A Comparison of Wicksell, the New Consensus, the Neo- Wicksellians, and the Post Keynesians with Respect to Inflation Targeting Policy

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Contents

Abstract

1. Introduction

2. Wicksell vs. the neo-Wicksellians

3. The New Consensus vs. the neo-Wicksellians

3-1. The difference between New Consensus and neo-Wicksellians

3-2. Inconsistency in Woodford's model

4. Post Keynesian's critiques of the New Consensus and the neo-Wicksellians

4-1. Arestis-Sawyer's critiques

4-2. Setterfield's critique

4-3. Rogers' critique

5. Conclusion

Table 1

Abstract

This paper analyzes the models of Wicksell, the New Consensus, the neo-Wicksellians, and the post-Keynesians with respect to inflation targeting policy. These various models make the claim that central banks fully accommodate the demand for money, while setting exogenously the nominal rate of interest to achieve the inflation target. However, each model has a different theoretical basis, depending on the assumptions regarding the role of credit and money, the nature of money supply, the nominal rate of interest, the natural rate of interest, the natural rate of output, and sticky/flexible prices. First, the models of Wicksell and that of the neo-Wicksellians are compared in terms of the definition of the natural rate of interest. Second, the models of the New Consensus and that of the neo-Wicksellians are analyzed from the viewpoint of sticky and flexible prices. Third, the post Keynesian critiques of inflation targeting policy are addressed with regards to the effectiveness and feasibility of central banks' setting of the nominal rate of interest, as well as discussing the compatibility of the post-Keynesian model with inflation targeting policy.

1. Introduction

"So long as prices remain unaltered, the banks' rate of interest is to remain unaltered. If prices rise, the rate of interest is to be raised: and if prices fall, the rate of interest is to be lowered; and the rate of interest is henceforth to be maintained at its new level until a further movement of prices calls for a further change in one direction or the other....In my opinion, the main cause of the instability of prices resides in the inability or failure of the banks to follow this rule." (Wicksell 1898, pp. 188-189)

Wicksell (1898) presented the theory that the price level is determined by the relationship between the natural rate of interest and the money rate of interest. He focused attention on the role of the central bank in keeping the price level stable by incorporating the endogenous nature of the money supply and the exogenous determination of the money rate of interest, assuming that the "natural" rate of interest is determined in the "real" capital market regardless of monetary policies of the central bank. The theory was to be a rejection of the assertion that the money supply determines the price level, taking a position totally different from that of the quantity theory of money on the relationship between money, the price level and interest rates.

The Classical theory imposes the neutrality of money, via the quantity theory of money to explain the determination of the price level, and via the Fisher equation to show the determination of the money rate of interest. The quantity theory of money makes the assumption that real variables are not influenced by the money supply in the long run, and

the Fisher equation holds that if prices rise, the money rate of interest goes up proportionately, with the real rate of interest being determined by real factors.

This tradition is linked to monetarism which gives price stability a top priority while asserting that the central bank determines inflation by controlling the money supply stock. Furthermore, monetarism even makes the point that since inflation itself undermines the efficiency of the economy by distorting relative prices, zero inflation is more beneficial to the economic performance than low or moderate inflation.

From the early 1990s, many central banks began to adopt inflation targeting policy which entailed controlling the central bank rate of interest to achieve the target inflation rate and letting the money supply be endogenously determined to meet the demand for money. Meanwhile, new Keynesian researchers have tried to provide a justification for this policy by offering a precise theoretical framework. These researchers, also called 'New Consensus' or 'neo-Wicksellians', emphasize the endogenous nature of the money supply, treating the latter as a residual, and also adopt the interest rate as a direct policy variable. Even if the neo-Wicksellians and monetarists are all alike in believing that the central bank ultimately determines the inflation rate, the neo-Wicksellians hold a view opposite to that of the monetarists when it comes to the nature of the money supply and the cause of

variations of prices.

"Inflation occurred whenever the central banks lowered interest rates without any decline in the natural rate having occurred to justify it or whenever the natural rate of interest increased without any adjustment of the interest rates controlled by central banks in response. Deflation occurred whenever a disparity was created of the opposite sign." (Woodford 2003, p. 49)

On the other hand, it is the post-Keynesian school that identifies money as a truly endogenous variable and emphasizes a critical role for money and credit in economic activities, not in controlling the inflation rate. They make the claim that "simply the expansion of investment expenditure requires the availability of loans, which leads to a corresponding expansion of bank deposits, and the investment expenditure generates a corresponding level of savings....Money is generated in the inflationary process as rising costs and prices lead to requirements of loans to finance higher nominal production and expenditure. The rate of inflation then influences the rate of increase of the stock of money, but the growth in the stock of money does not in any sense cause inflation" (Arestis and Sawyer 2004, p. 443).

According to this school, the inflation rate has a relationship with money that is reversed, compared to the direction that is postulated by the monetarists, while the central bank fully accommodates the demand for money, as the New Consensus authors assert. In

this regard, the post-Keynesians appear to be closer to the New Consensus than to the monetarists and their views seem to be compatible with the former as well as Wicksell, while taking a position which is diametrically opposite to that of the monetarists. However, the post-Keynesians totally disagree with both of the two in terms of the concepts such as the natural rate of interest, the natural rate of output, and the like.

This paper compares the assumptions and the theoretical frameworks of Wicksell and the neo-Wicksellians[1] in section 2. I find that even though Woodford (2003) incorporates the endogenous nature of the money supply in a pure credit economy to justify the direct control of the rate of interest by the central bank as Wicksell did, he also makes use of the Fisher equation and the marginalist theory to explain why interest rate policy is determinate in the general equilibrium framework. However, Wicksell did not accept the causality of the Fisher equation, according to which the rise of prices causes the interest rate to rise. Also, Wicksell opposed the marginalist argument that the money rate of interest is obliged to come into line with the natural rate of interest through the money market operation. I show why Woodford combines such neoclassical theories with Wicksell's theory, and I also show

[1] I confine neo-Wicksellian to Woodford in order to distinguish neo-Wicksellians from the New Consensus.

the different frameworks between them.

In section 3-1, the difference between the New Consensus and the neo-Wicksellians is reviewed in terms of the nature of the money supply in the case of a cashless economy. The advocates of the New Consensus and the neo-Wicksellians postulate an IS curve derived from the consumption maximization of a representative household, the so-called Euler equation. Often described as the Calvo model, the AS curve is derived from the profit maximization conditions of a monopolistically competitive producer. Finally, monetary policy is derived from a Wicksellian rule or a Taylor rule. However, the New Consensus makes the assumption that there exists money in the economy and sticky prices are treated as structural in their framework, whereas neo-Wicksellians make the assumption of a cashless economy and try to combine the long-run equilibrium in a flexible price framework with the short-run equilibrium in a sticky price framework. Furthermore, the New Consensus does not make explicit use of the natural rate of interest in explaining how to derive the IS curve but makes implicit use of the natural rate of interest when the monetary policy curve is derived, whereas neo-Wicksellians make explicit use of the natural rate of interest in both curves. This theoretical difference leads to the question of "what should be the target of the inflation rate?" According to the New Consensus

framework, monetary policies have no impact on real variables so that a central bank can adopt an arbitrary target of the inflation rate in equilibrium and achieve the target at no cost. However, neo-Wicksellians make the claim that there is no inflation in the long-run equilibrium so a central bank should target zero or near zero inflation rates.

Inconsistency in Woodford's model is discussed in section 3-2. Woodford (2003) deals with monetary policy in the flexible price system in chapter 2, where he infers the relationship among the money rate of interest, the natural rate of interest, and the money price by making use of the neoclassical Euler equation. However, I find that the money price that central banks target is the relative price and that the nominal rate of interest set by central banks is the natural rate of interest in neoclassical economics. Furthermore, the natural rate of interest is replaced with the intertemporal marginal rates of substitution of a representative household in chapter 2, whereas the natural rate of interest he deals with in chapter 4, where prices are sticky, is the equilibrium real rate of interest determined in the real capital market.

In section 4, I deal with the post-Keynesians' critique of the New Consensus and the neo-Wicksellian model. Post-Keynesians explicitly reject the New Consensus and neo-Wicksellian natural rate of interest as well as the natural rate of output, and they emphasize

the importance of an endogenous money supply, which is said, necessary for investment to increase, leading to the expansion of bank deposits and savings.

First, Arestis and Sawyer (2004) try to deduce the concept of the natural rate of interest from the New Consensus framework and to prove that it is impossible for a central bank to target the natural rate of interest since the natural rate of interest is greatly influenced by fiscal policy as well as monetary policy. However, I also find that New Consensus authors have not explicitly introduced the concept of the natural rate of interest in their equations, so that the relationship that this concept has with monetary policy is ambiguous. Furthermore, both the New Consensus and the neo-Wicksellians emphasize fiscal requirements for price stability by arguing that "If fiscal policy is locally Ricardian, ...equilibrium is determinate if and only if the monetary policy rule confirms to the Taylor principle. ... If, instead, fiscal policy is locally non-Ricardian, equilibrium is determinate if and only if the monetary policy rule violates the Taylor principle. If monetary policy conforms to the Taylor principle, there is no equilibrium.... (Leeper classifies fiscal rules as passive when policy is locally Ricardian and active otherwise, and classifies monetary policy as active when it conforms to the Taylor principle and passive otherwise. His central result is then that equilibrium is determinate if and only if either monetary or fiscal policy is

active, while the other is passive)." (Woodford 2003, p. 314)

Second, Setterfield (2006) identifies the neo-Wicksellian view with the monetarist view, meaning that a central bank is able to set the inflation rate at its discretion with no impact on the output level. However, I show that the equilibrium inflation rate in neo-Wicksellian theory is zero so that a central bank should target a zero or near zero inflation rate, such that the nominal rate of interest corresponds to the natural rate of interest and the real rate of return is equal to the equilibrium real rate of interest, as shown in Woodford (2003).

Third, Rogers (2006) makes the claim that "because there is no nominal rate of interest in Woodford's cashless limit, there is nothing in the model equivalent to Wicksell's market rate. For these reasons, I do not see any connection between Wicksell's pure credit economy and Woodford's cashless limit. Woodford's neo-Wicksellian monetary theory is a caricature of Wicksell" (Rogers 2006, p. 303). However, I find that Rogers' critique is applicable only to chapter 2 of Woodford (2003), where the latter had just tried to prove the determinacy of the Wicksellian rule in the flexible price world postulated by the monetarists and New Classical, and I also find that, unlike chapter 2, chapter 4 of Woodford (2003) provides the practical instructions about how to control the nominal rate of interest in order to achieve the target inflation rate.

In section 5, I conclude.

2. Wicksell vs. the neo-Wicksellians

Wicksell (1898) shows why money prices should be stable and what benefits stable prices provide to the economy in terms of economic efficiency. According to Wicksell, variations in relative prices are a result of changes in the conditions of production and technical improvement, and they have nothing to do with monetary policy. On the other hand, since variations in money prices are slower than variations in relative prices and are not complete, social ineffectiveness is left over whenever money prices vary. The relationship between relative prices and money prices leads to the relationship between the natural rate of interest and the money rate of interest in dealing with how to make the money prices stable in Wicksell's framework. Since the variations in the natural rate of interest are more volatile than the variations in the money rate of interest controlled by the central bank, it is impossible to bring the money rate perfectly into line with the natural rate. However, since central banks have the capacity and the authority to set exogenously the money rate, they can control money rates to obtain stable money prices, thus making the economy more efficient in the sense that there is no residue of social maladjustment.

Woodford (2003) shows the justification of maintaining a low and stable rate of inflation while incorporating Wicksell's key concepts of relative prices and money prices, the natural rate and the money rate of interest, a pure credit economy, and the endogenous nature of the money supply. According to Woodford, achieving invariable money prices should be the prime aim of monetary policy because the instability of money prices causes substantial real distortions which lead to inefficient variations both in aggregate employment and output. That is, both Wicksell and Woodford emphasize that zero inflation or stable prices are required to make the economy more efficient, and that even a moderate rate of inflation leads necessarily to a distortion.

However, even though Woodford makes use of key concepts of Wicksell to show why money prices vary and which conditions are required to make money prices invariable, he has a quite different view from that of Wicksell in terms of the definitions of the natural rate of interest and his views of the Fisher equation.

First, in Wicksell's theory, the natural rate of interest "depends on the efficiency of production, on the available amount of fixed and liquid capital, on the supply of labor and land, in short on all the thousand and one things which determine the current economic position of a community; and with them it constantly fluctuates" (Wicksell 1898, p. 106).

The natural rate of interest is neutral to money prices without raising or lowering them, and it is the interest rate on loans of real capital which is determined by the supply and demand in the form of real capital. This definition of the natural rate of interest of Wicksell is seemingly the same as that of neoclassical economics, associated with the quantity theory of money, which maintains that the money rate of interest is determined in the money market while the real rate of interest is determined in a real capital market. The two rates are presumed to have a fundamental relationship, specified by the Fisher equation, where the rise of money prices which is caused by an exogenous money supply leads to the rise of the money rate of interest without interfering with the real rate of interest.

On the other hand, in Woodford's model, the natural rate of interest is defined by the intertemporal marginal rate of substitution of the representative household, making use of the Euler equation of the neo-Wicksellians[2] to infer the Fisher equation[3], which is

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[2] $1+i_t = \beta^{-1}\left\{E_t\left[\frac{u_c(Y_{t+1};\xi_{t+1})}{u_c(Y_t;\xi_t)}\frac{P_t}{P_{t+1}}\right]\right\}^{-1}$ In this relation, the intertemporal marginal rate of substitution of the representative household plays the role of the real-interest factor. (Woodford 2003, p. 71) However, Woodford (2003) also maintains that Friedman's natural rate of output is a highly useful concept and that the gap between actual output and this natural rate of output is considered as what is relevant to explaining variations of inflation in chapter 4.

[3] $\hat{i}_t = \hat{r}_t + E_t\pi_{t+1}$ (Woodford 2003, p. 84).

interpreted as the equilibrium of the goods market called 'flexible-price IS equation', $p_t = E_t p_{t+1} + r_t - i_t$.

Furthermore, Woodford expands individual marginal utility to social marginal utility as is the case for neoclassical general equilibrium models, but Wicksell clearly rejects such an approach. According to Wicksell (1898), "the existence of proportionality between relative exchange value and the utility of the last unit...is immediately obvious....but it does not follow from this principle that the relation between marginal utilities must apply to the *whole* quantity of a commodity given in exchange" (Wicksell 4898, p. 19). In addition, Wicksell maintains that real capital is not made up of objects to be borrowed and lent between entrepreneurs in the real capital market, which means that the natural rate of interest determined in the real capital market plays a less important role in allocating resources and, as a result, in determining the natural rate of output than in causing the variations of money prices. Unlike neo-Wicksellian theory, which follows Friedman when it comes to defining the relationship between the natural rate of interest and the natural rate of output, Wicksell emphasizes that real capital goods are objects to be purchased and sold between entrepreneurs and capitalists in the capital market, which means that the rise of demand for real capital leads to rising prices of real capital goods, not to a rise of the

natural rate of interest. Unlike real capital goods, money is an object to be borrowed and lent, but its quantity to be demanded by entrepreneurs is fully accommodated by the central bank, so that the supply of and the demand for money have no impact on the money rate of interest. Now, since what is determined in the real capital market is not the natural rate of interest but the price of real capital goods and the money rate of interest is determined not in the money market but by the central bank, the natural rate of interest and the money rate of interest play a key role in determining money prices of real capital goods. When the natural rate of interest is higher than the money rate of interest, entrepreneurs make more than normal profits, leading to a rise in the demand for real capital goods and, as a result, the rise in the demand for money. However, the rise in the demand for money does not result in a rise of the money rate due to the endogenous nature of the money supply, whereas the rise in the demand for real capital goods results in a rise in money prices, because the real capital goods are objects to be purchased and sold in the medium of money. Therefore, the natural rate of interest plays no role in determining the natural rate of output in Wicksell's model when it comes to the relationship between the natural rate of interest and money prices, whereas, as we can see in the equation, $\hat{y}_t^n = -\sigma \hat{r}_t^n + E_t \hat{y}_{t+1}^n$,[4] the

[4] (Woodford 2003, p. 246).

natural rate of interest has a negative relationship with the natural rate of output in Woodford's model.

Second, Wicksell makes the claim that the Fisher equation is incompatible with his theory since the equation treats variation of prices as a cause of variations in interest rates. According to Wicksell (1898), the Fisher equation claims that when prices rise, entrepreneurs are in a position to pay a higher rate of interest on their loans because, if both income and expenses rise, the difference also rise, thereby leading to the expansion of entrepreneurs' profits. However, this argument is diametrically opposed to Wicksell's view which maintains that "a rise in prices is usually due to a rise in the entrepreneurs' demand for labor and other productive services. Such a rise in prices is thus the consequence of a previous rise in money wages and rents, and it merely serves to compensate the entrepreneurs for the rise in costs of production. It does not provide them with the means of paying a higher rate of interest –except in the case where the prevailing rate of interest is lower than the natural rate, i.e. than the profit which the entrepreneurs would obtain if prices did not alter" (Wicksell 1898, p. 166).

In fact, the Fisher equation is compatible with the quantity theory of money. The Fisher equation suggests that the rise of prices leads to the rise of the money rate of interest with

the natural rate of interest – the real rate of interest– remaining unchanged. The Fisher equation requires the quantity theory of money to explain the cause of the rise in prices. The quantity theory of money claims that the exogenous increase in the money supply leads to rising prices, with the natural rate of output remaining unchanged. It is combined with the Fisher equation, according to which the rise in prices leads to a rise in money rates of interest, with the natural rate of output remaining unchanged. This combination results in the argument that the exogenous increase in money supply leads to the rise in the money rate of interest, with the natural rate of output and the natural rate of interest remaining unchanged. From the viewpoint of Wicksell, however, the rise of the natural rate of interest above the money rate of interest, or the fall of the money rate of interest below the natural rate of interest, causes prices to rise and, as a consequence, a central bank should raise the money rate of interest both to make prices stable and to remove a distortion of resource allocation.

On the contrary, Woodford combines the Fisher equation with his general equilibrium model to show how an interaction of the natural rate of interest and the money rate of interest affects the variation of prices and whether Wicksellian monetary policy is determinate in the flexible price system. Woodford transforms the Fisher

equation, $i_t = r_t + E_t\pi_{t+1}$, to a Fisherian relation, $p_t = E_t p_{t+1} + r_t - i_t$, where he maintains that "Because r_t is a certain function of exogenous real factors, rather than the measured real rate of return, this is an equilibrium relation –the condition required for equality between aggregate saving and investment– rather than an identity. This '*flexible-price IS equation*' indicates how the price level that 'clears' the goods market –or equivalently, that equates saving and investment– depends on the expected future price level, real factors affecting saving and investment, and the nominal interest rate controlled by the central bank" (Woodford 2003, p. 50). Put differently, the neoclassical model, in which the real rate of interest –the natural rate of interest– plays a key role in equating savings and investment and thus determining the natural rate of output, is transformed into the Wicksellian model where the price level plays a key role in equating savings and investment for a given natural rate of output.

Assuming that the natural rate of interest does not play its role in clearing the goods market, but just affects savings and investment, while money prices clear the goods market instead[5], we should find out under which conditions the price level clears the goods market

[5] This means that saving is equal to investment when prices are stable in Woodford's model. That is, unstable prices lead to a difference between savings and investment.

or equates savings and investment.

To get to the point, we can infer from the equation, $p_t = E_t p_{t+1} + r_t - i_t$, that when p_t is equal to $E_t p_{t+1}$, i_t becomes equal to r_t. Because r_t is a function of exogenous real factors while i_t is also a function of exogenous monetary policy, the medium that equates i_t to r_t is the price level, p_t. In addition, due to the fact that p_t being equal to $E_t p_{t+1}$ implies a zero inflation rate, zero inflation is required to achieve equilibrium in the endowment economy. Therefore, there are two reasons in Woodford's theory why a central bank should target a zero inflation rate. The first one is that, as referred to above, any inflation that is not zero inflation makes the economy inefficient, and the other is that only a zero inflation rate leads to the long run equilibrium in which savings is equal to investment and the goods market is cleared.

3. The New Consensus vs. the neo-Wicksellians

3-1. The difference between the New Consensus and neo-Wicksellians

The advocates of the New Consensus and the neo-Wicksellians make the claim that monetary policy has a significant influence on the real economy in the short run with no influence in the long run. That is, they are assuming sticky prices in the short run and

flexible prices in the long run. The claim is quite the same as that of New Keynesians, whereas New Classical and the monetarist theories assume that monetary policy has no impact on the real economy both in the short run and in the long run assuming flexible prices in economy.

The New Consensus focuses on the nominal price rigidity to justify the non-neutral nature of monetary policy, assuming an economy in which there exists money as well as price rigidity. In this respect, its framework is not different from that of the New Keynesians in terms of the basic assumption regarding the economy. That is, the framework is a dynamic general equilibrium model where money and sticky prices exist and where monetary policy has an influence on real variables in the short run. The difference vis-à-vis the traditional Keynesian framework is that the IS curve is derived from consumption maximization of a representative household, called the Euler equation, while the AS curve is derived from the profit-maximizing behavior of a monopolistically competitive producer, called the Calvo model. In addition, the key difference between the New Consensus and the traditional Keynesian view is that the former replaces the LM curve with a monetary policy equation in which a central bank influences the real rate of interest. The New Consensus maintains that the central bank should indirectly control the real rate of interest to target the

inflation rate, assuming that controlling the nominal rate of interest leads to variations in the real rate of interest on account of temporary price rigidities, whereas traditional Keynesians or the monetarists maintain that the central bank should control the money supply, assuming that exogenous variations in the money supply cause the price level to vary, following the quantity theory of money. The issue in the New Consensus theory is how the central bank controls the nominal rate of interest in an economy where there exists money and a money market. One argument is that "central banks act by injecting or draining high-powered money from financial markets" (Romer 2000, p. 161). In this case, another issue is whether variations in the money supply can change the real rate of interest via variations in the nominal rate of interest. According to the New Consensus, the central bank can control the real rate of interest only on the assumption of price rigidity, which indicates that the policy is effective only in the short run, affecting only the nominal rate of interest in the long run.[6]

[6] The question of which instrument is effective between the interest rate and the money stock can also be answered in the traditional IS-LM framework. According to W. Poole, "the monetary policy problem is viewed as setting the money stock at the level such that the LM function will cut the IS function at the full employment level of income. Alternatively, ...the monetary authorities sets the real rate of interest, thereby making the LM function horizontal" (Poole 1970, p. 200). However, I do not deal with this issue in this paper.

Another argument is that the central bank can directly target the nominal rate of interest and accommodate the demand for money. That is, controlling the nominal rate of interest is treated as "a species of price control" (Woodford 2003, p. 33), assuming that "there is no inherent equilibrium level of interest rates to which the market would tend in the absence of central bank intervention and against which the central bank must therefore exert a significant countervailing force in order to achieve a given operating target" (Woodford 2003, p. 3).

Even though the New Consensus model has no active role for money and is a clear denial of the monetarist view in terms of the quantity theory of money, its monetary policy is not quite different from that of the monetarists, in that monetary policy has no influence on the natural rate of output and that inflation is determined by monetary policy with the remaining real variables constant. While the monetarists focus on the role of the central bank by emphasizing the relationship between an exogenous money supply and the inflation rate, allowing the nominal interest rate to be determined in the money market, the New Consensus focuses on the role of the central bank by emphasizing the direct control of the nominal interest rate and allowing the demand for money to be accommodated, which means that the LM curve should be replaced by a direct expression of the real interest rate

target. Put differently, the only difference between the New Consensus and the monetarists as far as money is concerned is that the "money supply has become a less interesting, minor endogenous variable" (Meyer 2001, p. 4) in the New Consensus model, in comparison with the monetarist theory that 'money matters'.

On the other hand, the assumption of the New Consensus that there exists base money in the economy does not correspond to the cashless economy of Woodford, who follows Wicksell's pure credit economy by showing that a Wicksellian rule can effectively control money prices even in an economy where there exists no base money. This difference between the New Consensus and the neo-Wicksellians leads to fundamentally different viewpoints vis-à-vis the monetarists. As shown above, the only difference between the New Consensus and the monetarists is the role of money in determining inflation. However, there exists no role for money in determining inflation in the neo-Wicksellian model since there is no base money in the model. Therefore, the neo-Wicksellians hold the opposite view to the monetarists when it comes to the quantity theory of money. In fact, the interest rate targeting policy which recognizes the existence of money in an economy is subject to the critique from neoclassical economists about the determinacy problem of real interest rate targeting.

"Sargent and Wallace argue that interest-rate rules lead to indeterminacy, meaning that even if one restricts one's attention to bounded solutions to the equilibrium relations, there is an extremely large set of equally possible equilibria" (Woodford 2003, p. 45)

The above critique from Sargent and Wallace is based on the quantity theory of money in which the money stock holds a causal relationship with regards to nominal prices. That is, since the classical properties of economics focus on real variable equilibrium with allowing nominal variables to get to any position, there would exist multiple combinations of money stocks and price levels whenever exogenous shocks occurs if the monetary policy authorities target the real interest rate. Thus, as long as the New Consensus model recognizes the existence of money, the real interest rate targeting policy cannot be free from the above critique. Dealing with the critique, Woodford (2003) develops a Wicksellian rule –Wicksellian monetary policy– on the assumption that there exists no base money in a flexible price endowment economy – cashless economy. This is the key difference between the New Consensus and the neo-Wicksellians.

"Such a setting (cashless economy)...allows one to display the relations that are of central importance in the neo-Wicksellian theory in their simplest form....In this chapter (chapter 2), I expound the basic outlines of the neo-Wicksellian theory in the context of a model with flexible prices and an exogenous supply of goods. This allows me to address a number of basic issues in a particularly simple context; it also allows direct comparison of this theory with the standard quantity theoretic approach. A more complete development of the theory is possible only after the introduction of nominal price rigidities in the following chapter" (Woodford 2003, pp. 61-62)

Once Woodford assumes a cashless economy with flexible prices, he introduces an equation to present a new relationship between the nominal rate of interest and the inflation rate. Withdrawing the existence of money from the model, Woodford injects Wicksell's concept of the natural rate of interest into a cashless economy following Wicksell's pure credit economy analytics. The natural interest rate of Wicksell and Woodford might be considered to have the same properties as that of the monetarists, in that it is determined by the demand for and supply of physical capital, not by monetary policy. However, each natural interest rate plays a different role, considering that the Wicksellian natural rate of interest affects money prices, while the monetarists' natural rate of interest has no influence on them.

As already pointed out before, Woodford transforms the Fisher equation into a formula in which money prices are determined by exogenous factors –the natural rate of interest and the nominal rate of interest. He gets a 'flexible-price IS relation', $p_t = E_t p_{t+1} + r_t - i_t$ which is equal to $\hat{i}_t = \hat{r}_t + E_t \pi_{t+1}$ (1). That is, the Fisher equation plays the role of the traditional IS curve.

Woodford replaces the traditional IS curve with this flexible-price IS relation.[7] Now he

[7] As stated before, Woodford maintains that this relation is an expression of the clearing goods

tries to replace the traditional LM curve with the Wicksellian policy rule to complete the simultaneous equilibrium of the goods market and money market.

The Wicksellian policy rule[8] is represented by $\hat{i}_t = \phi_p \hat{P}_t + v_t$ [9](2), and the simultaneous equilibrium of goods market and money market is given by

$$\hat{P}_t = \sum_{j=0}^{\infty} (1+\phi_p)^{-(j+1)} E_t\left[\hat{r}_{t+j} + \pi^*_{t+j+1} - v_{t+j}\right] \qquad (3)^{10}$$

Equation (3) implies that in a cashless economy with a flexible price endowment, a monetary policy following Wicksellian rules is ensured to be determinate, thereby leading to a simultaneous equilibrium in the goods market and monetary markets.

The reasons why Woodford introduced the new IS curve in Wicksell's framework are the following. First, it is to protect the direct policy of targeting the nominal interest rate

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market. Therefore this IS relation can be called the Wicksellian IS curve, $\hat{i}_t = \hat{r}_t + E_t \pi_{t+1}$.

[8] $i_t = \phi(P_t / P_t^*; v_t)$. Here v_t is an additional possible exogenous random disturbance to the policy rule (or to its implementation) and P_t^* is a time varying price-level target. (Woodford 2003, p. 76).

[9] Here $\hat{P}_t = \log(P_t / P_t^*)$, and $\phi_p > 0$ represents the elasticity of ϕ with respect to P/P^*. (Woodford 2003, p. 81)

[10] Where $\hat{P}_t \equiv \log(P_t / P_t^*)$, and $\phi_p > 0$ (Woodford 2003, p. 81).

from the critique coming from the rational expectations theorists in terms of indeterminacy issue, with no harm to the rational expectations methodology. Second, it is to integrate short-run equilibrium and long-run equilibrium in the framework of a rational expectations general equilibrium.

With respect to the first reason, the New Consensus has a theoretical limitation in dealing with the critique from rational expectations theorists as long as it recognizes the existence of base money in the economy and as long as it does not completely deny the causal relationship between the money stock and nominal prices. Even though New Consensus theory considers the money stock of minor importance, such a consideration is not sufficient to deal with the critique. As a result, Woodford completely denies the existence of base money as well as the relationship between the money stock and nominal prices. As to the second reason, the New Consensus considers price stickiness as a structural feature of the economy, such as the production function. As a result, the theory is not dealing with long-run rational expectations equilibrium in their models so that it is not easy to find a specific relationship between the long-run equilibrium and short-run equilibrium.[11]

[11] When the New Consensus refers to long run equilibrium, they just maintain that "in the limiting

Woodford seeks to achieve the two objectives by combining Wicksell's concepts –a natural rate of interest and a pure credit economy– with a rational expectation methodology, assuming an endowment economy. However, Woodford's model shows problems of inconsistency in chapter 2 where the endowment economy is assumed and chapter 4 where the production economy is assumed when it comes to Wicksell's concepts of relative prices/money prices and the natural rate of interest. I deal with the inconsistency in the next section.

3-2 Inconsistency in Woodford's model

As shown in section 2, Woodford transforms the Fisher equation to a 'flexible-price IS relation', $p_t = E_t p_{t+1} + r_t - i_t$, which shows how the interaction between the natural interest rate and the nominal interest rate affect prices. In the flexible-price IS relation, the price level –a dependent variable– is a function of the gap between the natural rate of interest and the nominal rate of interest. Showing how interest rates affect the price level in the flexible

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case of perfect price flexibility, the cyclical dynamics resemble those of a real business cycle model, with monetary policy affecting only nominal variables" (Clarida et al. 1999, p. 1664) or "the central bank cannot follow a real interest rate rule if prices are completely flexible" (Romer 2000, p. 156)

price system, Woodford overcomes the disadvantage of the New Consensus authors who consider price rigidity and the existence of money as structural properties of the economy, and he also deals with the quantity theorists' critique in terms of the indeterminacy problem.

In chapter 2 of his book, Woodford makes use of the Euler equation to explain how the Fisher equation could be a flexible-price IS equation.

$$1 + i_t = \beta^{-1} \left\{ E_t \left[\frac{u_c(Y_{t+1}; \xi_{t+1})}{u_c(Y_t; \xi_t)} \frac{P_t}{P_{t+1}} \right] \right\}^{-1} \qquad (4)^{12}$$

And then, to infer the Euler equation using the log-linear approximation method, he considers zero inflation rates as a steady-state inflation rate for the sake of simplicity, which means there is zero inflation in equilibrium.[13]

A log-linear approximation to (4) is then given by

$$\hat{i}_t = \hat{r}_t + E_t \pi_{t+1} \qquad (5)^{14}$$

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[12] Here β is a discount factor, u_c is a utility function of consumption, and ξ_t represents exogenous stochastic disturbances.

[13] "This does not require that the analysis considers only policies under which there is no trend growth in the price-level target: it only requires that the target inflation rate is never very large." (Woodford 2003, p. 79)

[14] "Note that the appearance in (5) of the inflation rate (rather than of the inflation rate relative to steady-state inflation) depends on the assumption that the steady-state inflation rate is zero.

In equation (5), $\hat{r}_t$ is the natural rate of interest given by

$$\hat{r}_t = \sigma^{-1}[E_t(\hat{Y}_{t+1} - g_{t+1}) - (\hat{Y}_t - g_t)] \qquad (6)^{15}$$

Equation (5) is considered as a type of Euler equation on the assumptions that there is zero inflation in the steady-state, that the target rate of inflation should have the value of near zero, and that variation of the natural rate of interest, $\hat{r}_t$, is determined by variations of the output $-E_t\hat{Y}_{t+1}$ and $\hat{Y}_t$. As stated above, the Fisher equation $\hat{i}_t = \hat{r}_t + E_t\pi_{t+1}$ can be transformed into a 'Fisherian relation', $\hat{p}_t = E_t\hat{p}_{t+1} + \hat{r}_t - \hat{i}_t$. Once again, the variation of the price level is a function of the gap between the natural rate of interest and the nominal rate of interest.

However, the key point in this equation is whether $\hat{p}_t$ is money prices or relative prices. Even though Woodford considers $\hat{p}_t$ as money prices in a flexible price system, it must be relative prices that exists in the Euler equation of neoclassical economics. Since

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(where $\hat{i}_t \equiv \log(\frac{1+i_t}{1+\bar{i}})$, $\pi_t = \log(\frac{P_t}{P_{t-1}})$)." (Woodford 2003, p. 80)

[15] "Here σ measures the intertemporal elasticity of substitution of aggregate expenditure and the disturbance term g_t indicates the percentage increase in output required to keep the marginal utility of income constant, given the change that has occurred in the impatience to consume." (Woodford 2003, p. 80)

the relationship between relative prices and money prices is replaced by a relationship between flexible prices and sticky prices in Woodford's model, he identifies relative prices with flexible prices, maintaining that a central bank is able to target the preferred price level by controlling the nominal rate of interest without any influence on the output level. It is evident in equation (4) that the target price level is not a measurable money price but is instead the relative price of neoclassical theory.

However, Wicksell clearly opposes policies that try to affect relative values:

"So far as relative values are concerned, their variations are dependent on natural causes, which in part elude all human control. Attempts by means of tariffs, state subsidies, export bounties, and the like, to effect a partial modification of the nature order of these values almost inevitably involve some loss of utility to the community. Such attempts must so far be regarded as opposed to all reason. Absolute prices on the other hand –money prices- are a matter in the last analysis of pure convention, depending on the choice of a standard of price which it lies within our own power to make" (Wicksell 1898, p. 4)

In addition, the relative price framework of Woodford is a non-monetary model which provides nothing in terms of policy makers' decision, so that a non-monetary economy is no more than a neoclassical exchange economy in which money is considered as an unnecessary addition. As a result, the nominal interest rate in equation (4) must not be the money rate set by the central bank, but the real interest rate seen in a classical Fisher equation.

In fact, given that the neoclassical Euler equation is $1+r_t=\beta^{-1}\left\{E_t\left[\frac{u_c(Y_{t+1};\xi_{t+1})}{u_c(Y_t;\xi_t)}\right]\right\}^{-1}$, the nominal interest rate on the left-hand side of equation (4) is just a simple addition of P_{t+1}/P_t to the real interest rate of the neoclassical Euler equation, so that equation (4) should not be identified with the Fisher equation. As a result, a central bank has no instrument to affect the price level on the assumption of a flexible price system with a cashless economy as assumed by Woodford, since the nominal interest rate is no longer defined in equation (4) without the help of a traditional Fisher equation.

Furthermore, Wicksell's argument that a central bank has an influence on money prices by setting a nominal interest rate is consistent and feasible on his assumptions of a pure credit economy, a natural rate of interest, a money rate of interest and an endowment economy, but the same argument is not feasible on the basis of Woodford's assumptions. The lack of feasibility relates to different definitions of the natural rate of interest.

In Wicksell's model, the natural rate of interest is determined by the supply and demand for real capital goods[16], whereas in Woodford's model it is determined by the intertemporal

[16] "There is a certain rate of interest on loans which is neutral in respect to commodity prices, and tends neither to raise nor to lower them. This is the same as the rate of interest which would be determined by supply and demand if no use were made of money and all lending were effected in the form of real capital goods. It comes to much the same thing to describe it as the current

marginal rates of substitution of a representative household[17]. However, in the neoclassical Euler equation, the natural rate of interest is clearly r_t on the left-hand side of the equation, not the intertemporal marginal rates of substitution on the right-hand side of the equation, since r_t is a real interest rate –a real rate of return– determined by the production function in an intertemporal dynamic general equilibrium model.

The reason that Woodford switched the position of the real interest rate to that of the nominal interest rate in his Euler equation is that he tried to infer a Fisher equation –a flexible price IS relation– from his Euler equation in a general equilibrium structure with flexible prices. As stated before, the IS relation derived in such a way and the money market equilibrium –the Wicksellian rule– are combined to produce a market equilibrium such as that developed in the traditional IS-LM model.

The traditional IS-LM model explains the macroeconomy using the goods market and money market. However, the real interest rate is included in the IS curve where investment corresponds to savings, whereas the nominal interest rate is included in the LM curve where a central bank exogenously controls the money supply. In addition of the issues of

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value of the natural rate of interest on capital." (Wicksell 1898, p. 102)

[17] "The intertemporal marginal rates of substitution of a representative household plays the role of the real interest rate." (Woodford 2003, p. 71)

different interest rates and of an exogenously supplied money supply, the rational expectations model does not accept the IS-LM analysis since the IS-LM model assumes sticky prices.

To resolve the three issues, Woodford replaces the IS curve with the Fisherian relation – the flexible price IS relation– derived from the Euler equation where the nominal interest rate is relevant to money prices, and he also replaces the LM curve with the Wicksellian rules where a central bank sets the nominal rate.

In the case of the New Consensus model, the model replaces the traditional IS curve with an IS curve derived from microeconomic analysis and also replaces the LM curve with a real interest rate policy rule. However, even though the same interest rate –the real interest rate– is relevant to each parts of the model, the model cannot deal with the rational expectations issue since it assumes sticky prices, and the model cannot deal with the indeterminacy issue since it assumes the existence of base money and still accepts the quantity theory of money as long as the model maintains that monetary policy is characterized by real interest targeting policy.

Woodford's model appears to deal with the three issues using Wicksell's concepts –a natural interest rate, a money interest rate, a pure credit economy, and an endowment

economy–, but his model faces three problem: First, the money rate of interest set by the central bank is actually the natural rate of interest, thus the central bank has no instrument when it is conducting policies. Second, the natural rate of interest in his Fisher equation depends on the consumption function of a representative household, not on the supply and demand for physical capital goods. Third, as I will show in the next section, the natural rate of interest in the flexible price endowment economy does not correspond to the natural rate of interest in a sticky price production economy.

After he demonstrated equilibrium in flexible price endowment economy in chapter 2, Woodford explains how the equilibrium is achieved in a sticky price production economy.

"In the basic model of chapter 2, the equilibrium real rate of return is completely independent of monetary policy. This means that a central bank can have no effect on nominal interest rates except insofar as it can shift inflation expectations. In the earlier analysis I assumed that it is able to do so as long as the change in expectations that is called for involves no violation of the postulate of rational expectations on the part of the private sector; but that analysis may give the appearance of assuming precise central bank control of something upon which banks have little direct influence in reality." (Woodford 2003, p. 139)

Even though the expression is ambiguous, Woodford accepts that central banks cannot affect the nominal rate of interest when prices are fully flexible. Then, he moves to the sticky price production economy since the sticky price assumption allows the central bank to control the real interest rate to achieve the inflation target. That is, only in a sticky price

economy will a representative household change its expenditure and a monopolistically competitive producer change its production when real interest rates vary. Since Woodford makes the claim that practical policies are feasible only when prices are sticky, it is necessary to see what happens with the concepts of the natural rate of interest, the real rate of interest, and the nominal rate of interest in a sticky price general equilibrium model:

$$x_t = E_t x_{t+1} - \sigma\left(\hat{i}_t - E_t\pi_{t+1} - \hat{r}_t^n\right) \qquad (7)\ [18]$$

$$\pi_t = \kappa x_t + \beta E_t \pi_{t+1} \qquad (8)$$

$$\hat{i}_t = \bar{i}_t + \phi_\pi(\pi_t - \bar{\pi}) + \phi_x\left(x_t - \bar{x}\right)/4 \qquad (9)$$

$$\hat{r}_t^n \equiv \sigma^{-1}\left[\left(g_t - \hat{Y}_t^n\right) - E_t\left(g_{t+1} - \hat{Y}_{t+1}^n\right)\right] \qquad (10)\ [19]$$

Equation (7) is the IS equation derived from the Euler equation, equation (8) is the AS equation derived in the Calvo model, equation (9) is the central bank reaction function, and equation (10) is the definition of the natural rate of interest.

Now that prices are sticky, variations of the nominal interest rate causes the real rate of interest to vary as we can see in the Euler equation, $i_t = r_t + E_t\pi_{t+1}$. In that case, however, the Euler equation is no longer an equation that equates saving and investment as in the

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[18] Here x_t is an expression of $y_t - y_t^n$.

[19] (Woodford 2003, p. 245).

flexible economy. Rather, the equation is just an identity, $i_t \equiv r_t + E_t\pi_{t+1}$ or $r_t \equiv i_t - E_t\pi_{t+1}$, in which the real rate of interest has no relationship with the natural rate of interest.

Woodford found the natural rate of interest, r_t, in the Euler equation, $i_t = r_t + E_t\pi_{t+1}$ when prices are flexible, whereas r_t plays a role of inflation-adjusted interest rate derived from an identity, $i_t \equiv r_t + E_t\pi_{t+1}$ when prices are sticky. Instead, Woodford derives the natural rate of interest from the concept of the natural output, following Friedman. As I stated in section 2, the demand and supply of real capital goods in the capital market determines the natural rate of interest, which plays a key role in determining the natural rate of output. That is, the natural rate of interest is on the right-hand side of the equation, allocating resources and, as a result, influencing the natural rate of output. As we can see in equation (7), the natural rate of interest is on the right-hand side, considering that x_t is an expression of $y_t - y_t^n$, and the natural rate of output is on the left-hand side.

Therefore, the inconsistency in Woodford's model is the following: The natural rate of interest in his flexible prices model arises from the intertemporal substitution of consumption of a representative household derived from the neoclassical marginalist tradition, and the natural rate of interest has a negative relationship with the natural rate of

output. Both concepts are not relevant to Wicksell's natural interest rate.[20]

4. Post-Keynesian critiques of the New Consensus and of the neo-Wicksellians

The New consensus model incorporates interest rate targeting within the traditional IS-LM-AS model. Considering that central banks adopt an interest rate as an instrument, the model replaces the LM curve –the money market equilibrium– with a direct monetary policy rule. At the same time, the model deals with the inconsistency issues within the traditional IS-LM-AS model: First, the inconsistency between real interest rate and nominal interest rate in the IS-LM framework. second; the inconsistency between the price level in the model and the inflation rate in practice; third, the inconsistency between money supply targeting in the model and direct interest rate targeting in practice.

To deal with the first inconsistency, the New Consensus model makes the claim that monetary policy should be based on real interest rate targeting, which supposes sticky

[20] In Wicksell's model, the demand and supply of real capital goods leads to variations of the price of real capital goods, not to the changes in the natural rate of interest. In fact, even though Wicksell (1898) mentioned that the natural rate of interest is determined in the exchange between entrepreneurs, it is just assumed that the exchange of real capital goods between entrepreneurs determines the natural rate of interest, whereas the trade of real capital goods between entrepreneurs and capitalists determines the price of real capital goods.

prices in the economy. To deal with the second, they adopt the Calvo Model as an aggregate supply curve, which means that, as we can see above in equation (8), the inflation rate is directly relevant to the aggregate output gap. Finally to deal with the third inconsistency, they deny the role of the exogenous money supply in determining inflation unlike the quantity theory of money and the monetarists, adopting instead the endogenous nature of the money supply with the central bank setting the interest rate exogenously by accommodating the demand for money. However, while dealing with the second inconsistency issue, they adopt the concept of the natural rate of output, following Friedman.

On the other hand, post-Keynesians maintain that the money supply is basically endogenous, with the central bank fully accommodating the demand for money and credit. Although post-Keynesians and the New Consensus seem to have the same conception of the nature of money supply, post-Keynesians attribute a major role to credit and money when they consider economic fluctuations and growth, thereby accepting effective demand theory, following Keynes. As a result, post-Keynesians criticize the New Consensus and neo-Wicksellians in terms of the natural interest rate, natural output, and the feasibility of monetary policy directly targeting interest rates.

4-1. Arestis-Sawyer's critique

"However, in this "New Consensus" little attention is paid to the process by which loans and deposits are created and destroyed. The causal links between investment expenditure and loan creation and between inflation and the creation of money, which feature strongly in the endogenous money literature, are rather overlooked in this "New Consensus." Further, within the "New Consensus" there is barely mention of fiscal policy - presumably with the implication that fiscal policy does not matter, whereas the focus is on monetary policy and the use of interest rate policy to target inflation." (Arestis and Sawyer 2004, p. 444)

Arestis and Sawyer (2004) criticize the New Consensus in terms of the endogenous nature of the money supply and the natural rate of interest, maintaining that although New Consensus model treats money as endogenously created and interest rates as exogenously set by the central bank, the model do not provide the positive and causal role of credit and money but emphasizes the interest rate targeting policy for stabilizing the price level, based on the concept of Wicksell's natural rate of interest. They also take the view that Wicksellian monetary policy is infeasible or inefficient since the central bank cannot calculate the natural rate of interest which is affected by fiscal policy. Put differently, they consider that the key point of the New Consensus model is to accept the concepts of natural output and natural interest rate.

However, even though I recognize that their argument of the causal roles of endogenous money supply and fiscal policies is persuasive to explain economic fluctuations and growth

in practice, I find the following problems: First, their critique, making use of the New Consensus equations, is not relevant to Wicksell's natural rate of interest. Second, Woodford himself makes the same point as that of Arestis and Sawyer, recognizing that it is not suitable to calculate the natural rate of interest. Third, Woodford himself recognizes that if fiscal policy is non-Ricardian, the equilibrium via the Wicksellian rule is indeterminate.

First, to evaluate their critique, it is required to look through the New Consensus model to find whether the model includes the natural rate of interest.

The New Consensus model can be depicted as follows:

$$y_t^g = a_1 y_{t-1}^g + a_2 E_t(y_{t+1}^g) - a_3[R_t - E_t(\pi_{t+1})] + s_1 \qquad (1.1)$$

$$\pi_t = b_1 y_t^g + b_2 \pi_{t-1} + b_3 E_t(\pi_{t+1}) + s_2 \qquad (1.2)$$

$$R_t = RR^* + E_t(\pi_{t+1}) + c_1 y_{t-1}^g + c_2(\pi_{t-1} - \pi^T) \qquad (1.3)^{21}$$

$$x_t = E_t(x_{t+1}) - \varphi[R_t - E_t(\pi_{t+1})] + g_t \qquad (2.1)$$

$$\pi_t = \lambda x_t + \beta E_t(\pi_{t+1}) + u_t \qquad (2.2)^{22}$$

(1.1)/(2.1) and (1.2)/(2.2) are the IS and AS curves respectively, which are similar to the

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[21] Here $b_2 + b_3 = 1$, y_t^g is output, R_t is the nominal rate of interest, and RR^* is the equilibrium real interest rate. (Meyer 2001, p. 2)

[22] Here x_t is the output gap and R_t is the nominal rate of interest. (Clarida et al. 1999, p. 1665)

new Keynesian model, based on the assumption of intertemporal utility maximization of consumption by the representative household and with monopolistic competition of firms. Equation (1.3) is the central bank's policy rule.

As we can see above, the equations do not contain explicitly the natural rate of interest. In addition, since the New Consensus assumes that there exists base money in the economy, the equations do not correspond to the Wicksellian pure credit economy or cashless economy. Nonetheless, post-Keynesians make the claim that the New Consensus model is based on the concept of Wicksell's natural rate of interest and that Wicksellian policy should be ineffectual since Wicksell's natural rate is based on a conceptual fallacy. However, such a critique of the equations would lead to confusion.

For example, Arestis and Sawyer make a transformation of equation (1.1) in order to show what relationship the New Consensus has with Wicksellian characteristics in terms of the natural rate of interest.

$$y_t^g = a_0 + a_1 y_{t-1}^g + a_2 E_t(y_{t+1}^g) - a_3[R_t - E_t(\pi_{t+1})] + s_1 \qquad (1)$$

$$\pi_t = b_1 y_t^g + b_2 \pi_{t-1} + b_3 E_t(\pi_{t+1}) + s_2 \text{, with } b_2 + b_3 = 1 \qquad (2)$$

$$R_t = (1 - c_3)\left\{RR^* + E_t\left(\pi_{t+1}\right) + c_1 y_{t-1}^g + c_2\left(\pi_{t-1} - \pi^T\right)\right\} + c_3 R_{t-1} \qquad (3)^{23}$$

The arguments of Arestis and Sawyer are the following: First, RR^* should be equal to a_0 / a_3 in an equilibrium, which corresponds to the Wicksellian natural rate of interest. Second, since a_0 is impossible to calculate correctly, a monetary policy rule such as the Wicksellian rule is less efficient than fiscal policy. Third, changes in a_0 represent fiscal policy, leading to changes in the natural rate of interest.

However, since (1.1) and (2.1) do not contain the autonomous component, a_0, it is not consistent to argue that changes in a_0 lead to changes in the natural rate of interest. Furthermore, a_3 and φ in (1.1) and (2.1) measure the intertemporal elasticity of substitution of aggregate expenditure. Although the objective of Arestis and Sawyer is to show that there exists a natural rate in the equations of the New Consensus and then that it is impossible to measure the natural rate so that the fiscal policy that has an influence on a_0 is effective, it is not consistent to make such claims by quoting New Consensus

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[23] Here y_t^g is the output gap, R_t is nominal rate of interest, π_t is rate of inflation, π^T is inflation rate target, RR^* is the "equilibrium" real rate of interest, that is the rate of interest consistent with zero output gap, s_1, s_2 represents stochastic shocks, and E_t refers to expectations held at time t. (Arestis and Sawyer 2004, p. 445)

equations because their equations have no coefficients related to the natural rate of interest.

In fact, New Consensus models do not say anything about the relationship between the natural rate of interest and the nominal rate of interest. But they just show that interest rate policy is a better choice than money-supply policy when prices are sticky and the demand for money is unstable in an economy where there exists base money.

On the other hand, the neo-Wicksellian model contains explicitly the natural rate of interest in its equations. In fact, the neo-Wicksellian equation (7)[24], is similar to the New Consensus equation (2.1) where g_t is relevant to $\left(g_t - \hat{Y}_t^n\right) - E_t\left(g_{t+1} - \hat{Y}_{t+1}^n\right)$ in equation (10)[25]. In the neo-Wicksellian equations, g_t reflects preference shocks and variations in government purchases.

What is interesting in the neo-Wicksellian equations is where equation (10) came from. Woodford applies the IS curve, $\hat{Y}_t = g_t + E_t\left(\hat{Y}_{t+1} - g_{t+1}\right) - \sigma\left(\hat{i}_t - E_t\pi_{t+1}\right)$, in order to design the natural rate of interest, $\hat{Y}_t^n = g_t + E_t\left(\hat{Y}_{t+1}^n - g_{t+1}\right) - \sigma\left(\hat{i}_t^n - E_t\pi_{t+1}\right)$, in which variations of the natural rate of interest, $\hat{i}_t^n - E_t\pi_{t+1}$, induces variations of the natural rate of output,

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[24] $x_t = E_t x_{t+1} - \sigma\left(\hat{i}_t - E_t\pi_{t+1} - \hat{r}_t^n\right)$

[25] $\hat{r}_t^n \equiv \sigma^{-1}\left[\left(g_t - \hat{Y}_t^n\right) - E_t\left(g_{t+1} - \hat{Y}_{t+1}^n\right)\right]$

$\widehat{Y}_t^n$. On the other hand, as is shown in section 3-2, such causality does not correspond to Wicksell's argument that the natural rate of interest varies without affecting the output level. Furthermore, Woodford reverses the causality to rationalize his concept of the natural rate of interest. As a result, $\hat{r}_t^n \equiv \sigma^{-1}\left[\left(g_t - \widehat{Y}_t^n\right) - E_t\left(g_{t+1} - \widehat{Y}_{t+1}^n\right)\right]$ implies that exogenous shocks induce variations of the natural rate of interest.

However, in $\widehat{Y}_t^n = g_t + E_t\left(\widehat{Y}_{t+1}^n - g_{t+1}\right) - \sigma\left(\hat{i}_t^n - E_t\pi_{t+1}\right)$, $\widehat{Y}_t^n$ and $\hat{i}_t^n - E_t\pi_{t+1}$ are nothing more than the long-run average output and the long-run average inflation-adjusted real rate of interest. The natural rate of interest in chapter 2 of Woodford has no relationship with the natural rate of interest in Wicksell, and the natural rate of interest in his sticky price model has no influence on variations of the price level in the way described in Wicksell's framework because the natural rate in Woodford's model is nothing but the inflation-adjusted real rate in the long run.

Second, with regard to the infeasibility of calculating the natural rate of interest, Woodford (2003) also emphasizes that the central bank should not adopt the natural rate of interest as its operating target.

"The mapping from the history of exogenous disturbances –the natural rate of interest- to the desired overnight interest rate at any point in time is not a suitable description of an optimal policy rule. Instead, it is argued that a more suitable policy prescription should

relate the instrument setting to the evolution of endogenous variables such as inflation and the output gap." (Woodford 2003, p. 58)

"Would the bank achieve its objective by committing itself to a policy of always adopting the current value of r_t as its operating target? While such a policy would be consistent with the desired rational-expectations equilibrium, it would also be equally consistent with an extremely large class of alternative rational-expectations equilibria, in most of which prices vary randomly....In fact, this is a consequence of any policy commitment that makes the interest-rate operating target purely a function of the economy's exogenous state (i.e., the history of disturbances alone), regardless of how sensibly the exogenous sequence of interest-rate targets may have been chosen." (Woodford 2003, p. 86)

That is, the central bank should not set the overnight rate at the natural rate of interest but should follow a Wicksellian rule in which the central bank raises the overnight rate when the inflation rate is higher than the target inflation rate.

On the other hand, Taylor (1999) has a different story from Woodford. The Taylor rule can be depicted as follows: $i = \pi + gy + h(\pi - \pi^*) + r^f$ [26]

Taylor maintains that "because the central bank does not know the equilibrium real interest rate, we cannot expect it to accurately set r^f equal to r^*, and this is a

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[26] "where y is real GDP measured as a percentage deviation from potential GDP; i is the short-term nominal interest rate measured in percentage points; and π is the inflation rate measured in percentage points. The parameters π^*, r^f, g and h are all positive. ... The intercept term r^f in this relationship is the implicit real interest rate in the bank's reaction function. The central bank takes actions to affect the nominal interest rate." (Taylor 1999, p. 50)

disadvantage of an interest rate policy compared with money growth rules. If the central bank uses an incorrect estimate of the equilibrium real interest rate, then a higher or lower inflation rate than targeted will result. However, such an error will not result in continuing increases or continuing decreases in inflation as would a policy which tries to peg the real interest rate above or below the equilibrium real interest rate. Note that the impact of the error on the long-run average inflation rate depends on the size of the response of monetary policy to the inflation rate." (Taylor 1999, p. 52)

Third, Arestis and Sawyer make the claim that fiscal policy is more effective to control the inflation rate than monetary policy since the natural rate of interest is influenced by fiscal policy, denying the Ricardian result which is based on full employment. As a result, they do not accept the Ricardian fiscal policy and monetary policy based on full employment. However, New Consensus and neo-Wicksellian models are based on the Ricardian fiscal policy, so that if fiscal policy is non-Ricardian, the monetary policy is inevitably indeterminate in the models. Therefore, Ricardian fiscal policy is an essential part in conducting monetary policy in the models.

4-2. Setterfield's critique

Post-Keynesians criticizing the New Consensus and the neo-Wicksellians agree with the neoclassical view that the central bank conducting inflation targeting policy is able to set the inflation rate at its discretion without any variation of the output level. That is, they identify the view of standard quantity theory of money with the New Consensus and the neo-Wicksellians in respect to the ability of central banks to control the price level.

"It follows that the policy authorities can set *any inflation target* they desire without this having any effect on the real equilibrium of the economy.... As the policy authorities vary their inflation target, the equilibrium level of real output is unaffected; only the equilibrium rate of inflation changes, falling in line with the reduction in the inflation target itself. In this sense, the New Consensus model describes an economy that is fully compatible with inflation targeting: not only does the structure of the model give rise to conditions under which an established inflation target can be achieved, it also suggests that inflation targeting can be given "free rein" as an autonomous policy objective, since the precise inflation target that is set and pursued by the policy authorities has no bearing on the real equilibrium configuration of the economy." (Setterfield 2006, pp. 6-7)[27]

However, neo-Wicksellian theory makes it clear that the long run equilibrium rate of inflation is zero and target inflation rate should be near zero. It is, on the one hand, because

[27] The purpose of his paper is to show that "(in Wicksellian model) far too much attention is currently being paid to inflation and that more of policy makers' attention should be devoted to output targeting" (Setterfield 2006, p. 1). However, I do not deal with the issue in this section. Instead, I deal with the basic model that he considers compatible with post-Keynesian economics

unstable price level itself is considered as an inefficiency of the economy[28], and, on the other hand, because neo-Wicksellian theory considers zero inflation as a steady state level.

Both the New Consensus and the neo-Wicksellians take as their aggregate supply curve the New Keynesian Phillips curve which has its origin in the Calvo model where "firms set nominal price based on the expectations of future marginal costs and the output gap captures movement in marginal costs associated with variation in excess demand." (Clarida et al., p. 1667). The model, however, is different from a New Classical Phillips curve in which unexpected variations in aggregate demand induce variations in inflation. In the monopolistically competitive model of the New Keynesians, firms set their prices depending on their expectations at each time. As a result, the inflation rate should be zero when the real output is equal to the natural output.

However, in the New Classical model with the so-called standard Phillips curve or traditional expectations-augmented Phillips curve, variations in the price level is caused by exogenous changes in the money supply in the long run. That is, the exogenous money

[28] "Instability of the general level of prices is a good indicator of inefficiency in the real allocation of resources –at least when an appropriate price index is used- because a general tendency of prices to move in the same direction is both a cause and a symptom of systematic imbalances in resource allocation." (Woodford 2003, p. 5)

supply determines the price level with the equilibrium level of output being unaffected in the long run so that the central bank can set the inflation rate at its discretion. Therefore, the supply curve that Setterfield refers to is a New Classical curve, not a New Consensus or a neo-Wicksellian curve.

According to the New Consensus and neo-Wicksellian framework, firms set their prices depending on their expectations at each time, so that "$Y_t = Y_t^n$" is exactly the condition needed for no firm to wish to charge a price different from the common price charged by all other firms, which is in turn the condition under which firms that adjust their prices continue to charge the same price as firms that do not, so that there is no inflation." (Woodford 2003, p. 247) That is, when real output is equal to the natural output, the inflation rate is zero in the neo-Wicksellian model so that the central bank cannot set the inflation rate at its discretion when the economy is in long-run equilibrium.

This confusion, however, comes from theoretical differences among New Keynesian researchers. For example, D. Romer (2000) rejects microeconomic foundations derived from the analyses of households' and firms' objectives and constraints adopted by most New Keynesians, and he also holds intuitive arguments of the IS-LM-AS analyses. That is, the New Consensus model should not be different from the traditional IS-LM-AS

framework except by replacing the LM curve with a monetary policy curve, called the MP curve. Therefore, the AS curve in D. Romer's theory corresponds to the traditional supply curve. J.B. Taylor (2000) also employs the standard Phillips curve to show the path of monetary policy effects.

"The third relationship (the supply curve) is between inflation and real GDP. This is a standard expectations-augmented Phillips curve in which the change in inflation increases when real GDP rises above potential GDP, signaling demand pressures. The simplest algebraic form of this relationship is $\pi = \pi_{-1} + cy_{-1} + w$ where w is a shift term." (Taylor 2000, p. 92)

The supply curve employed by Setterfield, $\pi = \pi_{-1} + \alpha(y - y_n)$, holds the same form as the above equation suggested by Taylor, $\pi = \pi_{-1} + cy_{-1} + w$. Even though the objective of Setterfield is "to show that inflation targeting is compatible with post-Keynesian economics but only if the policies used to achieve the inflation target explicitly acknowledge (a) the demand-determined nature of the real income generating process, and (b) the importance of conflicting claims over the distribution of income for determining the rate of inflation...and that far too much attention is currently being paid to inflation and that more of policy makers' attention should be devoted to output (and, by extension, employment) targeting." (Setterfield 2006, p. 1), the equations in which he tested the stability of monetary policy in neo-Wicksellian or New Consensus models are not

equations of the neo-Wicksellian or New Consensus model, but equations of New Classical researchers. As a result, he concludes that "not only do the policy authorities (specifically, the central bank) set an explicit inflation target, but by acting in accordance with the supply curve, they ensure that this inflation target is part of an aggregate equilibrium configuration towards which the economy will return following any disturbance." (Setterfield 2006, p. 7)

On the other hand, although inflation rates higher than zero or near-zero can be considered as a failure of monetary policy from the viewpoint of Wicksell and the neo-Wicksellians, the practical inflation targets chosen by central banks are around 2~3%, instead of zero or near-zero rate. Therefore, the question of "what should be the target rate of inflation?" should be answered in terms of actual inflation rate data as well as the theoretical analysis.

"In the U.S., policy-makers argue that "price stability" should be the ultimate goal. But they define price stability as the inflation rate at which inflation is no longer a public concern. In practice, it is argued that an inflation rate between one and three percent seems to meet this definition (e.g., Bernanke and Mishkin 1997). A further justification for this criteria is that the official price indices may be overstating the true inflation rate by a percent or two, as argued recently by the Boskin Commission. In this regard, interestingly, the Bundesbank has had for a long time an official inflation target of two percent. (Two percent is also the upper bound of the inflation target range established by the European central bank. On the other hand, Feldstein argues that the tax distortions that arise because corporate and personal income taxes are not indexed to inflation justify moving from three percent to zero inflation). They similarly argue that this positive rate of inflation is

consistent with price stability, and cite measurement error as one of the reasons." (Clarida, et.al., 1999, p. 1669)

Given that the actual inflation rate is around 2% in the countries which have practiced inflation targeting policy, it is important to evaluate the value of 2% from the viewpoint of each school. From the viewpoint of the neo-Wicksellians, the inflation rate of 2% indicates that the economy is in disequilibrium because the inflation rate should be zero in equilibrium. However, 2% may be justified to be an equilibrium if it is recognized that the official data may overstate the true inflation rate. In that case, the value of 2% actually corresponds to the value of 0%, which is the target value of Wicksell and Woodford.

4-3. Rogers' critique

Even though the Woodford's model is an effort to combine the neoclassical general equilibrium model with Wicksell's price determination theory, Rogers (2006) points out the fundamental difference between Wicksell and Woodford.

"Even though there is no cash in Wicksell's pure credit economy, all prices are expressed in dollars, and book entries expressed in dollar units are the medium of exchange and store of value. Woodford's model does not have either of the last two functions in the cashless limit, and the numeraire can be selected arbitrarily from the list of commodities. In a monetary economy, the numeraire is not arbitrary. Finally, because there is no nominal rate of interest in Woodford's cashless limit, there is nothing in the model equivalent to Wicksell's market rate. For these reasons, I do not see any connection between Wicksell's

pure credit economy and Woodford's cashless limit. Woodford's neo-Wicksellian monetary theory is a caricature of Wicksell." (Rogers 2006, p. 303)

However, considering that the purpose of Woodford (2003) in chapter 2 of his book is to argue against the critique from neoclassical economists that the direct interest rate policy when there exists base money is necessarily indeterminate, the conclusion that Woodford's theory would never help central bankers and that there is no nominal rate of interest in Woodford's theory which central bankers practically set is rather incomplete.

In chapter 2, Woodford deals with the model where equilibrium via an interest rate operating policy is determinate on the assumption of flexible prices and an endowment economy, allowing the comparison with the quantity theory of money. He also concedes that the model in chapter 2 provides no practical policy. Thus, he deals with the practical policy in chapter 4 where the model is replaced with a New Consensus model assuming sticky prices and production.

Therefore, although Rogers' critique that "there is no nominal rate of interest in Woodford's cashless limit and there is nothing in the model equivalent to Wicksell's market rate" is rational in the context of chapter 2 of Woodford, the critique that Woodford's model provides no practical policy is not justified in the context of chapter 4 since the model in chapter 4 is the same as the New Consensus model.

5. Conclusion

Wicksell believed that variations of the price level occur due to the gap between the natural rate of interest and the money rate of interest. The concepts of the pure credit economy and the natural rate of interest are essential to develop the model where entrepreneurs play critical roles in a production economy and the central bank has the authority to set the money rate of interest at its will. Such an endogenous money supply and an exogenous determination of the money rate of interest clearly contrast with models of the neoclassical theorists who believed that the price level is exclusively determined by an exogenous money supply while the money rate is determined in the money market.

Woodford accepts two interest concepts of Wicksell as well as the nature of money supply and the determination of the money rate, and he develops a new general equilibrium model to justify a zero/near zero inflation rate policy. To get to this point, he changes the physical attribute of the natural rate of interest defined by Wicksell into the intertemporal marginal utility of neoclassical theory. However, the neoclassical economists disagree with Wicksellian monetary policy due to the indeterminacy of the policy. To deal with the critique, Woodford shows how the determinacy is ensured in the flexible price model. However, his flexible price model does not provide practical policy since the nominal

interest rate in the model is actually the natural rate of interest. Instead, he provides practical policy in his sticky price model where a central bank can set the real interest rate. However, the model is not different from the New Consensus model.

The New Consensus economists believe that their model is much the same as the monetarist model except for the argument that the traditional LM curve should be replaced by a monetary policy curve. They also believe that there exists base money in the economy, and adopt the stickiness of prices as a structural feature, while ruling out perfectly flexible prices. However, the combination of a cash economy, sticky prices and interest rate policy induces an indeterminacy problem and also does not answer the question of "why low inflation should be better than high inflation?" These distinguishing features are summarized in Table 1 of the Appendix.

On the other hand, post Keynesians agree with Wicksell's viewpoints in terms of the nature of the money supply.[29] Even though Wicksell believed that the endogenous money supply theory of the post-Keynesian variety "clearly provides no clue to the causes that determine the value of money and it simply leaves the question an open one" (Wicksell

[29] Some post-Keynesians categorize Wicksell into standard quantity theorists. However, I do not agree with the viewpoint.

1898, p. 44) and tried to incorporate the concept of the natural rate of interest into an endogenous money supply theory to deal with the question of why the price level varies, post-Keynesians do not accept the concept of natural interest rate because it is incompatible with the effective demand theory of the post-Keynesians. As a result, many post-Keynesians try to criticize both the New Consensus and the neo-Wicksellians in terms of the natural rate of interest, by considering the two groups as identical. However, there is a wide gap between the New Consensus and the neo-Wicksellians when it comes to the natural rate of interest and the cashless economy. Even though New Consensus economists incorporate the concept of the natural output into the model, they do not make the claim that the price level varies depending on the gap between the natural rate of interest and the money rate of interest. Furthermore, they do not provide the reason why the gap between the two interest rates induces variations of the price level when they incorporate the natural rate of interest into the model. Likewise, they do not explicitly adopt an endogenous money supply theory.

Despite the theoretical limits of the New Consensus model, post-Keynesians criticize the model in various aspects. First, they try to infer from the New Consensus model the concept of the natural rate of interest which is essential in Wicksell/neo-Wicksellian models,

and to prove that the natural rate of interest is impossible to calculate so that fiscal policy is more effective than monetary policy in order to control the inflation rate. However, the New Consensus model does not include the natural rate of interest in its equations and postulates a Ricardian fiscal policy. Second, they consider the New Consensus model as being compatible with post-Keynesian models since they believe that central banks can control the inflation rate at their discretion. However, the neo-Wicksellians consider zero/ near zero inflation rate as a long run equilibrium and, as a result, consider inflation rates other than zero/ near zero inflation rate as a failure of policy. Third, they believe that the neo-Wicksellian model does not provide practical policies to central banks since money prices that the model deals with is, in fact, relative prices and there exists no money rate of interest in a cashless economy. However, this critique is relevant to the model with flexible prices.

Table 1

	Wicksell	Woodford		New Consensus	
		Chapter 2	Chapter 4	Clarida et al.	D. Romer
The natural rate of interest	Explicit in the model, determined in the real capital market between savers and investors	Explicit in the Euler equation, determined by the intertemporal substitution of marginal utility	Explicit in the New Keynesian IS curve, determined in the real capital market, negatively related to the natural level of output	Implicit in the New Keynesian IS curve	Not referred to
The nominal interest rate/inflation-adjusted interest rate	The nominal interest rate is determined by the central bank	The nominal interest rate is determined by the central bank, but the inflation- adjusted interest rate is always equal to the natural rate of interest	The nominal interest rate is determined by the central bank, but the inflation-adjusted interest rate is not equal to the natural interest rate due to sticky prices	The inflation-adjusted interest rate is determined by the central bank	The inflation-adjusted interest rate is determined in the money market
Sticky/ flexible prices	Flexible (with exception of money rate of interest)	Flexible in the endowment economy	Sticky in the production economy	Sticky in the short run	Sticky
Inflation target	0%	0%	Near 0% due to sticky prices	Low inflation	Low/moderate inflation
Base money	Does not exist (except for international movements of precious metals)	Does not exist		Exists (but without consequences on money endogeneity)	Exists and is a control variable

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