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Wicksell and Woodford: a *Cashless* Economy or *Moneyless* Economy ?*

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Abstract

Recently, one of the most fruitful debate in monetary macroececonomics that fascinates -and opposed- academics and policymakers has lied in the relevancy of money within the monetary policy analysis. Since the publication of King and Goodfriend 1997's article that gave birth to a new current -the *New Neoclassical Synthesis*- money seems to be *de-emphasized*[1]. A new step has been reached in 2003 with Woodford's monetary treatise that legitimates a *Cashless* framework. Woodford captures the "implied path of the money supply or the determinants of money demand" (Woodford, 2003, p.237) in the determination of the equilibrium of output and prices, without having to model the volume of money explicitly. Woodford gives his theory a *Wicksellian flavour* by comparing his cashless economy framework with Wicksell's *pure credit economy* framework. Such a legacy gives the impression that Wicksell's original writings downgraduated money for the conduct of monetary policy.

This paper considers the role of money in modern macroeconomics models. First, the article will restore the proper importance of money in Wicksell's original theory. Then, we will focus on Woodford's *Neo-Wicksellianism* model -which is *a priori* featured by its *anti*-monetarism approach- to demonstrate that there are grounds for the role of money even in a cashless framework.

Keywords: Woodford, Wicksell, Monetary Policy, De-emphasis of Money, Monetarism.

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[1]M. Goodfriend and R. King, 1997, The New Neoclassical Synthesis and the Role of Monetary Policy, NBER Macroeconomics Annual, Cambridge: MIT Press.

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1 Introduction

If we take for granted the Wicksellian definition of Economics as a *practical* science, it should, then, be quite natural to make the bridge between theory and practice. Unfortunately, most of the time a gap emerges between academics and policymakers. Goodhart (2005) for instance -in his survey of the last 25 years of macroeconomics history- raises the lack of realism as the main features of the recent models. Mankiw as well opposed the *engineers* in economics -who are concerned with social issues- to the *scientists* who try to understand the economic functionning. The last developments of macroeconomy, *i.e* New-Keynsian and New Neoclassical Synthesis models, bring us a proof to the domination of scientists over engineers. In spite of that, we can not deny that since a decade there is a real tendancy in monetary field to fill in this gap. The works of Taylor (1993) or Woodford (2003) -to name only few of them- are prime illustrations of such a mood.

Nowadays, one of the most intensive and -fruitful- debate in monetary macroeconomics lies in the relevancy of money within the monetary policy analysis. The debate that emerged can be summed up as follows: *Does money matter ?* (Woodford 1997, 2003, 2006; Goodfriend and King 1997; Berg et al. 2006; Meyer 2001; Noyer 2006; Laidler 2004). It's right that such a debate is surprising not to say paradoxical. In fact, any undergraduate student will be naturally disappointed if a teacher asked him to wonder whether money has to be taken into account when central bankers took decisions concerning monetary policy. At first sight, this debate seems to be only theoretical, however it has also empirical consequences since it raises the question of the necessity to consider monetary agregates within the monetary decision tools used by central bankers. Nowadays, if we have a look on the way the policy decisons are made, it is difficult to support the relevancy of monetary aggregates within the monetary policy framework. In most of the central banks, monetary aggregates play little role, not to say no role, in monetary policy deliberations. The only exception to that rule is ECB. In fact, the young central bank keeps on giving importance to the *old* monetarist tool, *i.e* the monetary agregates, within its two pillars monetary strategy (Noyer 2006) whereas the Fed gets ride off them and prefers taking into account nominal interest rate -an overnight rate- as its policy operating instrument.

More than that, Friedman himself, the charismatic leader of Monetarism, was less self-assured in the end of his life concerning the usefulness of monetary aggregates for monetary policy. Simon London (2003) reports in an interview for the *Financial Times* that Friedman has stated that "*the use of quantity of money as target has not been a success*" and that "*I'm not sure I would as of today push it as hard as I once did.*"

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On practical side too the relevance of money for monetary policy can be put into question. The IT revolution -in line with the 1980's institutional changes in the financial markets- legitimates such *anti-monetarism* position. The widespread development of electronic money and stored value cards are prime requiste to wonder whether money matters or wheter it still has a place in such a *new world* (Goodhart, King, Freedman)[2].

On theoretical term a *consensus* seems to emerge concerning the monetary framework that central banks should use. This recent monetary literature labelled under different flag -such as "*Post Modern* monetary policy", "*New* monetary policy "or "*New Consensus*"-refers directly as a quite identical framework. The latter is featured not only by its neglect of monetary agregrates but also by a *de-empasized* of money as well. So to say, the debate turned around theoretical and practical implications on how central banks can implement monetary policy in a context in which money is not taken into account within the basic equation of the theory. Among this literature, Woodford's monetary treatise -*Interest and Prices* (2003)- holds a leading place. Woodford's approach is based on the fact that the theoretical fundamentals of policy relevant monetary analysis are *best grounded in a model of a cashless economy, one in which stocks of monetary assets play no essential role*" (Laidler 2005, p.2). Woodford found inspiration in Wicksell's *Interest and Prices* to build his new monetary treatise. Particularly, it is Wicksell's *pure credit economy* framework that is abstracted.

The goal of this paper is to raise the question of "de-emphazing" money in Woodford's Neo-Wicksellianism case. Every (courageous) readers of Woodford's treatise end the book with the final conclusion that money should not matter in monetary policymaking. We will try to show that such a conclusion is misleading and that there are grounds for money even in a cashless framework. After recalling Wicksell's monetary theory in its proper context and content (Part II), we propose a new interpretation of Woodford's approach that restores the importance and relevancy of money within the monetary policy analysis (Part III). The last section concludes.

[2]Woodford (2000) minimizes the influence of such revolution for the conduct of monetary policy even if few changes may be needed notably in the way monetary policy is implemented : "Thus there is every reason to expect that in the coming century the role of central bank in the control of inflation will be essentially the same as it is now." (Woodford 2000, p.11).

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2 Wicksell and Woodford: Is money downgraduated?

It seems that policymakers found their own *bible* since the publication of Woodford's monetary treatise in 2003. Such a *New Wicksellian theory* holds a leading place in macroeconomy if we just take into account the increasing number of reaction that Woodford's *Interest and Prices* provoked (Green 2005; Nakajima 2005; Trautwein and Boianovsky 2005, Zouache and Trautwein 2005, Callum 2005, Laidler 2005, Goodhart 2005). Woodford's landmark and distinctive feature towards the traditionnal New Neoclassical Synthesis (hereafter NNS) model lies in his reference to Knut Wicksell[3]. Within this Woodfordian version of the NNS, the concept of *pure credit economy* (Wicksell 1898, 1935) holds a leading place. Since Woodford seems to be regarded as the first important contribution to Wicksell's thesis, it seems interesting to examine thoroughly Wicksell and Woodford respective *moneyless* frameworks[4].
Starting with the title, Wicksell and Woodford seem to have close similarities. At first sight, the one that comes directly into the head is their specific framework in which the economy is deprived from its most significant part: *money*. However, such a parallel is totally in opposition with Wicksell's goals. In other words, the *pure credit economy* did not mean a *moneyless* economy as Woodford let us understand.

2.1 Wicksell: a monetary theory in a *modern* banking system

> "To judge the character and importance of Knut Wicksell's monetary doctrines, it is necessary to view them against the background of the monetary controversy of the late nineties"
>
> B. Ohlin, 1936 [1898], Introduction in Wicksell's *Interest and Prices*, p.VII

If Woodford's monetary treatise appears with plenty of reaction among academics, it was not the same concerning Wicksell's monetary book. In

[3]The label *New Wicksellian* has to be understood as a disctinction to New Neoclassical Synthesis theory. Woodford distinguishes his own theory from the others notably by neglecting real balance effetcs and by assuming that inflation is determined by an interest rate gap which can be eliminated by the use of an interest rate feedback rule.

[4]We need to mention that Leijonhufvud in 1981 already shed light to Wicksell's theory by legitimating a *Wicksellian connection* between Wicksell and Keynes.

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fact, when this unkwonwn Swedish economist published his first monetary book in 1898, nobody gave attention to his analysis in Sweden and more less abroad[5]. Wicksell got involved in Economics in order to solve *practical* social problems[6]. The outstanding ones for some decades were the instability of prices. The nineteenth century is probably one of the most disordered both in terms of fluctuations in the level of activity and in terms of level of monetary prices. The second half of the century has been stricken by opposite movements of both inflation (1851-1871) and deflation (from 1873-1895). In such a context, Political Economy was worried with the monetary system to adopt. This period was the one in which the Bimetallism controversy prevailed and separate economists in two factions [7]. This was in that context that Wicksell wrote *Interest and Prices*. The objective was to give a clear statement on the origin of the fluctuation of the monetary prices in order to provide practical tools (or norms) to solve them. Wicksell's approach has to be understood as an attempt "*to restate the Quantity theory in credit-theoretical-terms*" (Trautwein/Boianovsky, 2001 p.500)[8]. As a consequence, he set up a two *ideal-typical* economy framework in which we have different assumptions on the definition of money and particularly its velocity of circulation. Wicksell underlines particularly the function of means of echange within those two monetary types. The approach was that if we can understand what was at the origin of the fluctuations of prices in each of these imaginary cases, then we can solve the problem of instability of prices in the actual system since "the monetary system actually employed can then be

[5]Wicksell was not unkwown in Sweden, he owed his celebrity not as an economist but as a journalist-pamphleter that took taugh positions on several social issues such as drunkness, prostitution, overpopulation and so on.... However, he was totally unkwown outside.

[6]Wicksell was at the origin a graduate student in Mathematics. He came *on the road* of Economics very late in his 37 years old. As underlined by Ohlin (1926, p.503): "*his interest in social and ethical problems had become so great he decided to deserted mathematics in favour of Economics*'(Ohlin 1926, p.503).

[7]Wicksell was entirely opposed to the monetary use of gold because of its two opposite functions: gold as *money* and gold as *raw material* in the industry which lead undoubtedly to fluctuation of its value and its consequences on the value of money which is anchored to it. So that, he adviced to substitute the gold reseves by bank notes and give up gold as a bullion. Wicksell's Ideal Bank model was motivated by such a goal of *de-goldization* of money

[8]Wicksell raises four major criticisms against the Quanty Theory: the inadequancy between the *modern* banking system and the Quantity theory framework; the hypothesis of the fixity of the velocity of money; the narrow definition of *money*; the impossibility to differentiate the stock of money into hoarding money and defraying money. In a more developed manner in the *Lectures II*, Wicksell reduced- or more exactly he focused- his criticism on two points concerning the Quantity Theory: the proportionality causality between M and P; the fixed velocity of circulation of money.

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reagrded as *combinations* of these two extreme types.“ (Wicksell 1898, p.70). By removing the fixed velocity assumption, Wicksell endogenouses this hypothesis by introducing several frameworks for the economy. Wicksell's "pure credit economy" is the extreme one.

- The case of the pure cash system:
  This hypothetical kind of economy is characterized by the total absence of the lending of money or of credit which is “neither given nor received” (Wicksell, 1936 [1898], p.56). In short, transactions are exclusively paid by (gold) coins. In that case, the cash holdings of each agent is mainly determined by the conjuncture and the level of the economic activity. People hold money for two reasons: first, for the payments of purchases at given points of time; and, second, for unforseen disbursements [9]. The most important motive of the money demand is the first one, *definite payment purposes*, which allows Wicksell to state that: “the average velocity of circulation of money is, of almost a constant magnitude. It would react immediately against accidental expansion or contraction.” (Wicksell, 1936 [1898], p.59). The level of prices is in taht narrow case totally dependent of the quantity of money into circulation. However, this first case is purely *imaginary* and far from reality.

- The case of the pure credit system:
  In this purely *monetary fiction*, Wicksell took the opposite framework of the above case. In this kind of economy, there is no place for money in its narrow sense. Only credit prevails under different forms. He introduces two intermediary stages within the pure credit economy:

  1. The case of simple credit economy (or *unorganised* credit system): The economy is featured by credit instruments under the form of both simple merchandise credit, *i.e* delay of payments, and lending of money between two people. However, money, under the form of cash, is not absent anymore because the necessity for holding cash balances still persists in regard to precautionary reserves against unforseen payments. These primary forms of credit are seen by Wicksell as a “*powerful pulley* for accelerating the circulation of

[9] Wicksell assumes also a third reason in the cash holdings: *the sale of individual blocks of capital*. However, this reason does not play a major role in the isssue into question. These money balances are seen as *a particular kind of cash holding*. The amount of this type of cash is subject to *individual caprice* so that it is unexpected and difficult to measure. This type of cash holding reason is close to the Keynesian *animal spirits* postulate in the analysis of money demand

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money" (Wicksell, 1936 [1898], p.59). The advantage brought by the credit instruments is to diminish the need for money "to an unlimited extent" (Wicksell, 1936 [1898], p.59). In fact, as soon as money is lent by one to another, the latter can uses it to redeem a third agent and so on... In Wicksell's own words :

> "As soon as a sum of money, no matter how small, were brought into circulation in the market, it would zigzag rapidly backwards and forwards between buyers and sellers"
>
> (*ibid*, p.60)

However, there are limits that prevent credit to substitute money: first, the *individual* lending system can not be developped untill an unlimitted extent because it only concerns a minority circle of people, *i.e* the ones who can provide guarantees for the debt; and second, obtaining credit or lending money necessitate to provide precautionary measures for both debtors and creditors. So that, an *unorganised* credit economy reduces the necessity for cash-holdings but it does not make it diseappeared. This imaginary case introduces us an economy in which the velocity of circulation is a "*somewhat elastic quantity*" (Wicksell, 1936 [1898], p.61). The level of prices, with degree of differences, is still a dependent factor of the quantity of money into circulation.

2. The case of organised credit economy:
   It is a model of a banking economy with centralisation of lending by banks and monetary institutions where "*all domestic payments are effected by means of Giro system and bookkeeping transfers*" (Wicksell, 1936 [1898], p.70). In this purely imaginary case "*money does not actually circulate at all, neither in the form of coin (except perhaps as small change) nor in the form of notes*" (*ibid*). That is only in that stage that Wicksell integrates the banks in his analysis. This new actor in the monetary system is not without consequence for the economy in the extent they provide the most *powerful pulley* in the circulation of money by means of bank credit. In that case, the elasticity of money can adapt itself to whatever quantity of money needed. The key variable in that process is to take advantage of credit tools and its elasticity. The banks allow to get rid off cash money but at the same time they are held responsible for the inflation/deflation process that they can bring about by increasing the velocity of circulation of money. Within this framework, Wicksell puts a special focus set

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> on the bank notes. He considers them as " a kind of deposit-receipt or cheque, which passes through a number of hands before it is presented to the banks either for redemption or as a deposit." (Wicksell, 1936 [1898], p.69). The status that is given to notes consists in providing a reserve-instrument instead of the gold coins rather than representing a substitute for money.

For sure, Wicksell was pioneer since he opened the path in economics to give up money for a theoretical purpose. However, in both the Wicksellian monetary fictions the goal was not to eradicate money. On the contrary, Wickell's original willingness was to provide a modern theory that integrate money in its modern forms so as to take into account its proper effects on economy, notably via the velocity of circulation and its effects on the level of prices.

We should, then, be careful by not associating Wicksell with an economy without money owing to the fact Woodford legitimates Wicksellian roots. Wicksell's original *pure credit economy* is not a moneyless one[10] . The Wicksellian inheritance in Woodford's framework has not be understood on that point. Following the 2004 HES Conference, Woodford justified himself his Wicksellian *flavour* (over a New-Keynesian flavour)" *because of his emphasis on the short-term nominal rate of interest as the instrument of monetary policy and the role of changes in the natural rate of interest over the business cycle*" (Boianovsky 2006).

2.2 Woodford's *cashless economy*

Woodford's landmark lies in the determination of the price level under a *cashless* economy canevas. The *cashless* framework is defined by Woodford as:

> "one in which there are assumed to be no transactions frictions that can be reduced through the use of money balances, and that accordingly provide a reason for holding such balances even when they earn a rate of return"
>
> Woodford, 2003, p.61

[10]Laidler : "*Wicksell's pure credit economy is not a moneyless economy, and that is why [...] monetary aggregates, particularly narrow defined monetary aggregates, continue to be systematically leading indicators of the behaviour of output, and hence inflation, under regimes in which policy is conducted by the manipulation of interest rates*"(Laidler 2004, p.4).

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So that, one of the message that is remembered turns around the fact that money does not matter since it is not integrated within the monetary framework that should be used by policymakers. Such a message attracked the reaction of the *Neo*-monetarists (Nelson 2003, Laidler 2005). Within his triad of equations -that we will present later on- Woodford neglects voluntary the supply and demand for money since he considers them as having trivial effects on the economy. It is a Woodfordian landmark to get aside with the "implied path of the money supply or the determinants of money demand" (Woodford 2003, p.237) in the determination of the equilibrium of output and prices[11] In other words, Woodford modelizes an economy in which apparently money does only matter as a unit of account for the economy's single good. Beyond to that function, there is no need for money since he assumes perfect frictionless markets which legitimate the utilityless of money. The cashless assumption is based on the axiom of total absence of monetary frictions. As a consequence there is no demand for money because there is no risk against which people has to be protected. One of the key -and polemical-element that justificate the utilityless of money in Woodford's approach lies in the assumption of complete financial markets [12]. Such a setting can be defined as a situation in which "*all eventualities can be forseen and appropriately hedged at the correct insurance/option price.*"(Goodhart 2005, p.10).

It is clear that Woodford gives up money in his monetary policy analysis framework. However, money does not totally diseappear since instead of money he pleads in favor of another operating instrument inherited from Wicksell's *Interest and Prices*: the interest rates gap[13]. In fact, the critical variable that policymakers must control, according to Woodford, is the *gap* between the rate's actual value and its (*exogeneous*) neutral level rather than the *nominal* interest rate alone.

As we will see in the following section, Woodford's approach does not neglect money at all. It is right that within his basic equations money does not appear. However is this enough to conclude that money is absent ? A thorough study of Woodford's framework and his transmission mechanism will bring us an answer.

[11]Woodford does not totally get rid off money because he copes with the case in which there is a determinate demand for money when he takes into consideration the existence of *frictions*.

[12]See Goodhart 2005 for a critical analysis on this complete financial markets assumption in Woodford

[13]Wicksell was the first in the early 20th century to advocate theoretically the importance of the interest rates gap between the *monetary* rate-charged by the banks (or the central banks)- and the *natural* rate- the one that approximate the marginal productivity of capital- for the conduct of monetary policy and as a basis of the stability of prices.

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3 Woodford's Monetary treatise: If money matters ?

The discussion on the role of monetary policy and its due place within the stabilization policies is a long tradition in macroeconomics. In his famous presidential adress in 1967 -published in 1968 in the *American Economic Review*- Friedman coped exactly with this topic[14]. By underlying what monetary policy can do -and particularly what it can not do- Friedman clarified which kinds of macroeconomic stabilization objectives best serve the economic welfare. Few decades later, Woodford does the same even if the book is mostly theoretical than empirical.

This section will focus on the relevancy of money in Woodford's treatise and we will wonder whether money really matters or not ? We will try to demonstrate that it does. In search for answer, we need, first, to have a look on the assumptions and contents made by Woodford since his framework is not so well-known. In a second step, we will focus on the importance of the interest rate expectation within the household optimization process. Such a channel of transmission allow us to restore the importance of money within the monetary policy analysis even in a cashless model.

3.1 Woodford's *Neo-Wicksellian* Model

The major advance brought by Woodford's treatise is to have demonstrated how monetary policy, under the form of an *instrument rule*, can correct inefficency, *i.e* output gap, by targeting the nominal interest rate at its natural level[15]. In fact, when the economy functions under a monopolistic framework -with stickiness on prices or on wages- the final outcome is under-optimal. As a consequence, monetary policy has to regulate it.

[14]Friedman (1968, p.1) " There is a wide agreement about the major goals of economic policy: high employment, stable prices, and rapid growth. There is less agreement that these goals are mutually compatible or, among those who regard them as incompatible, about the terms at which they can and should be substituted for one another. There is least agreement about the role that various instruments of policy can and should play in achieving the several goals."

[15]The definition of the natural rate in Woodford's approach is a tricky question. Most of the time the natural rate of interest is defined as the real rate of interest required to keep aggregate demand equal all the times to the natural output. By *natural output* we mean a virtual equilibrium in which the equilibrium output is determined by perfectly flexibles wages and prices (Trautwein and Boianovsky 2005).

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3.1.1 Woodford's assumptions

Woodford's basic model is based on several assumptions that give the specific flavour of his own approach:

- A representative household: the economy contains a larger number of identical households. The representative household seeks to maximize the expected value of its utility function over a discounted sum of periods. This assumption gives to the model its microeconomic foundations. Woodford distinguishes the household's wealth held in monetary base (M_t) from the one under the form of assets' portefolio, B, due to his emphasis on the consequences of the central bank's policy via the supply of its asset and the interest rate paid on it (See Woodford, 2003, p.65).

- Four economical agents:

  1. the Representative household : he is price-taker and he optimizes his intertemporal (forward looking) utility function (consumption-saving decision process);
  2. the Firms: they are price-maker within a monopolistic framework. According to the Calvo model (1983) adopted in such a framework, only one part changes the level of prices at which they will sell their product, the rest maintains a steady price. They produce the single good of the economy through a production function with only a labour factor;
  3. the Central bank: defined as an "*issuer of liabilities*" (Woodford, 2003, p.63). It fixes the level of the nominal interest rate on its liabilities in response of both the inflation rate and the output gap. It is represented by a quadratic loss function for inflation[16];
  4. the Government : it decides the fiscal policy, that is to say the level of taxes, T, and the level of government spendings, G, in terms of real goods and services. It also issues government bonds on the financial market in order to finance its purchases. Woodford assumes that the fiscal policy always satisfies the government budget constraint (given by equation (1.25) p.73).

- The economy's single good is both purchased by the representative household and by the government[17].

[16] see Svensson in (Mitzen 2003)

[17] The market clearing condition implies that $C_t + G_t = Y_t$ at all dates.

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- Two frictionless markets: the financial markets and the goods markets. Both markets are perfectly frictionless, that is to say, a perfect competition occurs, and prices adjust continously to clear markets. The corrolary of this assumption is that "no monetary assets are needed to facilitate transactions" (*ibid*). In the financial markets, "state contingent securities of any kind may be traded" (Woodford, 2003, p.62). The representative household can hold both financial claims on government -such as bonds- and privately issued financial assets. Within the financial markets there are two sorts of assets according to their maturity and according to their liquidity: the *monetary assets* in the sense of liquid (riskless) one period asset (*i.e* the central bank's base money) associated with a specific interest rate i_t^m and the *nonmonetary assets* which concern the long term assets -such as the public or private bonds- associated with the interest rate i_t.

- Complete financial markets: this rough assumption is made by Woodford in order to get rid off the household's uncertainty "about future prices, income, taste shocks..and so on..." (Woodford, 2003, p.64). This assumption is roughly put into question by Goodhart (2005). In this system, it is then not clear whether money, banks or financial intermediaries exist and if they does, what are they proper function.

- Woodford expounds his approach in a *purely cashless economy* framework, inherited from Wicksell's (1936 [1898] ; 1935 [1906]) *pure credit economy*, defined by Woodford as "an economy in which there are no *transactions frictions* whatsoever" (Woodford, 2003, p.31), so that, there is no reason to hold money balances "even when they earn a rate of return that is dominated by that available on other assets" (Woodford, 2003, p.61). This framework is not without consequences for the way monetary policy is implemented. In fact, this assumption leads the central bank to implement its monetary policy only by way of *adjustment of the interest rate paid on base money* and not through the adjustment of the *quantity* of base money. The latter strategy has no consequences for the equilibrium determination of interest rates. As we will see later on, this framework of a *cashless economy* involves that $i_t = i_t^m$ at all dates, that is to say the nominal short-term interest rate must equal the interest rate paid on base money.

- Money: there is no money in the strict sense of the word but only a monetary *unit of account*. The latter is used to quote the prices of both the financial assets and the real good. The unit is defined "in terms of a claim to a certain quantity of a liability of the central bank, which

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may or may not have any physical existence" (Woodford, 2003, p.63). It is no more than a claim to future units of central bank's liability. The only "money" that exists is *base money*, *i.e* the central bank's liabilities, and it can be seen as a "perfect substitute for other riskless nominal assets of similarly short maturity" (Woodford, 2003, p.63).

- From the above assumptions, we can understand the monetary policy as consisting in fixing "both the nominal interest yield on its liabilities and the quantity of them in existence" (Woodford, 2003, p.63). The key instrument for the central bank's policy rule is the nominal interest rate on its liabilities. Woodford rejects open-market operations since he focuses on an interest rate management with no regard to the quantity of the base money[18]. The monetary policy takes the form of a monetary rule such as the one defined by Taylor (1993)[19].

3.1.2 Woodford's basic model

Woodford basic model is in reality a triad of equations- an *IS-AS-MP* system- that enable to reach the equilibrium.
The basic building blocks is composed by:

- an intertemporal IS curve:
  It links the aggregate demand for goods and services to the nominal rate of interest controlled by the central bank [20]. The IS block can be obtained by log-linearizing the first order household equilibrium conditions. It results that:

$$x_t = E_t x_{t+1} - \sigma(\hat{i}_t - E_t \pi_{t+1} - \hat{r}_t^n) \tag{1}$$

  where x_t is the actual output gap; E_t expresses the rationale expectation process; σ is the intertemporal elasticity of substitution of aggregate expenditure (notably between private and public expenditure); $\hat{i}_t$ is the operating instrument of the central bank (here the nominal

[18]Woodford considers that open-market purchases have no effect on the prices or on the interest rates.

[19]In short, Woodford distinguishes two types of rules: *instrument rule* which is a formula for setting the policy instruments as a reaction against the fluctuations in the inflation rate and the output gap (Taylor's rule) or the *targeting rule* in which " no formula is needed for the central bank's operating target. Rather it is set at whatever level may turn out to be required in order for the bank's projection to satisfy a certain target criterion" (Woodford, 2003, p.43)

[20]The nominal interest rate which brings about changing in the output gap and in the inflation rate.

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interest rate); $\hat{r}_t^n$ is the exogenous parameter for the variations in the natural rate of interest (due to real disturbances)[21]. The idea is that the aggregate demand depends upon the expected value for the output gap and the short-term nominal interest rate.

- an aggregate supply (AS) curve:
  It links the rate of inflation to the gap between aggregate demand and some long run equilibrium level of aggregate supply. The log-linear AS relation is also called the *New Keynesian Phillips curve* because of the rationale expectation process that supplements the *old* Philips curve relationship [22]:

$$\Pi_t = \kappa x_t + \beta E_t \Pi_{t+1} \tag{2}$$

  where Π_t is the inflation rate in t; κ is a coefficient that depends on both the frequency of price adjustment and the elasticity of real marginal cost with respect to the level of real activity; and x_t is the *output gap* defined as the discrepancy between variation in the actual output and exogenous variation in the natural rate of output which results from several types of real disturbances.natural output (in mathematical terms: $x_t \equiv \hat{Y}_t - \hat{Y}_t^{\eta}$); β is a discount factor.

- a Taylor's monetary policy rule:
  It is the central bank policy reaction function which links the nominal

[21]This term, $\hat{r}_t^n$, represents the deviation of the Wicksellian natural rate from the value consistent with a zero inflation steady state rate. The exogenous disturbant term, $\hat{r}_t^n$, is defined as:

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

with g_t as a composite exogenous disturbance term that summarized the preference shocks or the variation in the government purchases; $\hat{Y}_t^n$ is an exogenous disturbance term on the aggregate demand Y in period t.

[22]The New Keynesian Philips curve is a response from Keynesian economists to Friedman 1968's sharp critique of the Keynesian Philips curve and to the rationale expectations school of though in the 1970's (led by R. Lucas and T. Sargent). The principale response has been to attempt to build models that incorporate rationale expectations and that provide microeconomic foundations for monetary policy having at least short-run effects. The main microeconomic rationale has been *sticky prices* notably the 1983's staggered pricing model by Calvo. According to such New Keynesian Philips curve, inflation rate can be expressed as a dynamics process with a forward looking flavour. In fact, it relates current inflation to the expected future inflation and a measure of current real activity. Thus, in such a framework, inflation can be interpreted as the present value of the entire expected path of future real marginal cost. By stressing the importance of the current expectations to the future inflation rate, such a framework insists on the idea that a monetary policy which is credible and that targets low inflation rate is a good means to sustain a low level of inflation.

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rate of interest to both inflation gap and output gap.

$$\hat{i}_t = \bar{i}_t + \phi_\Pi(\Pi_t - \bar{\Pi}) + \phi_x(x_t - \bar{x})/4 \tag{3}$$

where $\hat{i}_t$ is the operating instrument of the central bank (here the nominal interest rate); $\bar{i}_t$ is an exogenous intercept that reflect variation in both the target rate (Π_t^*) and the exogenous disturbance term (v_t) that arises from mismeasurements or errors by central bank; ϕ_Π and ϕ_x are the monetary policy coefficients that allow to put more or less weight on one of these two policy goals; $\bar{\Pi}$ is the target rate of inflation and $\bar{x}$ is the steady state value of output consistent with the inflation target ($\bar{\Pi}$).

According to such rule (3) *in the spirit* of Wicksell's proposed rule, we can say that the actual inflation rate depends on both the actual output gap and the expected value of the inflation rate in the next period[23]. In that sense, it is true that future matters more than the present. As a consequence committment and credibility are the key factors of an *optimal* monetary policy.

3.2 The Relevancy of Money within the Woodfordian Monetary Policy Analysis.

It is commonplace to read that monetary policymaking is more *art* than *science* (Blinder 1997)[24]. As an art discipline it is thus not a surprise if the leadership of a theoretical corpus is put into question by a totally opposite one. In that sense monetary macroeconmics is art. Monetarism holds center stage in macroeconomics for two decades. Such a current gave a prominent role to monetary aggregates due to the Quantity postulates between base money and inflation rate. In practical terms, and especially for the Bundesbank, Monetarism exerted a great influence for the conduct of monetary policy. If, nowadays, Monetarism is dead in practical term, it is because it is widely admitted among policymakers that monetary aggregates have no longer a reliable relationship with inflation or real activity. However, such interpretation is not admitted by many *neo*monetarists. In fact, they have shown that there is an emprical link between both if we allow a time lag

[23]The term *wicksellian* is here justificated by the fact that monetary policy should track variation in the natural rate (via the output gap). However, it is right that the monetary rule is more in the spirit of the Taylor eponymous rule.

[24]The exact quotation is the following: "Having looked at monetary policy from both sides now, I can testify that central banking is as much art as science. Nonetheles, while practicing this dark art, I have always found science quite useful" (Blinder 1997, p.17

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between the monetary aggregates and the inflation rate(Nelson 2003)[25]. As aconsequence, they are strong opponents to New Keynsian economists. New Keynsian models change direction and took the opposite road by legitimating a world *without* money. As we have shown, New Keynsian models made the *de*-emphasis of money as their distinctive feature. Nelson defines those models as ones in which "*money does not enter explicitly as a state variable in the solution for output and inflation.*" (Nelson 2003, p.1051). For sure, the changing of direction looks like a U-turn and seems to be contradicted with Friedman famous statement that "*substantial inflation is always and everywhere a monetary phenomenon*". However, as we will show, Woodford's model does not preculde to state that money should play a role in monetary policy.

The wave that New Keynsian economists provoked within the monetary ocean attracked sharp critics from the monetarist ones (Nelson, Meltzer and Mc Callum to name only few of them). The most interesting -and the most enlighting- controversy that emerged recently has been the one between Nelson and Woodford. The controversy is not only theoretical but it has is also practical consequences. It is perfectly illustrated by the two opposite monetary strategies of the ECB and the Fed[26]. Following the publication of "*Interest and Prices*" in 2003 Nelson counter-attacked with the publication of an enlighting article untitled "*The Future of Monetary Aggregates in Monetary Policy Analysis*". Several reproaches was made to New Keynsian models -and particularly to Woodford's one- due to their misinterpretations of Monetarism precepts. Such error push them to neglect the relevant channels of monetary policy.
Nelson gives rise to a debate by stressing what Monetarism is *not*. Contrary to what is commonly admitted, Nelson assumes that: (1) Monetarism does not require to claim that traditionnal real balance[27] effect should play a central place in the IS equation[28]; (2) Monetarism does not depend on

[25]Nelson (2003 p.1039) demonstrated that such a causality link is relevant with US data (January 1970 to August 2002) if we integrate a lag of two, three and four years in the regression between the inflation rate and the M2 money growth.

[26]ECB continues to assign a prominent role of monetary aggregates via its two pillar strategy. On the contrary, the Fed bases its monetary strategy on an active interest rate mangement through open-market operations in which monetary aggregates play little role in monetary policy deliberations(Woodford 2006).

[27]The traditional real balance effect -inherited from Pigou- refers to the stimulous to consumption or aggregate demand from the increment to real financial wealth that accurs when the real monetary base increases.

[28](Friedman 1972, p.947): "I never have believed that the real balance effect is of much empirical significance."

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the presence of explicit terms involving a money stock in the Philips curve; (3) Monetarism does not require to base monetary policy on credit channel mechanisms[29]; (4) the Monetarist's proposition "*does not require a belief that money demand is perfectly stable or that monetary aggregates play, or should play, an explicit role in either a price-setting or policy decisions.*".
So, what is Monetarism ? Nelson focuses on the money demand function and this is the main *anti*-monetarist reproach which is adressed to Woodford's model. He adviced Woodford to integrate a money demand function *à la* Friedman-Meltzer within his framework[30]. In fact, the thesis supported by Nelson is that not only*short term* interest rate should be integrated but it should also depend on long-term interest rate. He demonstrated that there is a robust empirical link between the monetary base and the long-term interest rate(Nelson 2003). Laidler insists on money demand as well. He opens the door to restore the significance of money in Woodford's framework by studying thoroughly the demand for bank deposits from the agent. In fact, based on Wicksell's failure to analyze such a topic, Laidler (2004) concludes that the demand for bank deposits -in this cashless framework- is motivated by the same *precautionary* and *transactionary* purposes as in the *pure cash economy* we saw in the previous section.

Woodford was not blind to such a call and answered to Nelson's criticisms in an article in 2006 -untitled "*How important is Money in the Conduct of Monetary Policy*[31]- both concerning his *anti*-monetarist inheritance and the relevancy of a money-demand function[32]. Woodford answers to criticism by legitimating the particularity of his approach but he does not refute explicitely the monetarist's postulate [33]. In line with Nelson, Woodford supports that the usefulness of monetary aggregates for monetary policy is not

[29]While stressing the importance of interest rate as " *the preferred instrument of monetary policy*" Taylor concludes that "*money should continue to play an important role in monetary policy formulation in the future*" (*in* Nelson 2003 p.1031)

[30]A Friedman-Meltzer demand function is one in which a spectrum of yields enters the money demand function. The idea is that not only the *short term* interest is integrated but also various yields brought by money such as physical assets.

[31]This article is the result of research made for the ECB Central Banking Conference in automn 2006 on the topic "The Role of Money: Money and Monetary Policy in the Twenty-First Century".

[32]For a time purpose, we will note explain Woodford's answer regarding his neglects of the money demand within his framework. We advice the reader to see Woodford (2006, p.14-15).

[33](Woodford 2006, p.15) : "*the model is not the one that requires the existence of a money demand-relation but not one that is incompatible with the existence of such a relation either*".

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the feature that allow to judge on this point. In his own words: "*in neither case does the preservation of the important insights obtained from the monetarist controversy depend on continuing to emphasize monetary aggregate in policy deliberations.*" (Woodford, 2006, p.4). If the emphasis on monetary aggregates is not *the* point that features Monetarism, then, what is at its basis ? Woodford remembers two distinctive features for Monetarism:

1. The central bank responsibility for controlling inflation:
   Such a statement is not typically monetarist since Wicksell in that time considered also that central bank should be held responsible of the level of prices (Wicksell 1898; 1935 (1906));

2. The superiority of *Committment* over discretion:
   Friedman's famous money growth rule is only one example among many of possible monetary rules.

It is crystal clear that money does not appear explicitly in Woodford's model. However, as stated above, the lack of explicit terms for money -in the IS equation- does not allow us to conclude that money does not matter. There are other channels of transmission for monetary policy that can be considered. There is a ground for money in Woodford's model via the intertemporal IS equation. As shown by Nelson (2003, p.1048) himself the "*forward looking property of aggregate demand (IS curve) allows a potentially important role for money as an indicator of economic conditions*" . In other words a thorough study of the way the expectations of future interest rates and future outputs are made allow us to restore the importance of money in Woodford's framework. In order to provide an explannation of the specific channel prevailed by Woodford, we need to start the analysis by the representative household utility function.

The first step in Woodford's approach starts with the household optimization problem which consists in choosing the path of total demand, and his assets portfolio, that optimize his utility function with respect to his budget constraint over an intertemporal lifetime, given the expected good and assets prices and given his initial wealth W_0. Within that program, the short-term interest rate is a key variable since it is of primary importance in consumption spending decisons but not only. It is also a crucial parameter for the assets' portfolio decisons, notably via the expectation of his future wealth. In fact, in line with his micro-founded approach, Woodford considers that the representative household has to choose his total demand in the single good under a budget constraint over an intertemporal time scale. He has to choose the level of consumption, C, and his money accumulation plan,

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M, that maximize his intertemporal (forward looking) utility function with rational expectations process[34] :

$$E_0 \left\{ \sum_{t=0}^{\infty} \beta^t u(C_t;\, \xi_t) \right\} \tag{4}$$

where E denotes the expected value of the utility function; the discount factor, β, is defined between 0 and 1; and the utility function u depends on the level of consumption, C_t, of the economy's single good; the function allows stochastic disturbances, ξ_t, which mainly materialized the time preference, *i.e* the impatience to consume, and the taste shocks.

The household has also to determine the composition of his own assets' portfolio between central bank assets (also called *monetary* assets), (M), and other financial claims (private or public *nonmonetary* assets) represented by the value of A. Woodford introduces an opportunity cost, represented by the variable Δ_t[35], of holding wealth in "monetary form" (in base money). This variable is an interest rate differential between monetary assets and nonmonetary assets[36]. Unfortunately, Woodford does not specified the way of the portfolio decision is made nor the different types of financial assets hold due to the convenience of the complete financial markets' assumption. We just know that the representative household holds a "wide selection of instruments with different state-contingent returns" (Woodford, 2003, p.65). This choice of portfolio is made in order to assure that all the households within the economy continue to have identical intertemporal budget constraints at all dates[37]. The portfolio decision of the representative household is summarized by the choice of the state contingent value of A_{t+1} (nonmonetary assets) at the beginning of the next period. The variable A is a ramdom variable which depends on the state of the world in $t+1$.

The household's flow budget constraint in each period is given by the following condition[38]:

$$M_t + B_t \preceq W_t P_t Y_t - T_t - P_t C_t \tag{6}$$

[34]The utility function is quoted from equation (1.1) in Woodford (2003, p.64) and the conditions for a rationale expectation process are given by Proposition 2.2 (p.72).

[35]The interest rates spread, $\triangle_t$, between monetary and nonmonetary assets is defined as follows:

$$\triangle_t \equiv \frac{i_t - i_t^m}{1 + i_t} \tag{5}$$

[36]By maintaining constant Δ_t, the central bank controls both the short term interest rate, the one on its liabilities, and the long term interest rates

[37]See Woodford, 2003, p.145 for justification of that convenientassumption

[38]The following equation is quoted from Woodford (equation (1.2), 2003, p.64

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where M_t denotes the household's nominal end-of-period balances in the monetary base (issued by the central bank); B_t represents the nominal value of the household's end-of-period portfolio in the other financial assets (both private assets and government's bonds); W_t represents the begining of period financial wealth; Y_t is an exogenous endownment of the single good; P_t is the price of the good (in the monetary unit) and T_t is the net tax collections by the government. Equation (6) simply means that the total end-of-period financial wealth (left side of the equation) cannot worth more than the value of the financial wealth brought into the period plus nonfinancial income during the period net of taxes plus the value of consumption spending. The wealth, W, of the representative household only comes from the interests earned by both the monetary assets and nonmonetary assets (financial claims).
Thus:

$$W_{t+1} = (1 + i_t^m)M_t + A_{t+1} \tag{7}$$

where A_{t+1} is the expected value in *t+1* of the nonmonetary portfolio. Note that in such equation, the value of W_{t+1} depends on the decision made in period t.

If we log-linearize the household intertemporal utility function, it results that:

$$\hat{Y} = g_t + E_t(\hat{Y}_{t+1} - g_{t+1}) - \sigma(\hat{i}_t - E_t\pi_{t+1}) \tag{8}$$

where σ is the intertemporal elasticity of substitution aggregate expenditure and g_t is a composite exogenous disturbance that summarized the preference shocks or the variation in the government purchases.

If we express the latter equation in terms of an *output gap*, we obtain the intertemporal IS equation (the same as in the previous subsection):

$$x_t = E_t x_{t+1} - \sigma(\hat{i}_t - E_t\pi_{t+1} - \hat{r}_t^n) \tag{9}$$

The particularity in that dynamic form of the old IS curve is that the aggregate demand is expressed according to the nominal interest rate level i_t. The aggregate demand in Woodford's model depends mainly on the expectation of the future state of the world, *i.e* the expected short rates. This result is of primary importance since it has consequences on the determination of other variables notably the index price level P_t. The mechanism of transmission in Woodford's framework work as follow[39] : a given nominal

[39] At the equilibrium, the conditions for the household optimization in this specific *cashless economy* require that M_t, the supply of money, should necessarily be nil or that the nominal interest rate on the central bank liabilities, i_t^m, should equal the short-term riskless assets' interest rate, i_t. Since the market clearing condition implies that $M_t^s \succ 0$, then the latter proposition prevails: $i_t^m = i_t$.

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short-term interest rate, i_t, determine the aggregate demand. Since the total output depends mainly on the private demand, the household equilibrium conditions determine as well the importance of the output gap. Such output gap has consequences to the dynamics of prices[40].

Such channels of transmission explains why Woodford concludes as follows regarding the theory of monetary policy:

> " expected future short rates matter a great deal [...] a central bank's primary impact on the economy comes about not through the level at which it sets current overnight interest rates, but rather through the way it affects private-sector expectations about the likely *future* path of overnight rates. "
>
> Woodford, 2003, chap.4, p.244

A new step has been reached with New Keynesian models in general - and with Woodford's model in particular- by neglecting money within the monetary policy framework used by policymakers. Explicitly money is absent among the relevant variables that monetary policy should respond. On the other hand, the emphasis put on the nominal interest rate as the key variable for the economic stability allows us to conclude that money is not abandonned insofar. All the structural relationships in Woodford's model are determined -more or less directly- by the operating instrument -the nominal overnight interest rate- of the central bank. In Woodford's universe the short-term interest rate renders implicitly the impact that money plays for the economic stability in overall.

Woodford's cashless approach does not mean that money does not matter for the monetary policy analysis. For sure, money -under the form of monetary aggregates- is not integrated which is a turning point in the way monetary policy is shaped. The fact that there is a lack of a money demand is more a feature of Woodford's approach than a defect since "*the model is not [...] incompatible with the existence of (a money demand relation) relation*" (Woodford 2006). The modern monetary regulation changed and it transits via the monetary market. Money keeps on being a *pilliar* even in modern macroeconomics models in which no explicit terms refers to money. If such was not true why the attention towards central bank reports and decisons would be so strong ?

[40]We have to keep in mind that at this stage, Woodford assumes an exogenous private endownment for Y_t the aggregate demand in the single good.

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4 Conclusion

Throughout this article, we saw that:

1. The legitimacy of Wicksellian roots in Woodford's approach should not let us think that Wicksell's original writtings focused on neglecting money and getting rid of it. It is exactly the contrary. Wicksell provided different monetary fictions -notably a cashless economy framework- in order to understand how money affect economy.

2. The controversy on the relevancy of money in monetary policy analysis is a false debate. The debate does not lie around the fact money matters or not. The debate lies on the way money is -or should be- integrated. Woodford's monetary treatise was seen as an *anti*-monetarist approach only because money did not appear explicitly within the key structural relationships of the system. Moreover, the term *cashless* is polemical since it is understood as a rejection of money.

3. Woodford's approach should be understood in a modern context in which not only the definition of monetary policy changed but also the way money is conceived changed. It has a reached a different status and form in comparison with the last two decades.

4. Such modern definition of monetary policy insists on the importance of the expectations. By stressing the future path of interest rates instead of current or past values, Woodford is perfectly in line with the modern definition of monetary policy. As an allusion to the above analogy with art, actual monetary policy is nowadays art in the management of expectations. During a conference on the theme "Central Banks as Economic Institutions", Prof. Eichengreen told that "*Monetary policy is not doing something but it is telling something*". If we accept such definition, it is clear that the credibility challenge becomes of primary importance for central banks and hence theory of monetary policy should take that into account. It is thus not a surprise if the emphasis is put on the way to manage expectations. Since the lessons brought by the Fisher effect, central banks have to shape and anchor expectations through their monthly (in the ECB case) communication reports. The monetary rule -as a monetary instrument- is a relevant tool to communicate and tell stories to the public. Woodford's *Interest and Prices* has to be understood in such a context. The goal was to provide foundations of a theory of monetary policy. It is thus not a surprise if Woodford emphasizes the forward looking property of the key structural relationships.

To finish we can make an analogy with Friedman's famous statetementè on the fact that "*substantial inflation is always and everywhere a monetary phenomenon*" by saying that in the Woodfordian framework "*inflation is always and everywhere an expectational phenomenon*".

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References

Berg, H., J. Haan, and J. Sturm (2006). Does money matter in the ecb strategy ? Working paper.

Blinder, A. (1997). What central bankers can learn from academics and vice-versa. *Journal of Economic Perspectives 11*, 3–19.

Boianovsky, M. (2006). Woodford's "interest and prices" from the perspective of the history and methodology of economic thought: A mini-symposium. *Journal of History of Economic Thought 28*, 139–142.

Callum, B. M. (2005). Michael woodford's "interest and prices": A review article. Working Paper.

Friedman, M. (1972). Comments on the critics. *Journal of the political Economy 80*, 906–950.

Goodfriend, M. and R. King (1997). *The New Neoclassical Synthesis and the Role of Monetary Policy, NBER Macroeconomics Annual*. MIT Press.

Goodhart, C. (2005). The foundations of macroeconomics: Theoretical rigour versus empirical realism ? IRES Conference on the "History of Macroeconomics".

Green, E. (2005, March). A review of "interest and prices": Foundations of a theory of monetary policy by michael woodford. *Journal of Economic Literature XLIII*, 121–134.

Laidler, D. (2004). Woodford and wicksell on "interest and prices", the place of the pure credit economy in a theory of monetary policy. EPRI Working Paper Series- RBC Financial group on Economic Policy Reserach Institute.

Laidler, D. (2005). Theoretical foundations for monetary policy. Bank of Findland Conference on "Open-Market Operations and the Financial Markets".

Meyer, L. (2001). Does money matter ? Working Paper.

Mitzen, P. (Ed.) (2003). *Central Banking, Monetary Policy and Practice Essays in honour of Charles Goodhart*, Volume Vol.1. Edward Elgar.

Nakajima, T. (2005). Book reviews: "interest & prices: Foundations of a theory of monetary policy" by woodford. *Economic Journal*.

Nelson, E. (2003). The future of monetary aggregates in monetary policy analysis. *Journal of Monetary Economics 50*, 1029–1059.

ujm-00162418, version 1 - 13 Jul 2007

Noyer, C. (2006). Les agrégats monétaires ont-ils de l'importance? une perspective européenne. Conference on Central Banking-.

Ohlin, B. (1926). Knut wicksell (1851-1926) [obituary]. *Economic Journal 36*, 503–512.

Trautwein, H.-M. and M. Boianovsky (2005). The new neocllasical synthesis: A wicksellian renaissance? IRES Conference on the "History of Macroeconomics".

Wicksell, K. (1936 (1898)). *Interest and Prices: A Study of the Causes Regulating the Value of Money*. Macmillan & Co.

Woodford, M. (1997). Doing without money : Controlling inflation in a post-monetary world. Working Paper-Annual Meeting of the Society for Economic Dynamics and Control.

Woodford, M. (2000). Monetary policy in a world without money. Working paper prepared for the World Bank conference on "The Future of Monetary Policy".

Woodford, M. (2003). *Interest & Prices, Foundations of a Theory of Monetary Policy*. Princeton University Press.

Woodford, M. (2006). How important is money in the conduct of monetary policy ? ECB Central Banking Conference on " The Role of money: Money and Monetary Policy in the twenty first century".

Zouache, A. and H.-M. Trautwein (2005). Natural rate in old and new wicksellian frameworks. ESHET Annual Conference in Sterling.