INFLATION TARGETING
And
FINANCIAL STABILITY

By Michel Aglietta
University of Paris X-Nanterre, FORUM
and CEPII

ABSTRACT.

In the world of financial liberalisation, the money supply is overwhelmingly endogenously determined. Monetary aggregates undergo wild gyrations without any relationship with nominal GDP, let alone price inflation. Credit growth in the private sector fluctuates in sympathy with asset prices but does not impinge upon the GDP deflator.

In this brave new world, monetary policy must meet the challenge of financial instability, about which monetarism has nothing to say. Its shortcomings go far beyond the familiar rule-versus-discretion trade-off to the theoretical underpinnings of the role of money. The Wicksellian theory of inside money, as opposed to the quantity theory of outside money, suits well the concern of central bank for overall financial stability.

Using this framework, the paper develops a model of flexible inflation targeting defined as a doctrine of constrained discretion. Monetary policy is framed in a two-tier decision making process. It is shown that the optimal operating target in the short run depends not only on inflationary expectations, but also on the degree of dissonance between the medium-term commitment of the central bank and the regime of credit. The commitment itself is determined to be trusted by the private sector for a given regime of credit. Since credit can shift from a debtor to a creditor regime, it is demonstrated that a range of credible inflation targets is compatible with a variety of credit regimes.

Since credit regimes shift endogenously in the financial cycle in positive correlation with asset price changes, the paper moves from a static to a dynamic model. Conditions for a pre-emptive monetary policy to keep the degree of dissonance close to zero are determined and the difficulty to implement such a pro-active policy is emphasised. Without insight on the building up of financial imbalances in the bubble-expanding stage, central banks should be prepared to adopt a reactive policy to forestall a credit crunch in the asset price deflation that follows. The last part of the paper assesses ECB policy in view of this framework.

RESUME

La libéralisation financière a rendu l'offre de monnaie essentiellement endogène. Les agrégats monétaires fluctuent au gré des arbitrages financiers sans relation avec le PIB nominal et encore moins avec l'inflation. La variation du crédit dans le secteur privé est étroitement liée à celle du prix des actifs, mais n'influence pas le déflateur du PIB.

Dans cet univers financier la politique monétaire doit se préoccuper de l'instabilité financière, au sujet de laquelle le monétarisme n'a rien à dire. Ses insuffisances vont bien au delà du fameux débat opposant le suivi d'une règle à la politique discrétionnaire. C'est le fondement théorique qui est en question. Il faut abandonner la conception de la monnaie externe propre à la théorie quantitative et adopter la conception wicksellienne de la monnaie interne.

A l'aide de ce cadre théorique, l'article construit un modèle de ciblage flexible de l'inflation conçue comme schéma de discrétion contrainte. La politique monétaire est définie dans une structure de décision à deux niveaux. L'objectif opératoire à court terme ne dépend pas seulement des anticipations d'inflation, mais aussi du degré de dissonance entre l'engagement à moyen terme de la banque centrale et le régime du crédit. L'engagement lui-même est tel que la confiance du secteur privé dans la politique suivie à court terme est préservée en permanence pour un régime donné du crédit. Comme ce dernier peut varier d'un régime de débiteur à un régime de créanciers, une plage de taux d'inflation est crédible, dont les bornes sont déterminées.

Toutefois les variations du régime du crédit sont endogènes, en interaction étroite avec celles du prix des actifs dans le cycle financier. Un modèle dynamique permet d'étudier les conditions d'une politique monétaire pro active dans le cycle. Ces conditions consistent à éviter la dissonance , donc à anticiper les changements dans le régime du crédit qui soutiennent la formation d'une bulle sur les prix des actifs. Cependant sans une connaissance précise de l'accumulation des déséquilibres financiers dans cette phase, cette politique peut être contre productive Mieux vaut se préparer à une politique très accommodante pour éviter un étranglement du crédit dans la phase de déflation des prix des actifs. La dernière partie de l'article évalue la politique de la BCE au regard de ces critères.

INTRODUCTION.

Central banks have inherited a doctrine of price stability that vanquished the Great Inflation, albeit at a dazzling social cost. Well-entrenched inflationary expectations finally gave way and the variability of GDP receded in the US and Europe near the end of last century. Zealots heralded a new era of high growth and never-ending appreciation of asset prices. However central bankers did not have much time for self-complacency. Other worries had arisen; other threats had already ridden high. Financial disequilibria had replaced the erosion of purchasing power as a source of macroeconomic woe.

Is the resolution of financial imbalances a challenge for monetary policy? Isn't prudential regulation more appropriate? Since the Stock Market euphoria has turned into a prolonged bear market, interspersed with occasional short-lived rallies, a hot debate has raged. Are monetarist principles still relevant in the global financial environment? Can a monetary doctrine be independent of the huge change in financial structures that has occurred in the last two decades?

In Europe the legacy of pragmatic monetarism has moved from the Bundesbank to the ECB. The latter holds that nothing has changed in the transmission channel of monetary policy, which would compel the central bank to deviate even minimally from a strict adherence to a narrowly minded concern on price stability. O.Issing forcefully restated the doctrine in a recent speech. According to this view, the financial disturbances of the last decade stem from fortuitous shocks, which being exogenous are not to be repeated.

A rival view has been elaborated notably in the BIS. It has been formulated and documented in a series of recent studies, showing that structural changes in finance have decisively altered the transmission mechanisms of monetary policy. Cumulative financial disequilibria, not only inflation scares are harbingers of a macroeconomic malfunction that monetary policy has a duty to prevent or at least to contain. Indeed the risk of deflation has lately come to the fore. Central banks must be aware of the balance of risks, must design relevant indicators and act accordingly. The doctrine should thus evolve towards an enlarged framework encompassing financial stability.

Following others, this paper hopes to contribute to elaborating this framework theoretically. In the next section it will point out that the monetary policy debate rests upon rival conceptions of outside and inside money. The third section will draw upon the Wicksellian conception of inside money to show that the general level of nominal prices is no guarantee for macroeconomic equilibrium. The fourth section will contend that the definition of inflation is relative to the theoretical view about money and the ongoing monetary regime. The fifth section will propose a model of inflation targeting dependent on the regime of credit. It will derive the optimal inflation target as a function of the degree of dissonance between the commitment to price stability and the magnitude of financial fragility. The sixth section will apply the framework to determine whether a pre-emptive action by the central bank can smooth out a credit-induced boom in asset prices. The last section will conclude on ECB's behaviour.

FROM OUTSIDE TO INSIDE MONEY.

The quantity theory of money has recourse to a thought experiment: the impact of an exogenous amount dropped by helicopter. It simulates a uniformly distributed increase in the money supply. It is not a simplifying assumption. Whether money creation was the counterpart of credit (inside money), the experiment could not be conceived at all. This is the reason why Friedman insists upon the separation between money and credit in the quantity theory.

Being a (n+1)° commodity either in the utility function of individuals (Patinkin) or in their budget constraint (Clower) is a necessary condition for a money market that does not impinge on relative prices in equilibrium. After the adjustment has been completed there is a one-to-one relationship between an increase in the supply of money and the decrease of its purchasing power. Therefore an excess supply of money is the sole source of a permanent increase in the general price level. In the usual macroeconomic framework, the long-run neutrality of money shows up in the so-called natural rate of unemployment.

Under the inside money view, money creation stems from the initiative of economic agents who demand credit not on their existing wealth, but on the prospect of their future income. At the micro level, new money gives an additional spending power to the agents who borrow independently of their saving. An excess demand for particular assets follows the debt-induced creation of new money. Therefore the increase in nominal and relative prices, the rise of capital yield in particular sectors, the subsequent change in the structure of production are intrinsically intertwined.

If the creation of new money comes from the initiative of the state, the adjustment starts the same way. Production factors move from the sectors of private consumption to the sectors producing for the state. The rise in prices in these sectors leads to a rise in income and purchasing power over consumption goods. An excess demand for these goods ensues, which entails a correlative rise in nominal prices. The chain reaction of price changes in both nominal and relative prices can be fuelled by a supplementary demand for money fulfilled by another round of credit. An endogenous process can arise whereby money demand and money supply augment together. When equilibrium is re-established the general level of nominal prices is indeterminate.

If money creation proceeds from a demand of credit to acquire capital assets with rising expectations about future earnings, the relative price of these assets rise in sympathy with their nominal prices. Because these assets are no part of the conventional general price index, there can be stability in this price index. Obviously such a thought experiment does not guarantee that the stability of the purchasing power of money goes hand in hand with macroeconomic equilibrium.

One can provisionally conclude that, in an inside money economy, relative price distortions between all kinds of assets, under the impact of credit bearing new money creation, raise the problem of defining macroeconomic equilibrium.

EQUILIBRIUM AND DISEQUILIBRIUM IN THE WICKSELLIAN MODEL.

Banks create money as part of their business of supplying credit. In addition there are broader sources of private money in a liberalised financial system via the issue of securities cum derivatives. Correlatively securities have become repositories of liquidity in competition with bank deposits. Because transactions are sequentially processed by payments in those competing means of payments, the system of payments is the glue, which ties together the myriad of decentralised transactions. What makes a system is the rule of settlement. There are interconnected sub-systems of clearing, which transfer net balances in agreed means of settlement up to central sub-systems where net debts are settled in central bank money.

Central bank money is the ultimate liquidity, because it is the liability in which the unit of account is defined. It follows that the whole process of debt issuance, transfer and settlement is monitored by the conditions under which the central bank provides its own liquidity. They are encapsulated in the money interest rate. But the dynamic of a debt economy is driven by the initiative of the private sector, demanding credit to acquire capital assets. In turn, credit demand depends on the difference between the expected yield on new capital and the cost of financing. The latter is itself a function of the money interest rate and the pricing of risk. Therefore the macroeconomic equilibrium is defined by a neutral (labelled natural by Wicksell) interest rate. This is the money interest rate equal to the risk-adjusted expected return on capital.

The neutral interest rate is linked to macroeconomic equilibrium, because at this rate production capacity increases in line with overall demand, so that no tension arises in the saving-investment balance. There is no excess or shortage in the market for loanable funds. *One can show that in the neutral interest rate equilibrium, not only the general price level, but also the rate of inflation is indeterminate.*

Writing that the supply of loanable funds is equal to the demand of loanable funds:

New Money Supply+Nominal Saving=Nominal Investment+New Money Demand.

$$\dot{M} + pS = pI + H$$

Because S=I, it follows that: $\dot{M} = H$

The flow demand of new money is a positive function of income, a negative function of the nominal rate of interest and a positive function of the risk-adjusted nominal expected return on capital: $H = H(Y, i, r^a + \frac{\dot{p}}{p})$, where r^a is the real risk-adjusted expected rate of return and $\frac{\dot{p}}{p}$ the expected inflation rate.

In the real sector, expected consumption is: C*=C*(Y).

The ex post consumption is: $C = C(Y, \frac{\dot{p}}{p}) = C^*(Y) - aY\frac{\dot{p}}{p}$.

It is pared by the inflation tax. Conversely saving is augmented beyond its desired level by the counterpart of the tax: $S = S^* + aY\frac{\dot{p}}{p}$

The above equations describe the dynamic generated by the creation of inside money. The last one is the linear form of the equality between forced saving on the one hand and excess demand of loanable funds on the other.

The demand for gross investment (net investment plus capital depreciation) is:

$$\frac{I}{K} = \frac{\dot{K}}{K} + d = l[r^a - (i - \frac{\dot{p}}{p})] + d$$

The macroeconomic dynamic equilibrium is given by I=S, or: $Y - C(Y) = \dot{K} + dK$, and finally:

$$S^*(Y) + aY\frac{\dot{p}}{p} = K[(\frac{\dot{K}}{K} + d]$$

One can get the neutral interest rate equilibrium by setting the real risk-adjusted expected return of capital equal to the real money interest rate: $r^a = i - \frac{\dot{p}}{p}$

Expressing the aggregate variables by unit of labour, one posits y=Y/N, $g = \frac{\dot{K}}{K}$ and k=K/N. Then rewriting the dynamic equation for the neutral interest rate, one finally gets the equilibrium inflation rate:

$$\frac{\dot{p}}{p} = \frac{1}{ay}[k(g + d) - s^*(y)]$$

The equilibrium rate of inflation is an increasing function of the gap between "animal spirits", which drive the growth of investment, and desired saving. *It results that the dynamic equilibrium is compatible with any inflation rate.* There is no market mechanism whatsoever to bring back inflation to a "normal" inflation rate, be it zero or any number. For price stability, the condition should be: $r^a = i$. But this adjustment does not exist in an inside money world, i.e. in a capitalist economy.

Hayek clearly understood the feedback effect preventing such occurrence: the present conditions of demand impinge upon the structural conditions of production. Nowhere is there an anchor, an exogenous benchmark independent of money creation, which could underpin a particular rate of inflation. Surprisingly Keynes arrived at the same conclusion, but for different reasons. He emphasised the intrinsically unstable nature of the expected real rate of return, due to radical uncertainty.

At this point one can ask an intriguing question: why bothering about inflation? The reason is the razor's edge nature of the dynamic equilibrium. Because the neutral interest rate is volatile, being dependent on perceived future opportunities of profit and of the changing attitude toward risk, an inside money economy is more than often out of equilibrium. If the money interest rate is under the neutral rate, a distortion in real asset prices accompanies their nominal rise. If the central bank keeps its leading interest rate sticky, fluctuations in the yield of capital assets trigger an accumulation spree, which is magnified by the high elasticity of the supply of credit whether risk aversion declines dramatically. *What it means is that financial instability should be the primary concern of monetary policy.* It is also true that an excess credit demand launched in the real sector can trigger an inflationary spiral, fuelled by outbids of indexing formulae. *What it means is that excessive fluctuations of the purchasing power of the unit of account can lead to the rejection or at least the weakening of the monetary standard and its replacement by competing private standards.*

Facing the dual woes of financial fragility and potential breakdown of trust in money, central banks cannot certainly content themselves to rely on rigid operational rules. They must build up an institutional framework whereby they can interplay dynamically with an elusive financial system. The remainder of the paper will first elaborate on the framework, then show how it be put in use to mitigate asset price bubbles and subsequent credit crunches.

INFLATION TARGETING AND INSIDE MONEY VIEW.

Economists can agree in principle. Central banks have a duty to preserve the common trust in the integrity of the unit of account through time. But it was demonstrated above that there is an infinity of equilibrium inflation rates. The common trust is the result of a co-ordination game that entails multiple equilibria. The purpose of the so-called anchor function of the nominal standard is thus to eliminate the indeterminacy of private expectations on all but a narrow zone of equilibria. How narrow? Is it possible to define an optimal anchor? These questions are tantamount to asking what price stability means. It is a truism to assert that inflation is a monetary phenomenon. But it means that there is no unique theoretical answer. The way monetary phenomena are conceptualised depends on the theoretical view of money. The outside money view and the inside money view cannot deliver the same answer.

One might argue that a pragmatic approach suffices. After all, even if one cannot define an elephant, everyone can agree on what it is, whether that entity stands in front of oneself. Nonetheless it is not so simple with price stability. The understanding of price stability seems to differ from one country to another. The measure of inflation is an artefact, conventionally designed by statistical institutes. It excludes asset prices on grounds of a dubious rationale. It is plagued with a lot of problems stemming from quality changes in individual products. Furthermore changes in the actual price index might capture a host of events that have nothing to do with a monetary phenomenon, like a freeze, an oil price spike, a strike or a catastrophic destruction of production capacities. Therefore one needs to put some theory because there is nothing as pure empirical evidence. A move to abstraction is the construction of core inflation indexes. But why staying in the middle? The trust in the monetary standard is not represented by actual price changes, but by the co-ordination of private agents on the expected standard, upon which they will set their own prices in the future. A definition of price stability follows, which was suggested by Allan Greenspan: *price stability is an accepted standard upon which individual prices are set as if it were expected not to change.*

If price stability has more to do with trust than with evidence, it is because inflation is not a number, but a phenomenon, i.e. a process. Confidence in the common monetary standard is deteriorating whenever private agents try to impose their own standards in indexing on each other's expectations. When confidence is shattered, the co-ordination game reverts to indeterminacy. *Therefore inflation is not a number; it is the anarchy of price setting when the rule of money is contested.* The symptom of the process of defiance in the monetary standard shows off in price spirals and a high volatility of individual prices with murderous distribution effects, which undermines social cohesion. One is back to theory. It is impossible to escape the conclusion that the conception of price stability, upon which an institutional framework of monetary policy can be built, depends on the theory of money one has in mind.

Inflation can only be defined within a monetary regime. The regimes are quite distinguishable whether money is a net asset or a debt for the private sector. If money is a net asset, there are two sub-regimes whether the asset is issued as fiat money or is produced as commodity money.

Fiat money belongs to the Friedman-Patinkin framework. A real money demand function can be derived from inter-temporal utility maximisation, embodying transaction services of money. Real money demand is a stable function of definite real variables. Nominal money supply is issued by a central institution. It follows that inflation is unambiguously

defined as an excess money supply. To diagnose its existence and assess its magnitude, it is irrelevant to look at empirical price statistics. One has to measure the growth of the relevant money aggregate against the best estimate of the real demand function. A money supply rule is consistent with the theoretical framework Indeed there is no other way to implement the goal of price stability.

A regime based upon commodity money is institutionalised by a rule of convertibility or hard peg. This rule defines the unit of account in term of commodity money, or more accurately sets an official nominal price for the commodity. The monetary authority is committed to preserving the immutability of this price. An incipient inflation is detected whereas a tension is building up between the official and the market price of the commodity minted as currency. Therefore inflation is unambiguously defined as the rise of the market price over the official price of the commodity used as ultimate liquidity. This regime has been extended to so-called currency board, commodity money being replaced by a foreign currency. In any case, inflation is not an empirical rise of a conventional price index. It is the rise of the market price of the ultimate form of liquidity in the market for money.

In an inside money regime cum central bank settlement there is no anchor, either in the quantity or the price of money. All types of competing monies are issued as debts. Money supply and money demand are endogenous and impinges on one another in a roundabout process. Their changes induce both shifts in relative and nominal prices, leading to the indeterminacy of the inflation rate in macroeconomic equilibrium. Therefore the definition of inflation is ambiguous. It cannot be substantial but procedural. The proper procedure, which defines inflation in the process of regulating it, is called *inflation targeting*. The purpose of inflation targeting is to eliminate the indeterminacy of private expectations on the common monetary standard. What is the optimal standard, i.e. the optimal inflation target? How does it depend on financial fragility?

DEFINING AN INFLATION TARGET DEPENDENT ON THE REGIME OF CREDIT.

As shown in the Wicksellian model, in an inside money economy the regime of credit (measured by the gap between the real interest rate and the neutral interest rate) impinges upon real income. The objective of monetary policy can only be sustainable full employment, which results from equality between both interest rates. But the neutral interest rate is not observable. The central bank must be content to assess a balance of risks.

On the one hand, too loose a debtor regime makes debt settlement easy, but triggers a competition between different sources of income and types of wealth. Inflation might arise while the competition for income distribution and wealth protection is waged by crossed indexing, financed by new issues of private monies. On the other hand, too tight a creditor regime enhances the monetary standard, but raise doubts on debtors' ability to honour their commitment. The financial system might lack liquidity and gets fragile.

Both sources of disruption in the regime of credit entail credibility costs to the central bank. If she believes that current real income is under the full employment level, she can be motivated to raising real income by indulging in unexpected inflation. But, if the move launches the war of indexing, inflation gets volatile. The variability of inflation inflicts a social cost on the economy that the central bank must make allowance for. Conversely a dissonance between the regime of credit and the commitment of the central bank on a strict monetary standard can induce financial fragility with high social costs as a consequence. The central bank must care about the regime of credit, because financial fragility degrades the transmission mechanism of monetary policy.

Formalisation of the dilemma.

The central bank preference function is (Z)*:*

Z=Benefits *(S)*-Costs (ϕ)

The benefits are commonly defined by the augmented Phillips curve:

$S=\delta\pi \exp(-\alpha\pi^{e})$

Where p is actual inflation and p^{e} is expected inflation.

The costs have two components. The first is the deterioration of the co-ordination on the common monetary standard. It is expressed by the volatility of inflation: $\exp\pi^{2}$

The second is the deterioration of confidence in the regime of credit. It is measured by the cost of financial fragility. The formal expression of this cost needs some elaboration. As explained above, it depends on *the degree of dissonance* between the commitment to price stability *(C)* and the regime of credit *(IS).*

C and *IS* are normalised on a (0, 1) scale, which represents a weak/strong commitment to price stability and a loose/tight regime of credit. The table portrays the four polar cases.

IS features the regime of credit between the extremes of debtor (0) and creditor (1) regime. Recall that a debtor regime is characterised by a real interest rate on debt lower than the neutral interest rate; a creditor regime is characterised by the opposite.

The degree of dissonance is $x = |C - IS|$. It is variable between 0 and 1.

(0,0) and (1,1) are two combinations where the stance of monetary policy fits the regime of credit. The degree of dissonance is nil.

(0,1) is the dissonance resulting from a loose monetary policy contested by creditors and savers, who try to protect their wealth via indexing spreading to the factor and product markets whether the dissonance persists.

(1,0) is the dissonance that measures a deteriorating creditworthiness due to high real interest rates bearing on heavy indebtedness.

Confidence in monetary policy is linked to the degree of dissonance. What matters for the central bank preference function is the cost of losing confidence. This cost is due to the build-up of financial fragility with a change in the regime of credit, from a situation where confidence has been established. Since confidence is the highest at zero degree of dissonance, the cost of losing confidence is an inverted function of the degree of dissonance. At x=0 confidence is strong and there is much to lose with an increase in x.

Positing the cost of losing confidence because of an increase in financial fragility as g(x), one can pick up the function:

$$g(x) = \frac{1-x}{1+x}$$

The total cost of inflation targeting for the central bank is:

$\phi = \exp[\pi^2 + g(x)]$

IS

	Debtor	Creditor
Weak	0 / 0	1 / 0
Strong	0 / 1	1 / 1

C

The program of the central bank is:

$$Max Z/p = dp \exp(a p^e) - \exp\left[p^2 + \frac{1-x}{1+x}\right]$$

The first order condition expressed in logarithm gives:

$$p^2 + \log 2p = f(p) = \log d - a p^e - \frac{1-x}{1+x}$$

The solution p^* is depicted on the accompanying figure. It gives the optimal inflation target as a function of expected inflation and the degree of dissonance in the financial system. *The stricter the target, the higher price expectations and the lower the degree of dissonance.* Since the virulence of inflationary expectations and the seriousness of financial fragility cannot be directly observed the central bank shall ponder the balance of risk before setting her target. There is an irreducible amount of discretion, albeit constrained by the framework of inflation targeting.

Defining flexible inflation targeting with a concern for financial stability as constrained discretion implies a two-tier decision making process. p^* is the optimal operational target. It is the result of the balance of risks compounding the volatility of inflation and the degree of dissonance between the regime of credit and the central bank commitment. But the degree of commitment itself must be determined in view of the concern for medium-term stability.

In the medium term the credibility of monetary policy involves:

$$p^* = p^e$$

This condition depends on the degree of commitment of the central bank (C). For a given state of the regime of credit (IS), the central bank determines the degree of dissonance (x) in choosing C since:

$$x = |C - IS|$$

Ploughing the condition of credibility into the first-order condition for optimality gives a relation between the degree of dissonance and the expectation of inflation:

$$-\frac{1-x}{1+x} = (p^e)^2 + g p^e + \log(2p^e) = h(p^e)$$

where $h(p^e)$ has a shape similar to $f(p)$.

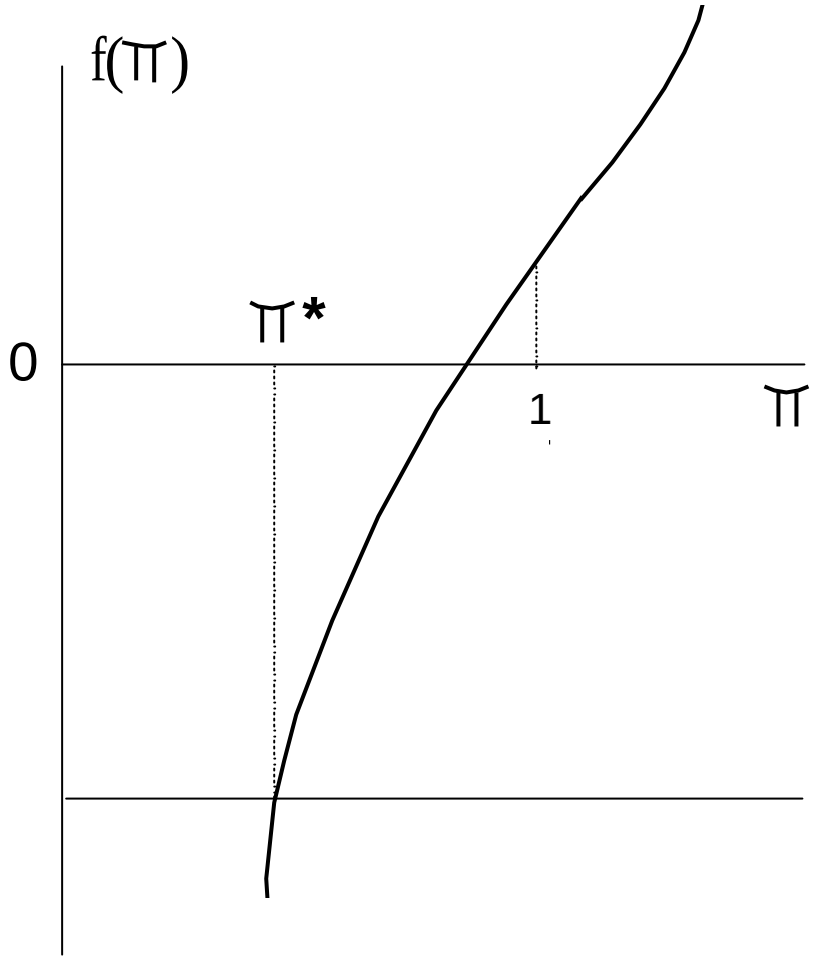
For a given inflationary expectation and a given regime of credit, the above equation determines the value of x and thus the degree of commitment C that upholds the expectation.

But the expectation of inflation is not exogenous since it depends on the trust of the private sector in the commitment of the central bank. Since the regime of credit can change overtime from a debtor to a creditor regime and *vice versa*, there is a range of inflation expectation wherein the trust in the central bank is self-perpetuating when the degree of dissonance shifts from 0 to1. The bounds of the range are:

$(p^e)_{\min}$ such as: $-1 = h(p^e)$

$(p^e)_{\max}$ such as: $0 = h(p^e)$

If the central bank wants to keep the degree of dissonance at zero, she must have a prospective view of the change in the regime of credit. In that case her commitment is continuously compatible with the lower bound $(p^e)_{\min}$



SHIFTS IN THE REGIME OF CREDIT, ASSET PRICES AND MONETARY POLICY.

However this high policy standard might be exceedingly difficult to achieve because the regime of credit changes endogenously within the financial cycle. When asset prices are booming, business investment and M&A ride high. Credit shifts to a debtor regime. When asset prices are plummeting, real investment recedes, M&A come to a halt, interest rate spreads jack up. Credit shifts again to a creditor regime. Therefore the relevant question is to investigate how the central bank can interact with the powerful pro-cyclical forces in the credit regime in an inside money economy.

Drawing from work by Bordo and Jeanne, which is meant to capturing the financial cycle, the dynamic interaction between shifts in the regime of credit and the boom-bust profile in asset prices will be merged into the model of inflation targeting studied in this paper. Since the credit-financed asset price speculation gives rise to financial fragility, the question arises of the central bank's response from the preference function modelled above.

Let us consider a shift from a regime (1,1) to (1,0). The regime (1,1) describes a tight commitment to inflation control combined with creditor dominance. The latter is defined by a rate of interest on credit higher or equal to the neutral interest rate. At some point credit growth accelerates in line with a rising expected real return on capital assets. Credit becomes debtor dominated (1,0). This is about what occurred in the US, starting in the mid-1990's and getting momentum in the midst of the Asian crisis to the apex of spring 2000. This sharp cyclical profile in the financial variable, while the conventional measure of inflation remained subdued, led to a rising degree of dissonance from 0 to1.

The crucial question is what happens after the downturn in asset prices. There can be or cannot be a credit crunch. If one arises, insolvency spreads in the real sector. The economy can be trapped in a balance sheet recession. It is hard to ward off while under way, because the usual channel of monetary policy no longer works. The tough question for monetary policy is the following: is there an arbitrage between a pro-active action ex ante and a reactive response ex post?

A dynamic model.

Two periods are defined, t=1,2.

In t=1, private agents expect higher return in t=2. In an inside money economy, they demand more credit, which is not resisted by the financial system. The speed up in the growth of credit backs higher values in asset prices, which in turn validate the optimistic profit expectations.

The price of assets Q can take two values: a low one Q_L in the regime (1,1) and high one Q_H in the regime (1,0). One can define the mood of the market:

$p_H = \Pr ob(Q_2 = Q_H)$

The higher the probability of high asset prices the more optimistic the mood.

Firms borrow in t=1. The credit demand is an increasing function of optimism and a decreasing function of the rate of interest.

$D = D(p_H, r)$

$\quad\quad + \;\; -$

The balance sheet constraint of the corporate sector in period 1 is:

$D = Q_1 - K$ With K equity capital and $Q_1 = Q_L$ the "normal" value of assets in t=1.

The value of assets in t=2 expected in t=1 is:

$E_1(Q_2) = p_H Q_H + (1 - p_H) Q_L$

The balance sheet constraint in the beginning of period 2 is:

$(1+r)D = E_1(Q_2) - (1+r)K$

An additional short term borrowing (G) is required in period 2 to finance the working capital called for by the expected value of the asset price.

A credit crunch event.

The optimistic mood in t=1 launches credit-induced boom in asset values at the beginning of t=2. In the course of period 2 information on profits is revealed, which does not sustain the higher value. The asset price falls back to the lower value: $Q_2 = Q_L$.

The condition for a credit crunch is that the asset value at the end of period 2 does not cover the debt: $Q_L \le (1+r)D + G$

Using balance sheet constraints and feeding into the above condition, one gets:

$K(1+r) \le G + p_H (Q_H - Q_L)$

From the final inclusion one can see that a credit crunch is all the more likely than the equity capital base is weak, the short-term borrowing is strong in period 2, optimism rides high in period 1, the magnitude of the bubble is large.

The dilemma of monetary policy.

When the cycle in asset prices has run its course, the degree of dissonance has climbed from 0 to 1. Ex post the priority of monetary policy is clearly to contain the credit crunch. The prior model determining the optimal inflation target tells that the central bank shall loosen its stance. A higher inflation target is required to lower the real interest rate, so that the burden of the debt service can be lessened. Ultimately an aggressive supply of liquidity may be necessary to eschew deflation.

However this policy, which is tantamount to an enlarged lender-of-last-resort intervention, may be costly because it is difficult to tailor and it entails moral hazard. It is why one wonders whether an ex ante policy can stem the shift to financial fragility.

It should be a monetary policy leaning against market sentiment in period 1 to eliminate the systemic risk that a collapse in asset value in period 2 be conducive to a credit crunch. Using the condition for no credit crunch and the credit demand function in period 1, one can determine a threshold interest rate r such that:

$$1+r=\frac{G+p_H(Q_H-Q_L)}{Q_L-D(p_H,r)}$$

From this equation one can derive an implicit function $r=F(p_H)$, which is increasing in p_H. It is also an increasing function of the size of the bubble. The larger the bubble, the higher is the required r for a given p_H. It is a threshold because it is the lowest interest rate in period 1 that can avoid a credit crunch in period 2. To determine it the central bank shall gauge the mood of the market and the strength of the speculation leading to a bubble of a given size. The complexity of the problem facing the central bank is daunting.

Allan Greenspan stressed this point repeatedly. Unless the central bank can detect a credit-induced bubble in making early enough, the rising market mood makes monetary policy unduly restrictive to break the bubble. The loss of output in period 1 may overstep the loss due to the subsequent crash in period 2, with the caveat that the central bank undertakes a strongly reactive policy after the crash. Nonetheless, recent empirical work in the BIS is promising. It tends to show that a cumulative divergence of the private sector credit aggregate/GDP to the long-run trend of this ratio performs well in selecting episodes of financial fragility leading to financial crises.

Whatever future empirical advances, one should answer theoretically the question: when is early enough? The question means finding the level of p_H above which it is not useful to indulge in a pre-emptive policy.

From the relation above, there is a function $r=F(p_H)$, which defines the *pre-emptive monetary policy* to avoid a future credit crunch as a function of market sentiment. To determine the level of p_H above which it is not worthwhile to resort to such a policy, it is reasonable to suppose that financial fragility, and thus the degree of dissonance x, is a rising function of $p_H: x(p_H)$. The diverging growth of credit, spurred by rising expectations and fuelling higher asset prices, is conducive to limping financial fragility, reflected in a higher degree of dissonance.

Besides, a standard Keynesian model with Phillips curve gives a decreasing relation between the rate of inflation and the rate of interest: $p(r)$.

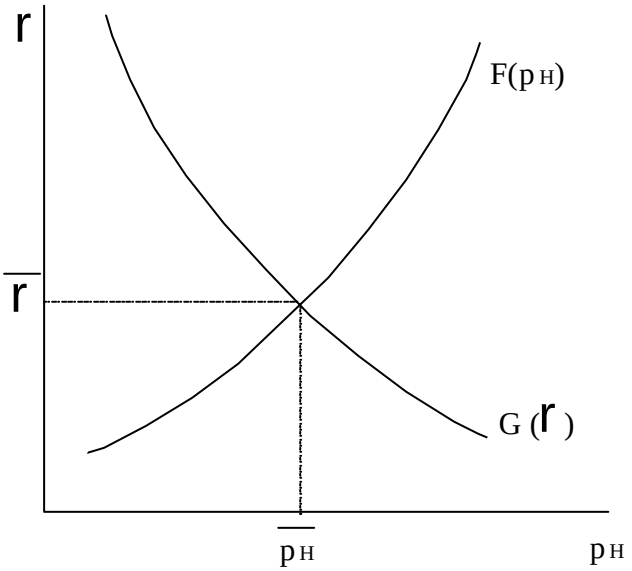
Replacing into the first-order condition derived from the optimum of the central bank preference function gives:

$$f[p(r)] = \log d - a p^e - \frac{1 - x(p_H)}{1 + x(p_H)}$$

The left-hand side of the equation decreases in r.

The right-hand side increases in p_H

Thus there is an implicit function p_H = *G(r)* which is decreasing. Combined with the function $r = F(p_H)$ increasing, it determines the highest level of p_H and associated level of r, for which it is still worthwhile to undertake a pre-emptive action. The graph below sums up the twin determination of the couple $(\bar{p}_H, \bar{r})$. The larger the size of the bubble $(Q_H - Q_L)$, the higher the position of the curve $F(p_H)$, the broader the zone of financial fragility, the lower the limit $\bar{p}_H$, the earlier the diagnosis of a shift in the regime of credit is necessary to conduct a pro-active monetary policy.



THE ECB AND ASSET PRICES.

In two recent speeches at the Bank of France and at the BIS, Otmar Issing spelled out the official truth. He distinguished what he called the conventional view opposed to the "new environment" hypothesis. It happens that the distinction overlaps largely with the theoretical distinction between outside and inside money.

The conventional view forcefully claims that price stability is a sufficient condition for financial stability. A softer statement is says that price stability tends to promote financial stability. In implementing its two-pillar strategies, the ECB implicitly stresses that its stability-oriented strategy is more than a simple inflation forecast targeting. Since the second pillar makes allowance for credit developments, the strategy may lead, from time to time, to a different monetary policy stance than fixed-horizon inflation targeting. It seems that Issing's presentation of the ECB's policy actions conforms to the theoretical model developed here, which embodies financial fragility within the framework of inflation targeting. Is it really so?

Rightly Issing acknowledges that policy shall not be encapsulated in simple rules, or any type of predetermined rule for that matter. He goes on saying, "money is deeply connected to trust". But he still believes that monetary aggregates are relevant because there is a stable demand money function. Therefore he will not endorse the "new environment hypothesis" hinted at by Fed officials as soon as the fall of 1996. There was then Allan Greenspan's famous warning about financial market exuberance. In addition Governor Lindsay remarked in a FOMC meeting that "the central bank's success of keeping inflation under control could trigger a too optimistic outlook on the future course of economic development". What is meant plainly is that *inflationary pressures might not show up in conventional inflation itself.*

Indeed the BIS has experimented with broader price indexes embodying several asset prices (Stock prices, residential and commercial property prices). With respect to this barometer, the US underwent a huge inflation from late 1995 to mid-2000 and a severe disinflation followed by outright deflation later on. In Europe the inflationary wave started in 1997 and culminated in 2000. Then the regime change to deflation occurred as son as the beginning of 2001. The consequence is that the long-run real interest rate measured against the composite index is very high (4 to 5%) both in the US and in Europe. The conclusion is rather deceptive because anyone has the intuition that the Fed has been much more reactive than the ECB. More positively the conclusion warrants the pro-active policy studied theoretically in this paper. What matters most is to stem the asset price inflation.

The relevant attitude is not to try targeting an asset price level or trend. But the hard question is how the central bank will avoid accommodating asset price increases she deems moving away from fundamental values. Clearly communication to the markets will not do when an optimistic mood is in the making. In conformity with the inside money view, the central bank should give more weight to the behaviour of credit aggregates. More broadly financial imbalances should be investigated by central banks in figuring their viewpoint on the balance of risks, prior to deciding their stance. The reason is that financial imbalances carry critical information not exhibited in price data.

A strategy, which emphasises the balance of risks and drawing on line of information unfamiliar with the traditional money demand/supply framework, should also alter its procedure. It is not useful to announce an explicit inflation target on a short horizon. Because

the time for unwinding financial imbalances is long, price stability should be defined on a time span of two to three years. Either it is possible to drop any public quantitative announcement altogether, relying (like the US) on an implicit definition of the monetary standard or to target a single number linked to a public announcement of the relevant horizon.

BIBLIOGRAPHY.

Allen F and Gale D, 2000,Asset Price Bubbles and Monetary policy, Wharton Financial Institutions Center, Working Paper Series,n°01-26, May.

Artus P et Wyplosz C, 2002, La Banque Centrale Européenne, Conseil d'Analyse Economique, rapport n°38, La Documentation Française.

Bernanke B and Gertler M, 2001, Should central banks respond to movements in asset prices ?, American Economic Review, vol 91, n°2, May, pp 253-257.

Bernanke B, Laubach T, Mishkin F and Posen A, 1999, Inflation targeting: lessons from the international experience, Princeton University Press.

Bordo M and Jeanne O, 2002, Boom-bust in asset prices, economic instability and monetary policy, NBER Working Paper, n°8966, May.

Borio C, English W and Filardo A, 2003, A tale of two perspectives: old or new challenges for monetary policy?, BIS Working Papers, n°127, February.

Borio C and Lowe P, 2002, Asset Prices, Financial and Monetary Stability: Exploring the Nexus, BIS Working Papers, n° 114, July.

Cechetti S, Genberg H, Lipsky J and Wadhwani S, 2000, Asset Prices and Monetary Policy, International Center for Monetary and banking Studies, Geneva, May.

Cette G and Pfister C, 2003**,**The challenges of the "new economy" for monetary policy, BIS Papers, forthcoming.

Clarida R, Gali J and Gertler M, Monetary policy rules and macroeconomic stability: evidence and some theory, Quaterly Journal of Economics, vol CXV, Issue 1, February, pp 147-180.

Filardo A, 1999, Asset Prices and Monetary Policy, Federal Reserve Bank of Kansas City Economic Review, 3rd. Quarter.

Gilchrist S and Leahy, 2002, Monetary Policy and Asset Prices, Journal of Monetary Economics, vol 49, n°1, pp 75-97.

Goodhart C, 2001, What weight should be given to asset prices in the measurement of inflation?, The Economic Journal, 111, June, pp 335-356.

Issing O, 2002, Monetary Policy in a changing economic environment, Symposium "Rethinking Stabilisation Policy, Jackson Hole, August.

Laubach T and Williams J, 2001, Measuring the natural rate of interest, Federal Reserve Board, Finance and Economics Working Papers, n° 56, December.

Mishkin F, 2001, The transmission mechanism and the role of asset prices in monetary policy, NBER Working Paper, n° 8617, December.

Mussa M, Reflections on monetary policy at low inflation, Journal of Money, Credit and Banking, 32(4), Part 2, November, pp 1100-1106.

Neiss K and Nelson E, 2001, the real interest rate gap as an inflation indicator, Bank of England Working Paper, n° 130.

Smets F, 1997, Financial asset prices and monetary policy: theory and evidence, BIS Working Papers, n°47, September.

Svensson L, 1999, Price stability as a target for monetary policy: defining and maintaining price stability, NBER Working Paper, n° 7276, August.

Wicksell K, 1907, The influence of the rate of interest on prices, The Economic Journal, May.