autonomous element (η), the equation of labor productivity growth reflects the Kaldor-Verdoon effect ($\varepsilon > 0$) and the impact of the increase in wage share ($-\theta < 0$):

$$\hat{y} = \varepsilon g - \theta m + \eta. (\varepsilon, \theta, \eta > 0) \qquad (27)$$

With the labor productivity equation, we can obtain the different investment function. We assume that firms will accumulate capital stock more when they have technology with higher labor productivity growth:

$$g^i = \gamma + g_u u + g_{\hat{y}} \hat{y}. \left(\gamma, g_u, g_{\hat{y}} > 0\right) \qquad (12')$$

Using (12') and (13'), we can obtain the following equilibrium growth rate of capital stock.

$$g * = \frac{s_f\left[m\left(\gamma + g_{\hat{y}}\hat{y}\right) + \Psi i g_u k\right]}{m s_f - k(1 - x - \Psi) g_u}. \qquad (14''')$$

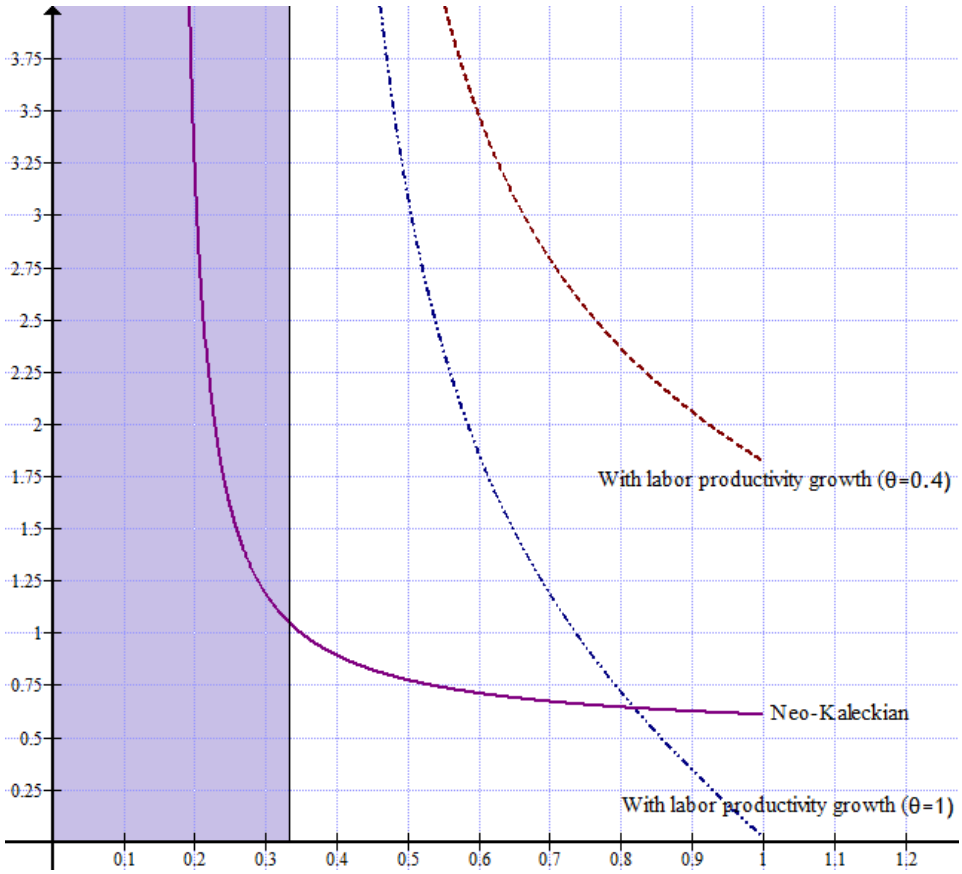
After replacing $\hat{y}$ in (14'') with (27), we can derive the equilibrium growth rate of capital stock with consideration of labor productivity growth determined within a model.

$$g ** = \frac{s_f m\left(\gamma + g_{\hat{y}}(\eta - \theta m)\right) + s_f \Psi i g_u k}{m s_f\left(1 - g_{\hat{y}}\varepsilon\right) - k(1 - x - \Psi) g_u}. \qquad (14'''')$$

Calibration

In the section 2.5, we have compared two cases, i.e. (14') and (14'') by simple calibration and have reported the result in Figure 3. Similarly we can depict the graph of relationship between the profit share and equilibrium growth rate of capital stock when we introduce the labor productivity. By doing this, we can confirm whether or not the introduction of labor productivity lets the profit-led growth regime possible.

Figure II.1. The relationship between steady-state growth rate and profit share



(*Note*: $s_f = 0.3, \gamma = 0.5, x = 0.1, \Psi = 0.8, i = 0.02, g_u = 0.1, g_{\hat{y}} = 1, \varepsilon = 0.5, \theta = 0.4$ or $1, \eta = 0.5$ and $k = 5$ are assumed. X-axis is profit share (m), and y-axis stands for the steady-state growth rate of capital stock (g^*).)

First, from Figure II.1, we can find that the higher is the sensitivity of productivity growth to wage share (θ), the lower equilibrium growth rate of capital stock will be realized. Figure II.1 shows that the function of equilibrium growth rate of capital stock with respect to

profit share moves down when θ increases from 0.4 to 1. Note that the nature of wage-led growth regime will be strengthened with higher θ. This result may come out since we do not explicitly consider the positive feedback effect of changes in labor productivity growth to profit share.

Second, there could not be a profit-led regime. We can obtain the profit-led regime with consideration of post-Kaleckian investment function (21) with extremely high value of g_m.

Lastly, the area of unstable growth regime is larger than the case without consideration of labor productivity. The shaded area in Figure II.1 shows unstable growth regime in which the profit share is lower than approximately 0.3333.

Appendix III : Empirical results of domestic growth regime

Table III.1. Domestic demand regimes according to single equation estimation

	Period	Austria	Germany	Netherland	France	Italy	Spain	Euro	Swiss	UK	US	Japan
Bowels and Boyer (1995)	1953/ 61-87		W		W					W	W	W
Naastepad (2006)	1960-2000			W								
Naastepad And Storm(2007)	1960-2000		W	W	W	W	W			W	P	P
Ederer and Stock hammer(2007)	1960-2004				W							
Ederer (2008)	1960-2005			W								
Hein and Vogel (2008)	1960-2005	W	W	P	W					W	W	
Stockhammer andElderer(2008)	1960-2005	W										
Hein and Vogel (2009)	1960-2005		W		W							
Stockhammer et al. (2009)	1960-2005							W				
Onaran et al. (2009)	1962-2007										W	
Stockhammer et al. (2011)	1970-2005		W									
Onaran and Galanis(2012)	1960s-2007		W		W	W		W		W	W	W
Hartwig (2013)	1950-2010								W			

(Eckhard, 2014. p.302-303) *Notes:* W : Wage-led; P: Profit-led

From this table, we find that most countries have wage-led growth regimes within domestic economy. This is supported by the prediction from our model which is based on neo-Pasinetti theorem and Kaleckian Framework. It is also noteworthy that US, Japan and Netherlands may have profit-led growth regimes within domestic economy, which is consistent with the result of post-Kaleckian.

Table III.2. Relationship between the profit share and estimated effects of a 1% point increase in the profit share on consumption and investment (OLS estimates)

Dependent Variable: DD
Method: Least Squares
Sample: 1 15
Included observations: 15
White heteroskedasticity-consistent standard errors & covariance

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.888122	0.202265	-4.390882	0.0009
PS	4.332572	1.424041	3.042449	0.0102
PS^2	-6.518704	2.192369	-2.973360	0.0116

R-squared	0.326837	Mean dependent var	-0.235200
Adjusted R-squared	0.214643	S.D. dependent var	0.147714
S.E. of regression	0.130905	Akaike info criterion	-1.051836
Sum squared resid	0.205633	Schwarz criterion	-0.910226
Log likelihood	10.88877	Hannan-Quinn criter.	-1.053345
F-statistic	2.913141	Durbin-Watson stat	2.760986
Prob(F-statistic)	0.093051		

We try to estimate the relationship between the profit share and the domestic effective demand on the basis of results derived in Onaran and Galanis (2013). These estimates have been derived using 15 samples of profit share data and estimated effects of a 1% point increase in the profit share on consumption and investment. Although, the estimates results should be cautiously interpreted because of low numbers of sample, we can at least point out that there may be a correlation between the profit share and the domestic effective demand from this result. Furthermore, these results also imply that there is a quadratic relation between the profit share and the domestic effective demand.

Appendix IV

Table IV. 1. ADF test

Exogenous: Constant, Linear trend
Null Hypothesis: No unit root at significance level 1%***, 5%**
Sample: 1975 2014
Included observations: 38

	GDPR	LOG(UTIL)	LOG(WSC)	LOG(SHLOAN)
Level variable	**-4.718833*** **	-3.880943**	-2.356329	-1.898706
Differentiated variable	-5.987605***	**-5.494841*** **	**-6.982346*** **	**-4.862125*** **

Table IV. 2. VAR lag tests

Endogenous variables: GDPR DLOG(UTIL) DLOG(WSC) DLOG(LOAN)
Exogenous variables: C
Sample: 1975 2014
Included observations: 35

Lag	LogL	LR	FPE	AIC	SC	HQ
0	106.5028	NA	3.36e-08	-5.857300	-5.679546*	-5.795940
1	134.5549	**48.08947***	**1.70e-08***	**-6.545997***	-5.657227	**-6.239194***
2	150.1393	23.15384	1.81e-08	-6.522243	-4.922457	-5.969997
3	156.6147	8.140505	3.46e-08	-5.977981	-3.667178	-5.180292
4	172.7126	16.55787	4.23e-08	-5.983577	-2.961758	-4.940445

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

Table IV. 3. VAR residual serial correlation LM tests

Null Hypothesis: no serial correlation at lag order h
Sample: 1975 2014
Included observations: 38

Lags	LM-Stat	Prob
1	19.03903	0.2666
2	20.01204	0.2197
3	10.39977	0.8449
4	10.17284	0.8574
5	17.31228	0.3657
6	10.41518	0.8441
7	8.489883	0.9329
8	5.888054	0.9893

Probs from chi-square with 16 df.

Table IV. 4. VAR residual Normality tests

Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: residuals are multivariate normal
Sample: 1975 2014
Included observations: 38

Component	Skewness	Chi-sq	df	Prob.
1	-0.427807	1.159117	1	0.2816
2	0.063007	0.025142	1	0.8740
3	0.387686	0.951903	1	0.3292
4	0.418129	1.107266	1	0.2927
Joint		3.243428	4	0.5179

Component	Kurtosis	Chi-sq	df	Prob.
1	3.699712	0.775194	1	0.3786
2	3.753939	0.900005	1	0.3428
3	3.141469	0.031688	1	0.8587
4	3.008259	0.000108	1	0.9917
Joint		1.706995	4	0.7894

Component	Jarque-Bera	df	Prob.
1	1.934311	2	0.3802
2	0.925147	2	0.6297
3	0.983591	2	0.6115
4	1.107374	2	0.5748
Joint	4.950423	8	0.7629

Appendix V : Alternative choice of orderings

In this Appendix, we want to check the robustness of results in Figure 6 and 8 by choosing alternative orderings.

$$\begin{bmatrix} v_{dlog(\mathrm{u})} \\ v_{dlog(w)} \\ v_g \\ v_{dlog(\Psi)} \end{bmatrix} = \begin{bmatrix} b_{11} & 0 & 0 & 0 \\ b_{21} & b_{22} & 0 & 0 \\ b_{31} & b_{32} & b_{33} & 0 \\ b_{41} & b_{42} & b_{43} & b_{44} \end{bmatrix} \begin{bmatrix} \varepsilon_{dlog(\mathrm{u})} \\ \varepsilon_{dlog(w)} \\ \varepsilon_g \\ \varepsilon_{dlog(\Psi)} \end{bmatrix} \qquad (27')$$

The matrix B in (27') implies that there is a contemporaneous effect from the utilization ratio (u) to the adjusted wage share (w), not vice versa. This ordering is also selected to capture the feedback effect of aggregate demand to the adjusted wage share. However, the adjusted wage share is assumed to have a contemporaneous effect to the growth rate of GDP (g), not vice versa. This ordering can be an alternative choice, because the Kaleckian growth model tries to show the partial effect of the change in the wage share to the growth rate of capital stock. All variables are still assumed to have a contemporaneous effect to the amount of bank loan (Ψ).

Figure V. 1. Accumulated impulse response functions with adjusted wage share

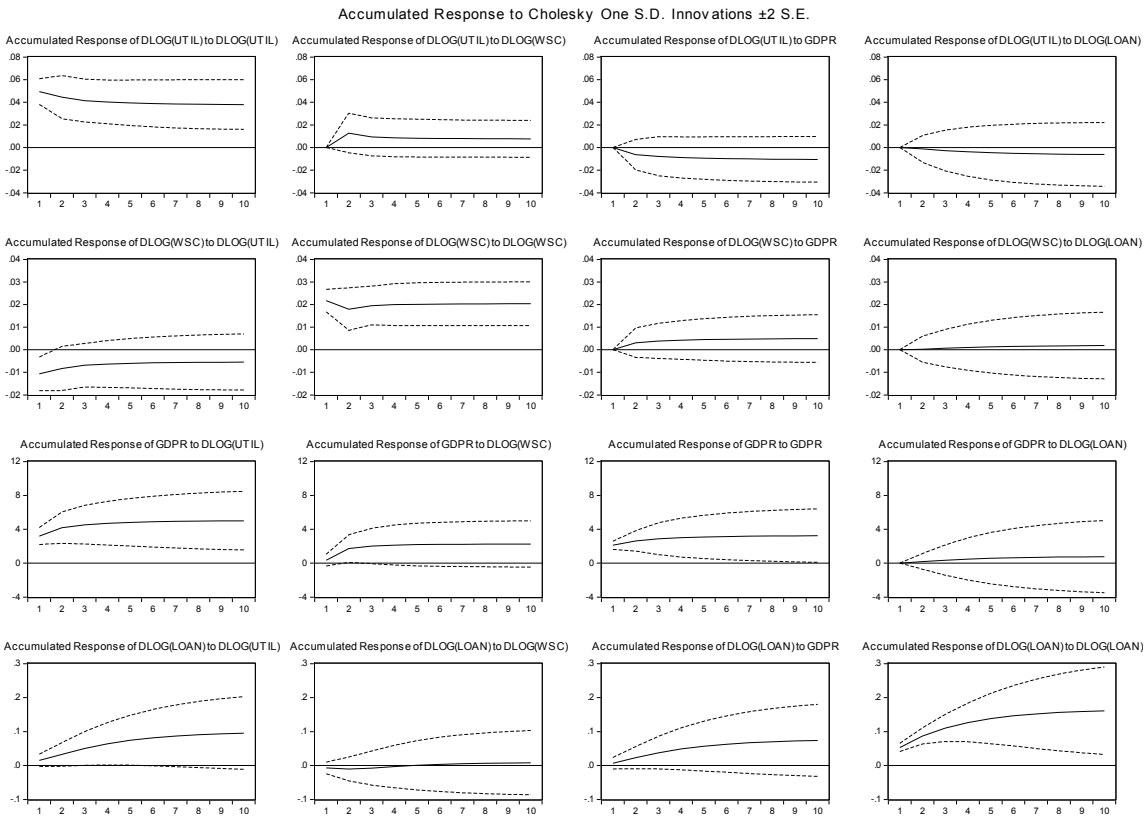
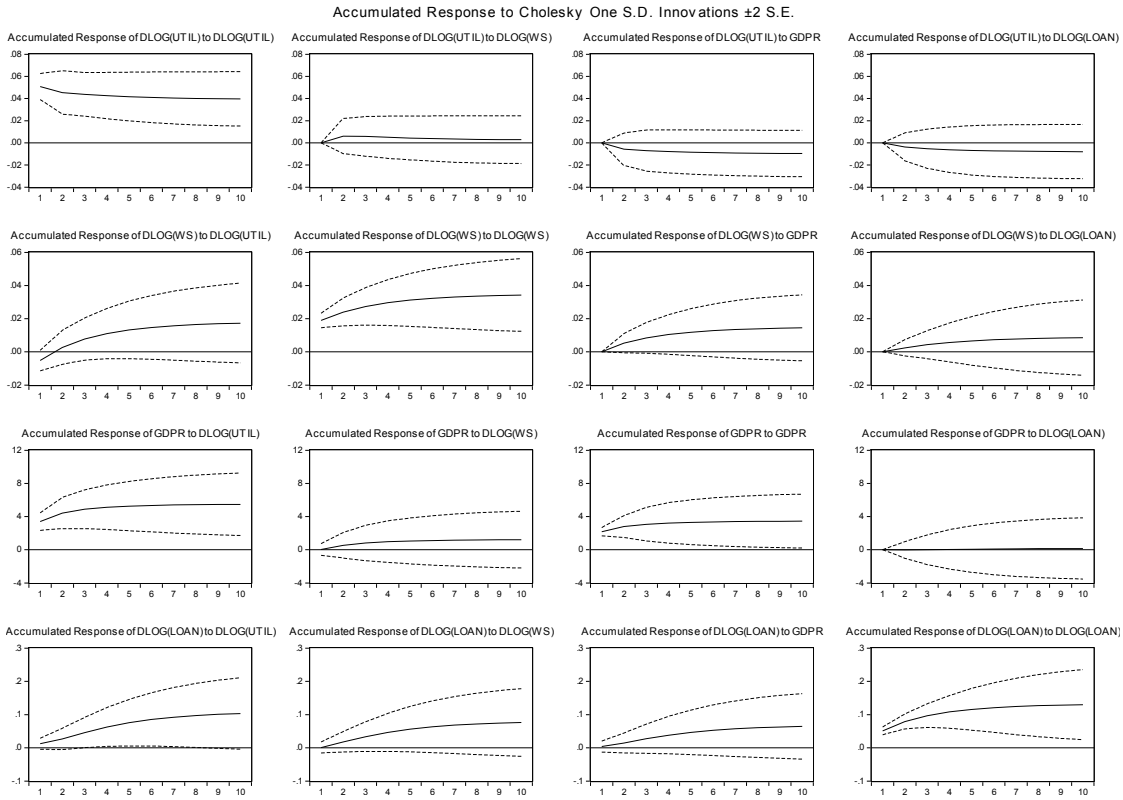


Figure V. 2. Accumulated impulse response functions with unadjusted wage share



First, in Figure V. 1, we can argue that the shock in adjusted wage share has a significantly positive impact on the growth rate of GDP even though we have chosen a different ordering in (27'). It implies that the argument of wage-led regime in Korea is still valid.

Second, we find that the nature of wage-led depends on the incomes of the self-employed in Figure V. 2. That is because there is no significantly positive impact of the shock in wage share to the growth rate of GDP when wage share is not adjusted to the incomes of the self-employed.

Lastly, we can point out that the amount of bank loan does not affect the growth rate of GDP. These results are similar with Figure 6 and 8, which implies that our conclusions are not strongly dependent on the orderings in (27').

국문초록

이 논문의 목표는 기능적 소득분배와 유효수요 간의 관계를 고찰하는 대안적 관점을 제시하는 데에 있다. 본 논문은 칼도(Kaldor, 1966)의 소득분배 이론과 포스트 칼레츠키언 성장모형(Bhaduri and Marglin, 1990; Kurz, 1990, 1994; and Marglin and Bhaduri, 1990, 1991)을 통합함으로써 이 관계를 분석하고자 시도한다.

아라주(Araujo, 1995)에 의해 요약된 바 있는 네오 파지네티 정리를 활용하여, 우리는 칼도의 소득분배 이론과 네오 칼레츠키언 성장모형을 통합하고자 했던 라부아(Lavoie, 1998)의 논문을 약간 수정하고자 한다. 포스트 칼레츠키언 성장모형의 도입은 임금주도와 이윤주도 성장체제 모두가 가능함을 보인다. 본 논문은 또한 박만섭(Park, 2004)의 논의를 따라 칼도의 소득분배 이론에 내생화폐 개념을 통합하는 것을 시도한다. 여기서 우리는 이자율이 파지네티 정리의 형태로서 결정될 때, 투자지출에서 은행대출이 차지하는 비율의 변동이 자본스톡의 성장률에 대해 중립인 경우가 성립함을 보인다.

마지막으로 이 논문은 스톡햄머와 오나란(Stockhammer and Onaran, 2004)에 의해 제시된 칼레츠키언 성장모형에 대한 VAR 분석 방법론을 통해, 한국의 성장체제를 분석하고자 한다. 우리는 한국에서 이윤소득분배율이 감소할 때 더 높은 성장을 달성할 수 있다는 결과를 얻었다. 이는 한국의 경제규모가 증대해왔고, 독점적인 시장이 여전히 지배적이기 때문으로 보인다. 그리고 한국의 임금주도 성장체제라는 성격이 자영업자의 소득 상태에 깊이 의존하고 있음을 보인다.

Keywords: 포스트 케인지언 경제학; 기능적 소득분배; 네오 파지네티 정리; 내생화폐; 칼레츠키언 성장모형; 임금주도 성장체제

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