

The Theory of Monetary Policy: Reflections on a Winding and Inconclusive Road

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The theory of monetary policy had a major upturn in the beginning of the 21st Century. Monetary aggregates and the Quantity Theory were sidelined and new-Keynesianism became its mainstream analytical framework. Without an exogenous money supply, the price level becomes indeterminate and interest rate rules leave inflation and deflation unanchored, pure expectation processes. Financial markets are also absent in the moneyless new-Keynesian world, but price rigidity of financial contracts may have disruptive consequences in deflationary processes. It is argued that money as nominal reference, as opposed to cash, is an indispensable feature of modern economies. Nominal price rigidities delay equilibrium, but are of the essence of a monetary economy. It is argued that QTM has not been properly buried. In order to evolve, instead of merely blaming changes in circumstances, monetary theory has to acknowledge where and why it went wrong. A few provocative starting points are advanced.

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1. The Quantity Theory of Money road from dominance to irrelevance

The belief in a certain proportionality between the stock of gold and nominal income dates from the 16th century, when the influx of gold from the New World provoked a rise of prices in Europe. In the 19th century the idea reappeared in the writing of classical economic thinkers, like David Hume and others, but it was Irving Fischer, in the 1920s, who introduced the quantity of money equation, where the money stock was related to the value of all transactions in the economy in a given period of time. It came to the forefront of the macroeconomic debate when John M. Keynes questioned the stability of the so-called money velocity in his General Theory. Since Keynes main interest was to explain the incapacity of monetary policy to stimulate the economy after the depression of the 1930s, a condition he named the Liquidity Trap, he did not directly challenge the proportional relation between money and prices under normal circumstances. On the contrary, the controversy probably helped the diffusion of the Quantity Theory of Money (QTM). The Hicksian pedagogic IS-LM model, that became the standard reference of macroeconomics, adopted a slightly revised version of the QTM where the demand for real money balances was also a function of the interest rate. Income velocity was no longer given, but a stable function of the interest rate. This not only left unscathed the belief in a given proportionality between money and nominal income, but also helped to transmute the quantitative identity into a theory of the demand for money.

The Friedman and Schwartz study of the monetary history of the United States argued that the contraction of the money supply played a major role in the depression of the 1930's and that monetary policy was indeed a very powerful instrument to stabilize nominal income. The 1960's and 1970's controversy between monetarists and Keynesians focused mainly on the degree that monetary policy was able to affect real income; there was no disagreement about the influence of money on the determination of the general price level and inflation. The most popular macroeconomics textbook of the late 1970's, written by two MIT professors, therefore non suspect of being on the monetarist camp, states that "to maintain the equality between the supply and demand for money, changes in the nominal money supply must be matched by corresponding changes in prices. The argument that 'inflation is always and everywhere a monetary phenomenon' is thus entirely correct as a description of long-run equilibrium."² The acceptance that inflation was caused by excessive money - even by non-monetarists or Keynesians - shows how dominant was the Quantity Theory.³ This dominance was only slightly scathed, in

² R. Dornbusch and S. Fischer; *Macroeconomics*, (1978)

³ It is true that Keynesians like Dornbusch and Fischer added disclaimer like this: "It is clear from Chart 13.3 that there is no close link in the short-run between the growth rate of money and the inflation rate. The absence of a close link between the growth rate of money and the inflation rate in the short-run suggests that there are other factors accounting for inflation in the short-run".

the next reference macroeconomic textbook, written by another MIT 'oriundi'.⁴ In its second edition of year 2000, we read that: "In the medium run, inflation is equal to nominal money growth minus normal output growth". To be fair, the textbook of year 2000 goes quite extensively on questions that became prominent in the last two decades of the 20th century. Topics like expectations and the Lucas critique, nominal rigidities, Stanley Fischer's staggered wages, the costs of disinflation, and John Taylor's gradualism are introduced. But in his summary of the chapter on inflation, activity and money growth, the author goes back to the conclusion that "Money growth determines the inflation rate: a 1% increase in the money growth leads to a 1% increase in the inflation rate", and he cannot resist to quote the Friedmanian adagio that "inflation is always and everywhere a monetary phenomenon".

Such a long dominance - almost seven decades - of a theory that never and nowhere corresponded to the facts is indeed disturbing. It gets even more perplexing when we notice that here was never a solid theoretical ground to define what is money and why is there a demand for it. In the Arrow-Debreu General Equilibrium model there is no role for money. It is inadequate to analyze nominal prices because it assumes no transaction costs, consequently, no need for nominal prices, only relative prices. It leads to a barter equilibrium with no reference to money and credit. Intertemporal transactions are dealt with state-contingent prices. With relative prices set, money enters the scene to determine the nominal price level as an ad-hoc addition. This is the origin of the classical expression of money as a veil.

But if in the real world, where nominal prices and money exist, we are left with the necessity to explain why is it so. That is where the QTM enters the scene. It correctly assumes that money is necessary for transaction purposes. The real world is not frictionless, it demands time to produce and to trade goods; there are information and transaction costs. That is why nominal prices and money have a role to play.

The QTM assumes further that there is a degree of proportionality between money balances and nominal income. Even if it never had a sound theoretical underpinning, the hypothesis that transactions require a proportional level of real money balances might have made intuitive sense in the past. When gold from the New World arrived in Europe, it probably put pressure on prices. After all, it was a transfer of wealth from abroad to a stagnated economy. An increase in wealth with no correspondent increase in the supply capacity of the economy is bound to put pressure on prices. The fact that gold happened to be considered money explains that an increase in wealth was perceived as an increase in money. This led to the equivocal conclusion that there was proportionality between money and prices. It is much harder to justify this intuition in the contemporaneous world of fiat units of

⁴ O. Blanchard; *Macroeconomics* - second edition (2000)

account and highly sophisticated centralized electronic bookkeeping and payment systems. The fact that this "intuitive" proportionality between money and prices went such a long way is probably explained by Herbert Simon's observation, quoted by Daniel Kahneman, that intuition is nothing more than recognition of information stored in our memory.

Several ad-hoc shortcuts have been used to explain why there is a demand for money. It was included in the utility function, e.g. Patinkin (1965), or some kind of cash in advance constraint was assumed for expenditures, e.g. Lucas (1980), but none of these tricks, as pointed by Hahn (1965), are enough to prevent the existence of a barter equilibrium and no demand for money⁵. The Walrasian auctioneer is an inappropriate representation of markets, since it assumes away time, information and transaction costs. It should not surprise that there is also no place for money and nominal prices in such a frictionless world.

Even if accepted that, for whatever reason, in practice there is a demand for real money balances, M/P , it is not sufficient to explain the general price level. This still leaves indeterminacy, since there is an infinite combination of M and P that satisfies a given demand for M/P . The supposedly stable relation between money and prices, that consistently failed the test of reality, is also a logically insufficient explanation for the actual price level.

Until very recently,⁶ monetary theory got rid of this indeterminacy by assuming that the money supply, M , was an exogenous policy instrument. The choice of M determines the price level. Given that the money supply was an exogenous policy variable, the price level and its rate of change, inflation, were a matter of choice of the monetary authorities. There was never a coherent theoretical underpinning for nominal prices – as opposed to relative prices - nor a good explanation for why there was a demand for money, but the assumption of the money supply as an exogenous policy instrument under control of the central bank was never questioned. Central banks were supposed to be able to print money and create bank reserves, the two components of the monetary base, and therefore control the money supply.

2. Interest Rates, Monetary Aggregates and Price level Indeterminacy

Contrary to what was for a long time assumed, in practice it is not true that central banks are free to print money and create bank reserves at own discretion. Even when targeting at monetary aggregates, central banks have always used the interest rate as their policy variable. In the late 1980's, the widespread evidence that

⁵ See G. Calvo (2012) "The Price Theory of Money, Prospero's Liquidity Trap and Sudden Stops"

⁶ More precisely until 2003, when Michael Woodford published his book; *Interest and Prices: foundations of a theory of monetary policy* (2003)

central banks use the short term interest as their policy instrument finally lead to a revision of the theoretical assumption that the money supply was an exogenous policy variable. Bernanke and Mihov (1998) argued that the short-term interest rate, charged in the market for bank reserves, was indeed the policy instrument of the Federal Reserve. Theory is supposed to guide practice, but in this case it was practice that led to the revision of the theoretical framework.

The fact that banks had to maintain reserves to face the volatility of their deposits was obviously true in the past, under the gold standard and with no lender of last resort. But in a system of a pure fiat unit of account, with a readily available market for bank reserves and a lender of last resort, it simply does not make sense for banks to keep reserves above the mandatory level. There is no reason to forego the interest paid on reserves and keep it above the mandatory level. It is always possible to go to the market and borrow the reserves if necessary. Banks will daily lend their excess reserves and borrow their insufficient reserves in the market. Collectively, however, banks cannot create or destroy excess reserves unless they are able to borrow or to lend them to the central bank. This is the reason why central banks do not control the level of bank reserves; if they want to avoid wild swings in the overnight interest rate for reserves, they will have to accept to supply whatever the banking system demands at a given interest rate. Leaving cash aside, the reserves held by the banking system at the central bank corresponds to the monetary base. Exogenous factors, like an inflow of foreign currency bought by the central bank, create base money and therefore excess reserves for the system. If at the end of the day, the central bank does not sterilize these excess reserves - normally through reverse repos - the overnight interest rate on the interbank market would collapse to zero. Symmetrically, when an exogenous factor destroys bank reserves, like an outflow of foreign currency sold by the central bank, if at the end of the day the central bank does not supply the missing reserves, through repos or by acquiring bonds through open-market operations, the interest rate on reserves would skyrocket and force banks to go to the central bank discount window.

The market for bank reserves - or for fed funds market, as it is called in the US system – is a very special kind of market. Although it is called a market - banks are indeed free to buy and sell reserves during the working day - it can only be cleared by the central bank. This is the reason why it could be replaced by a system of deposits in the central bank. If excess reserves would be deposited and insufficient reserves withdrawn, at the risk-free daily interest rate, at the central bank, there would be no "market" for reserves, but no material change in the system. This would make transparent that the central bank does not control the monetary base, only the interest rate paid or charged for bank reserves.⁷ Even when

⁷ The mechanics of bank reserves control and the alternative use of a single interest rate paid on reserves by the central bank is discussed in detail by Woodford in "Monetary Policy in a World Without Money", paper prepared for the conference "The Future of Monetary Policy", World Bank, june, 2000.

they used to have monetary aggregate targets, central banks always used the interest as the policy variable. Now that they have interest rate targets, contrary what is sometime assumed,⁸ central banks do not and cannot adjust the money supply to hit its interest target. They simply set the interest rate to be paid in the market for bank reserves. The daily interest rate for reserves is always the variable under direct control of the central bank, even when they choose to pursue a monetary aggregate target.

It was only with Woodford, in 2003, that this "curious disjunction between theory and practice", as he called it, or this "unhelpful dichotomy between theory and practice", according to Goodhart (1989), came to an end. Woodford sought to revive the approach of Knut Wicksell, the Swedish economist that at the end of the 19th century, when there was yet no dominance of the QTM, discussed macroeconomics in terms of deviations of the interest rate from its "natural" level. Wicksell argued that it was "possible to conceive the problem of monetary policy as a problem of interest-rate policy". So Woodford set out to present a theory of the price-level determination under interest-rate rules of the sort that describe central bank actions in practice. He argues that, in order to understand the consequences of such rules, it is not necessary to first determine their implications for the evolution of the money supply and then analyze the implicit money supply rule. Rather, that it is possible to analyze the price-level determination under such rules in terms of an explanatory framework that makes no reference to either the money supply or the demand for money. In this neo-Wicksellian framework, the determinants of the equilibrium price level are not the supply and demand for money, but instead the real factors that determine the equilibrium interest rate and the relation between interest rates and prices.

Such was the dominance of money aggregates as the policy variable in the profession, that Woodford felt obliged to explain, first that this was indeed the operating procedure of the Federal Reserve, and second that when monetary policy is described in terms of rules for setting nominal interest rates, there is an implied evolution of the money supply. This might give the impression that the use of the interest rate as the policy variable is only a question of practical choice, but irrelevant from logic point of view. There would always be an implied path for money aggregates given the evolution of nominal interest rates and vice-versa. Woodford chooses not to pick up this fight and let this interpretation run free, but in several points of his analysis it becomes clear that he does not believe in this biunivocal relation between money and interest rates paths. In the very first chapter of his book, where he tries to give a bird's-eye view of his argument, Woodford says, "while the implied evolution of the money supply is sometimes discussed, the question is often ignored. Some of the time I do not bother to specify policy (or an

⁸ Clarida, Gali and Gertler (1999), for example, say, "With the interest rate as the policy instrument, the central bank adjusts the money supply to hit the interest rate."

economic model) in sufficient detail to determine the associated path of the money supply, *or even to tell if one can be uniquely determined in principle.*⁹

But without a defined path for the money supply we are back to the indeterminacy of the price level. Even if there is a demand for real money balances, there are infinite combinations of M and P compatible with a given interest rate. Woodford comes back more explicitly to this indeterminacy when he discusses interest-rate rules and price stability and says that: "In the context of the basic neo-Wicksellian model set in Section 1, suppose that monetary policy is conducted such as to ensure that the short-term nominal interest rate follows an exogenously specified (bounded) target process. Then rational expectations equilibrium is indeterminate, regardless of the nature of the target process". He goes on to conclude that, "this means that there are an infinite number of different possible equilibrium responses of the endogenous variables to real disturbances..."

It is an explicit recognition that with rational expectations the model does not have a unique equilibrium path for the price-level. This is the point of Sargent and Wallace (1975), according to whom, under rational expectations, interest rate rules lead to indeterminacy and even among bounded solutions there is an extremely large set of possible equilibria. It led them to conclude that monetary policy could only be framed in terms of money supply rules. In the mid-70s, when Sargent and Wallace were writing, it was not yet understood that in a system with fiat money and consolidated payments, the money supply is not clearly defined and central banks cannot control it.

Almost four decades later, John H. Cochrane,¹⁰ from the University of Chicago, in a long and detailed review of the now extensive literature on the indeterminacy of the price level in the post-Keynesian world, came to the conclusion that "the Taylor rule, in the context of the new-Keynesian model, leaves the same inflation indeterminacy as with fixed interest targets". He examines all the proposed alternatives - in what is today a long literature - to solve the indeterminacy of the price level and is forced to conclude that inflation is just as indeterminate, in microfounded neo-Keynesian models, when the central bank follows a Taylor rule with Ricardian fiscal regime, as it is under fixed interest rates targets." Cochrane says that his is an entirely negative paper and long enough, so that he does not exposit or test an alternative theory. In the 21st century, not even an economist from the University of Chicago feels comfortable to propose the return of the money supply rule or monetary targets.

⁹ Emphasis added here to the non-uniqueness of the equilibrium.

¹⁰ John H. Cochrane (2011) "Determinacy and Identification with Taylor Rule", JPE June 2011

3. The Moneyless Neo-Keynesian World

Rational expectations are a logically irrefutable assumption for the rational maximizing agent of economic theory. But with rational expectations, as in the Arrow-Debreu General Equilibrium model, the real economy is no longer dependent on money or monetary policy. Sargent and Wallace (1975) represented the seminal moment of the revival of the dichotomy between real and monetary equilibria in macroeconomics. As a result, monetary economics became out of fashion and macroeconomics turned attention to the impact of real shocks and the real business cycle.¹¹ More than a decade later, in the late 1980's, a stream of empirical work began to show that monetary policy significantly influences the short-term course of the real economy. It was clear that the choice of how to conduct monetary policy seriously affects aggregate activity. The exile to which money was confined by theory - as a veil that only determines the price-level and inflation in the long run - could no longer hold. Monetary questions were reintroduced to the theoretical macroeconomic framework.

In face of the evidence that monetary policy matters, the macroeconomics of rational expectations had to be revised. Frictions, such as the Keynesian nominal wage and price rigidities, were brought back to make the model suitable for the evaluation of monetary policy. The search to ground macroeconomic relations on first principles led to models based on staggered price setting, from which price rigidities could be reconciled with individual rational maximization. The dynamic general equilibrium model with staggered prices, where the aggregate behavioral equations evolved explicitly from optimization, replaced the simple IS-LM model.¹² They replicate most of the IS-LM results, with the advantage that they are also able to accommodate the limiting case of perfectly flexible prices. In this case, they replicate the dynamics of the real business cycle model, where monetary policy was unable to affect anything but nominal variables.

The derivation of the model can be found in the works dealing with monetary policy in the 1990s.¹³ Like the IS-LM model, it can be represented in terms of two reduced form equations: an IS curve that relates the output gap inversely to the real interest rate and a Phillips curve that relates the inflation positively to the output gap.

$$(1) \quad x_t = -\varphi (i_t - E_t \pi_{t+1}) + E_t x_{t+1} + g_t$$

$$(2) \quad \pi_t = \lambda x_t + \beta E_t \pi_{t+1} + \mu_t$$

¹¹ G. Corsetti (2015), when discussing Calvo (1998) multiple inflation equilibria possibility, says that in the 1980's monetary economics was so out of fashion that it was difficult to publish a monetary piece in the AER, so that Calvo had to write his model in real terms first, before he could tell his inflation story.

¹² See, e.g. Clarida, Galí and Gertler (1999)

¹³ See Woodford (1995), Kimball (1995), Yun (1996), Bernanke, Gertler and Gilchrist (1998).

Where x is the output gap; i is the nominal interest rate; π is the inflation rate; g and μ are random disturbances with zero means.

Equation (1) differs from the traditional IS curve because it is derived from the intertemporal maximization process of consumers and firms. This results in current consumption depending on expected future output as well as the interest rate. Higher expected future output raises current output, because individuals prefer to smooth consumption over time. Expectations of higher product and consumption in the future lead to higher consumption today, which raises current output. The negative effect of the real interest rate on current output in the basic model is due exclusively to the intertemporal substitution of consumption. The elasticity of the new IS curve does not depend on the effect of the real interest rate on investment, nor on its implication for the financial markets, but only on the intertemporal consumption preference of individuals. Aggregate demand is inversely related to the real interest rate, but there is no investment function and financial markets are absent.

Equation (1) may be iterated to obtain:

$$(1.1) \quad x_t = E_t \sum_{i=0}^{\infty} [-\varphi(i_{t-1} - \pi_{t+1+i})] + g_{t+i}$$

Equation (1.1) results from the staggered nominal price setting, along the original spirit of Stanley Fischer (1977) and John Taylor (1980). The individual price setting decision is derived from an explicit optimization process where monopolistically price-setting firms choose nominal prices subject to constraint on the frequency of future price adjustments. It has the flavor of a traditional expectations-augmented Phillips curve, but it is expected future inflation, $E_t \pi_{t+1}$, which appears there, as opposed to expected current inflation, $E_{t-1} \pi_t$. This implies that, in contrast to the traditional Phillips curve, there is no lagged dependency or arbitrary inertia in inflation. It makes transparent the degree to which, in the new-Keynesian framework, beliefs about the future affect the current aggregate activity.

The same is true for inflation. With further iteration, equation (2) may be rewritten as

$$(2.2) \quad \pi_t = E_t \sum_{i=0}^{\infty} \beta^i [\lambda x_{t+i} + u_{t+i}]$$

It is clear that inflation depends entirely on current and expected future output gaps, that is, it is totally independent of nominal variables. It depends entirely on current and future real variables. This is a major change, not only from the original IS-LM model, but also and more fundamentally from the classical monetary tradition of quantitative theory. There is no longer a relation between money and the price level, nor between monetary expansion and inflation. Inflation depends exclusively on the current and expected conditions of the real economy. The nominal interest rate closes the model. There is no money supply or demand. Monetary policy enters the scene through the interest rate. It is assumed that the

Central Bank controls the short-term nominal interest rate and that, due to nominal rigidities, it has leverage over the real interest rate.

A crucial feature of the original Keynesian framework is lost with the disappearance of the LM curve. The link between the real and the monetary sides of the economy through the interest rate is no longer present. In the pre-New-Keynesian world, the interest rate is the variable that intervenes in both the money and the real market equilibria. The nominal interest rate appears in the demand for money and the real interest rate in the aggregate expenditure function - through investment - in the original Keynesian model. In the New-Keynesian dynamic general equilibrium model, the nominal interest rate is under the direct control of the central bank. The money market has vanished from the scene.

As sketchy as the original formulation of the money market derived from the quantitative equation might have been, it at least introduced the financial market in the macroeconomic scene. The passage from the IS-LM model to the dynamic general equilibrium framework that marked the shift from the Keynesian to the New-Keynesian perspective, deleted money and finance from the analysis. Even the most simplistic representation of the financial and the money markets are omitted. The only nominal variables are the exogenously determined nominal interest rate, set by the Central Bank, and the rate of inflation. The link between them is no longer directly through the money market, but only indirectly, through the output gap and the Phillips curve.

The Woodfordian solution for demand management through the interest rate solves the “curious disjunction between theory and practice”, but reopens the question of price level indeterminacy. Aggregate demand and supply capacity influence the acceleration or the deceleration of the rate of change of the price level. But where does this rate of change come from if there is no unique equilibrium?¹⁴ If the price level and its rate of change are ultimately a function of history and expectations, what prevents self-fulfilling deflations or inflationary spirals? On the case of self-fulfilling inflations, that Woodford acknowledges to be a more troubling possibility than self-fulfilling deflations, he vaguely hinges back on the same money supply rules he had previously dismissed by affirming that “conditions have been identified under which such equilibrium would not exist in the case of constant money-growth rate.” He then proceeds to acknowledge that during observed hyperinflations, money real balances do indeed fall to a small fraction of their normal level and might approach zero in the case of high enough expected inflation. And concludes: “Hence it is not clear that one can rely upon this mechanism to prevent self-fulfilling inflations in the actual economy”.¹⁵ The last section of his chapter 2, dedicated to the question of price level indeterminacy, self-

¹⁴ Woodford says: “it is clear that there exists a continuum of perfect foresight equilibria, one corresponding to each possible initial inflation π_0 . This result obtains even if ... the Taylor principle is satisfied, at least locally.” – chapt. 2 page 125.

¹⁵ Woodford, chapt.2 pags. 135 and 136.

fulfilling inflations and deflations, is a dramatic example of how the reliance on formal analysis, on the deduction of limit conditions within a model, may obscure understanding, instead of shedding light on the subject.

1. The Forgotten Nominal Rigidity: Financial Contracts

The New-Keynesian model inflation depends exclusively on current and expected future output gaps. Given that the central bank controls the output gap through the interest rate, this means that it can control and bring to a halt, even high and persistent inflation through monetary policy alone. The optimal distribution of the cost of this option, in terms of product and unemployment over time, would depend on the policy maker's objective function, but it could be done in a single period. It just requires the creation of the right amount of slack today and an expected non-inflationary trajectory for output in the future, i.e., choosing $\sum_{i=0}^{\infty} x_{t+i}$ such that $\pi_t = 0$.

This possibility is in sharp contrast to the experience of the economies that have experienced a history of high and persistent inflation. The attempt to stabilize chronic inflationary processes through restrictive monetary policy, with no attention given to the inertial component of inflation, is bound to provoke a major banking crisis, long before it could curb inflation.

In the Keynesian world, nominal wage rigidity was acknowledged as the cause of persistent unemployment. Inflexible nominal wages also explain the cost-push downward resistance of inflation to respond to unemployment. In the 1970s, efforts were made to reconcile the downward inflexibility of wages with individual rationality,¹⁶ but the sticky wage hypothesis never succeeded to figure as the accepted nominal rigidity in new-Keynesian macro models. It was dominated by the far more successful staggered prices hypothesis that excluded past inflation from expected inflation formation and derived inertia from staggered contracts .

Nominal wage rigidity had a long history in macroeconomic theory, but another pervasive source of nominal rigidity – financial contracts - has always been completely overlooked. Financial markets were never part of the mainstream macroeconomic theory of the business cycle. After the financial crisis of 2008, financial markets and the liquidity trap were brought to the center of the macroeconomic debate, but until very recently, mainstream macroeconomics completely disregarded the importance of financial issues.¹⁷ The vast majority of

¹⁶ See C. Azariadis, (1975) "Implicit Contracts and Underemployment Equilibria" JPE vol.83

¹⁷ G. Calvo (2013) "The Mayekawa Lecture: Puzzling over the Anatomy of Crises", quotes Kindleberger, (1978): "The debate between the monetarists and the Keynesians ignores the instability of credit and the fragility of the banking system and the negative impacts on production and prices when the credit system became paralyzed because declines in the prices of many commodities and goods caused many borrowers to default on their loans..."

financial contracts are written in nominal and non-negotiable or state-contingent terms. Indexed contracts - as long as they are backward looking and have discrete readjustment periods - are also a source of inflationary inertia.¹⁸

A sharp and unexpected reduction of inflation has a profoundly disruptive effect on banks balance sheet. If by an act of God - or of the central bank – inflation comes to a halt, the real value of financial contracts will increase, independent of expectations having been adjusted to reality. Defaults would be inevitable, followed by a banking crisis and a deb-deflation like recession. The impact of a substantially lower inflation is analogous to the case of Irving Fischer's debt deflation. In the case of debt deflation, it is the reduction of the general price level that increases the real value of debts,¹⁹ but an unexpected reduction of high inflation has the same effect. It increases the real value of all financial contracts written with a nominal interest rate based on a much higher expected rate of inflation. The reverse case, when inflation happens to accelerate above expectations, hurts creditors, not debtors. Since non-bank creditors are not leveraged, and banks have no mismatch, it does not lead to default and financial crisis. Higher than expected inflation transfers wealth from creditors to debtors²⁰, in the longer run, this might increase creditors preference for liquidity and reduce their willingness to accept longer maturities,²¹ but it has no short-term macroeconomic impact.

It could be argued that, in order to prevent a crisis, the central bank should influence expectations and follow a gradualist approach to stabilize inflation. This is the idea behind inflation targeting and the Taylor rule derived from the standard New-Keynesian model of equations (1) and (2). It assumes that the inertia of inflation is due exclusively to staggered price contracts in the wages and goods market. In the basic New-Keynesian model, inflation in equation (2) depends exclusively on the current output gap, expectations of future inflation and disturbances. Since the basic model completely ignores the financial market, it also ignores the issue of contractual wealth transfers in the transition to a new policy regime. If rational expectations are assumed, it follows that the private agents immediately understand and react to a regime change, with no wealth transfers between debtors and creditors. This is not only unrealistic, after a long period of

¹⁸ Backward-looking indexed wages have been extensively discussed in the Brazilian case, after the original contribution of Simonsen (1970) *Inflação: gradualismo versus tratamento de choque*. However, the nominal rigidity of financial contracts and the inertial element introduced by backward-looking indexed financial contracts have also been overlooked until much later in the Brazilian inflationary debate.

¹⁹ Fisher, I. "The Debt-Deflation Theory of Great Depressions"; *Econometrica*

²⁰ In this case, the simple redistribution of wealth from creditors to debtors, assumed no large differences in their propensity to spend, has no macroeconomic impact. This explains the long time disregards for Irving Fisher's debt deflation theory in academic circles according to B. Bernanke (1995) "The Macroeconomics of Great Depression: A Comparative Approach" *Journal of Money Credit and Banking*

²¹ Arida, Bacha and Lara-Resende (2004), "Credit, Interest and Jurisdictional Uncertainty: Conjectures on the Case of Brazil"

accommodative policy, but also contractually impossible given financial contracts of longer duration.

4. Money and Nominal Prices

We never had a very precise definition of what fiat money was, nor a good explanation for why there was a demand for money, but the supply of money as a policy variable went a long way before being scrapped by new-Keynesianism. Accepted that, for whatever reason, in practice there is a demand for money, the supposedly stable relation between the money supply and prices has consistently failed the test of reality. No matter what the monetary aggregate considered, no matter how lags were played with, no matter how many Ptolemaic epicycles were added, the relation of money to prices has never been stable or a stable function of known variables. Finally, in the last two decades, confronted to the irrefutable evidence that there was no stable relation between money and the price level, money aggregates disappeared from theory and practice.

As convenient, theoretically and empirically, as it might be, banishing money from the basic macroeconomic model brings back the indeterminacy of the price level. If not money, what determines the price level and inflation? The question is still left unanswered. The current reference macroeconomic model, of equations (1) and (2), eludes the question. Inflation is a function of demand pressure, or the output gap, and of expected inflation. But why is there inflation to start with, where does inflation come from? What anchors inflation to the output gap? If inflation has no anchor, we are back to the nominal indeterminacy. If there are multiple possible rates of inflation associated with a given output gap, inflation is determined by its arbitrary initial conditions, that is, actual inflation is a function of its history, but this still leaves open the possibility of self fulfilling inflations and deflations.

What is money and why is there a demand for money? Without an answer to these questions we don't really have a monetary theory. With the Quantitative Theory of Money, we had one. Money was an aggregate of readily and universally accepted commodity in terms of which prices were quoted. With the introduction of fiat money, the physical stock had to be replaced by the real value of the nominal stock of fiat money or real balances. As seen, this creates indeterminacy, since infinite combination of price levels and nominal balances could satisfy the demand for real balances. It also creates two even more fundamental questions: First, why is there a demand for money, something that has no intrinsic value; and second, what is the money supply in a pure fiat system with centralized bookkeeping, payments and compensation.

Textbooks list the properties of money as means of payment, store of value and unit of account. There are many assets that are vastly superior as a store of

value in the economy, especially in inflationary environments and anything might be used as a means of payment if its illiquidity penalty is paid. In centralized system of payments and compensation, like the contemporaneous banking system, accessed from anywhere through cards and mobile phones, money as means of payment is a complete anachronism. This anachronism of money has been lately recognized, but most of the discussion about the so-called end of money are really discussing the end of cash, or currency, that became fashionable with the advent of negative nominal interest rates, not the end of fiat money.²²

The essential property of money, which remains valid even in today's centralized electronic payment system, is the fact that it serves as the unit of account, that it is the reference to which prices are set. It is the fact that it serves as the unit of account, that is, that nominal or absolute prices are set in reference to its unitary face value, that makes money perfectly liquid. The liquidity of money is therefore tautological: money has no discount to its face value because its face value is the reference according to which all prices are established.

Calvo (2012) suggests that the answer to Hahn's puzzle²³ - the fact that nothing precludes a general equilibrium where the price of fiat money is null – lies in the fact that prices and wages are posted in terms of fiat money and are held stable for some period of time. Calvo claims that credit to the original intuition should be given to Keynes. In the General Theory, chapter 17, he calls attention to the fact that wages are fixed and relatively stable in terms of money and argues that this “unquestionably plays a large part in attracting to money so high a liquidity premium”. The value of money, or its liquidity premium, derives from the fact that it is used to quote prices that remain stable for a certain period of time. It is the faculty of being the unit of account - which depends on prices and wages being quoted and stable for a relevant period in reference to its unitary value - that explains the demand for money.

The fact that nominal prices are held stable for a period of time is critical to the role of money. As seen, in the Walrasian world of Arrow-Debreu general equilibrium models, there is no role for money nor for nominal prices. In tune with the original intuition of the proponents of QTM, money is related to transactions, but in the instantaneously cleared Walras-Arrow-Debreu world there are no transactions. Transactions are only carried in a world where there is time and imperfect information. Relative prices are indeed all we need to make decisions, under perfect and instantaneous information, but since production and commercialization require time, we need to be able to compare nominal prices in different moments of time in order to have relative prices. Nominal prices – that remain fixed for the relevant period of time – are essential to our ability to compute

²² This is the case of Woodford (2000) “Monetary Policy in a World Without Money”, as well as numerous pieces discussing the costs and advantages of no-currency economies.

²³ F. H. Hahn (1965) “On Some Problems of Proving the Existence of an Equilibrium in a Monetary Economy”

relative prices in the real world.²⁴ This highlights something that has been obscured by monetary theory: it is not money, or more precisely, the role of money that is important and should be understood, but absolute prices and the role of nominal prices. Money is just the convention in which absolute prices are quoted in order to be carried over time in a world where relative prices cannot be instantaneously known. Nominal prices take precedence over money, that is why there can be a world without currency, but not a world without a unit of account and nominal prices, at least as long as there is no perfect and instantaneous information about relative prices. The microeconomics foundation of nominal prices – as opposed to those of relative prices, which are the object of the Walras-Arrow-Debreu General Equilibrium model – is what is missing, not the micro foundation of money.

5. Sticky Prices as the Anchor of Money

What Calvo calls a Price Theory of Money (PTM) inverts the classical relation between money and prices. For conventional monetary theory, money is the nominal anchor for prices, and sticky prices are a nuisance that delays full employment. PTM argues that prices – or more precisely, prices that remain unchanged for a while, or sticky prices – are the reason money, or the nominal unit of account, exists. Stable nominal prices are the anchor for money.

This leads to the conclusion that there might be a trade-off between the stability of fiat money in real term, that is, the stability of the general price level, and the speed to which the economy restores full employment equilibrium. There would be a trade-off between the length of the interval of price readjustments and the speed that the economy goes back to equilibrium. The shortest are the intervals between price readjustments; the faster is the return to equilibrium. This is the reason why chronically high relatively stable rates of inflation are so hard to control, while hyperinflations are relatively easy to stabilize with a change of regime. In hyperinflations prices are almost instantaneously readjusted, there is no longer price stickiness, therefore money loses its value; it is no longer the unit of account. This inverse relation between price stickiness and the speed to reach equilibrium after a disturbance highlights the importance of money and price stickiness. There is value in stability, even if the price to be paid for it is disequilibrium. The value of money derives from price stability and when price stability – or predictability - vanishes, like in hyperinflations, money has no value.

We have accepted fiat money – after a long and costly obsession with the gold standard – but we were never able to completely overcome our fixation with the physicality of money. If the essential property of money is the fact that it is the

²⁴ Modern Behavioral Economics have shown that all we are indeed able to understand are relative values. Not only values, but anything can only be evaluated in comparison to something else. See Ariely, D. (2008) *Predictably Irrational* – HapperCollins, NY

unit of account - because prices and wages are set in terms of its unitary value and remain stable for a period of time - money is whatever the unitary reference for prices and wages is. It does not have to be legal tender or to have a physical existence. Demand deposits are perfectly liquid, and therefore considered money, because their value remains stable with respect to the unit of account. The crucial point here is the *nominal* stability of money with respect to prices for a meaningful time interval. That is why, even with high inflation, when its real value is constantly eroded, money remains valuable as long as the interval of time that it maintains a stable nominal relation with prices and wages is meaningful. What is a meaningful time interval depends on the existing alternative for domestic unit of account. Large closed economies, where the presence of foreign currencies is restricted, might tolerate much smaller intervals between price readjustments than small open economies, before giving up on the national fiat money. In the last stages of hyperinflation, when prices are almost instantaneously revised, fiat money loses completely its appeal.

The introduction of the real in Brazil illustrates the point that the essential characteristic of money is the predictability of quoted prices. Brazil had very high rate of inflation, in excess of 40% per month in the last months immediately before the stabilization plan was announced. A new currency, the real, would be issued in the near future, with no stipulated date. In the meanwhile, a virtual unit of account, the URV, was introduced. Its value with respect the old currency would be daily adjusted in accordance to the on going rate of inflation. The indexed currency idea behind the URV²⁵ was conceived to avoid the problems caused by the sudden reduction of high chronic inflation.²⁶ Even if the government and the central bank that were issuing the new indexed money were the very same that issued the money devastated by inflation, the URV had immediate acceptance and there was no inflation in terms of the URV. Four months later the real was issued with a one to one exchange rate to the URV and became the official Brazilian currency. Inflation had been defeated. Once a stable reference in which prices are quoted exists, it becomes “money”, even if it has no physical existence and therefore no supplied and demand quantities.

There was a heated discussion at the time about what would be the nominal anchor for the new currency.²⁷ It could not be the monetary base, or any other definition of money. When inflation is reduced from 40% per month to close to zero, there is a sharp and difficult to quantify increase in the demand for money. The exchange rate was a possible alternative, but Brazil had not become a

²⁵ The idea of an indexed currency was introduced by A. Lara-Resende (April 1985) “A moeda Indexada: Uma Proposta para Eliminar a Inflação Inercial”; “A Moeda Indexada: Nem Mágica nem Panacéia”(Jun.1985); and later developed in P. Arida and A. Lara-Resende (Nov.1985) Inertial Inflation and Monetary Reform in Brazil”.

²⁶ In the presence of contracts with generalized backward looking indexation, the sudden disappearance of inflation would lead to a banking crisis followed by a deep recession.

²⁷ Arida and Lara-Resende (1985) discusses possible alternatives for a nominal anchor.

dollarized economy. This was seen as an advantage, since it left leeway to adjust the real exchange rate. The use of the dollar as the nominal anchor for the real would risk dollarizing the economy. Price Theory of Money sheds light on why the debate about the nominal anchor was so inconclusive. Since prices anchor money and not the other way around, money and liquidity are always endogenous. There is no possible nominal anchor to prices since stable prices are the anchor for money.

In the opening pages of his Interest and Prices, Wicksell says “Absolute prices on the other hand – money prices – are a matter in the last analysis of pure convention”. Since what anchors money is pure convention, money is itself pure convention and there can be no exogenous supply of a convention. Central banks have the monopoly of creating bank reserves, that in a fiat money regime are always perfectly liquid, but the degree of overall liquidity in the economy is endogenously determined. Central banks can always create bank reserves, contrary to the QTM this has no impact on prices and inflation, as long as the equilibrium interest rate is paid on these reserves, but it cannot try to supply less than demanded bank reserves without provoking a banking crisis.

6. Monetary Policy under The Price Theory of Money

The Price Theory of Money solves the puzzle of the demand for money, but we are still left with the indeterminacy of the price level. The critical corollary of PTM is that money and liquidity are endogenous and that prices have no objective anchor. Current mainstream macro theory tells us that we can influence the price level, or inflation, through the interest rate and inflation targeting. The interest rate influences inflation in an indirectly way, through the output gap, while inflation targets – if the central bank is credible – guides expectations. Accepted PTM, the more prices are stable or predictable, the higher the value of money, and less effective will be interest rate policy to influence inflation, that is, the worse the Phillips curve trade-off between output and inflation. The evidence for twenty countries examined recently by Blanchard, Cerruti and Summers (2015),²⁸ seems to confirm that after 1990, once inflation targets were established and inflation expectations anchored, the impact of unemployment on inflation is indeed very small.

If money and liquidity are conventions, endogenously determined in financial markets, there can be no theory of monetary policy without a reference to finance, leverage and asset prices.²⁹ Current Woodfordian orthodoxy is, however, unequivocal: no attention should be given to asset price inflation. In discussing

²⁸ Blanchard, Cerutti and Summers (2015), “Inflation and Activity – Two Explorations on their Monetary Policy Implications – IMF working paper

²⁹ After the financial crisis of 2008, a large number of papers tried to introduce financial markets as an endogenous source, as well as an amplifier, of business cycles.

whether central banks should also target asset-price inflation, Woodford says: “The answer provided by the theory developed here is no. The prices that monetary policy should aim to stabilize are the ones that are infrequently adjusted and that consequently can be expected to become misaligned”. The problem with this reasoning is that it presupposes that frequently adjusted prices, as asset price are, cannot become misaligned. If it was ever needed, we now have irrefutable evidence that this is not so. The new orthodoxy seems to have agreed that asset price should be monitored and influenced, not through interest rate policy, but through so-called macro-prudential measures. But willing it or not, the interest rate has a powerful impact on asset prices, liquidity and leverage. There is an endogenous financial cycle, which is self reinforcing and prone to produce bubbles and crashes with dire consequences for the real economy. Liquidity feeds asset prices inflation, which in turn feeds back into more liquidity through leverage.

The single policy variable of the central bank is the daily interbank interest rate that is used to influence inflation through the output gap. If there was no price stickiness, the reaction would be instantaneous and inflation would perfectly follows targets with no output and employment loss. Price stickiness slows the reaction and worsens the trade-off between output and inflation. Price stickiness reduces the power of the interest rate to influence inflation, but it is always present in a monetary economy because it is of the essence of the value of money. The more stable are prices the more liquid, or monetized, is the economy and the less powerful is the interest rate to influence inflation through unemployment. The power of the interest rate to influence asset prices is equally dependent on their nominal stability, that is, on the interval of their revision. Long nominal denominated contracts are more affected by the interest rate, since it has a stronger impact on their present discount value, but the interest rate influences asset prices both directly – through their present discount value - and indirectly – through asset prices influence on leverage and liquidity. Its full impact is however not instantaneous, since the new equilibrium of asset prices feeds into leverage and liquidity that feeds back into asset prices. This is where explicit asset price inflation targeting by the central bank would help. It would guide expectations of asset price inflation that are the major determinant of the expansion of leverage and liquidity. Inveterate optimists – or pessimists in the case of a deflationary economy - could always bet against the central bank targets but these would guide consensus expectations. If asset price inflation targeting is used to complement traditional inflation targets, monetary policy might not become more powerful to influence current inflation, but it would reduce the volatility of the real economy.

7. Conclusion

The theory of monetary policy has made a major upturn in the last two decades. After more than seven decades of dominance, the Quantity Theory of Money, a stable relation between money and prices and an exogenous determined money supply have been abandoned. In every discipline, old theories are eventually

replaced by new ones. In the so-called hard sciences, new established theories not only have a better explanatory power of the empirical evidence, but are also able to elucidate why and where the old theories were wrong. In social science, the excuse that reality itself may change, is used to justify a major upturn in theory, with no need to explain how and why previous orthodoxy failed.

Old monetary theory was in contradiction with evidence for too long to be simply brushed aside as a victim of changes in circumstances. The silence of the profession on its sudden death reveals an uncomfortable recognition that it traveled along a wrong path for too long. As uncomfortable as it might be, given its importance and prevalence for such a long period of time, the Quantity Theory of Money requires an appropriate burial. The refusal to do so has left shattered pieces of it all over. These splinters of a dead theory adds to the perplexity of the inability of the new orthodoxy to explain the price level, inflation and deflation. In order to evolve, monetary theory has to understand not only where but why it has been wrong for so long. It should not go on blaming changes in circumstances.

Here are some provocative starting points:

- Nominal prices play a relevant role in a world where there is neither instantaneous nor perfect information.
- The essential characteristic of money is the it serves as the unit of account, the reference in which nominal prices are quoted.
- Money is a convention whose value depends on a certain stability, or predictability, of prices. If prices are not predictable there is no demand for money.
- Demand for money is not demand for a specific physical asset. It is the demand for assets whose prices are relatively stable in terms of the nominal unit of account.
- There can be a quantity supply of currency, since currencies have physical existence, but not a quantity supply of money, since money is a convention.
- Liquidity, which is the best approximation of the money supply in a fiat system, is endogenous and, left unchecked, prone to produce bubbles and crashes.
- Price stickiness reduces the speed of the return to equilibrium but is valuable itself. Too much volatility reduces the information value of prices. We are willing to trade some disequilibrium and unemployment for the stability, or the predictability, of prices.
- Since the dismissal of the QTM, there is no coherent explanation for what determines the price level. We do not know what causes inflation; it has its own subjective dynamics.
- Excessive liquidity is correlated with asset-prices inflation, but there is not a unique causal direction.

- Excessive liquidity does not necessarily translate into inflation, but high real interest rates – or more precisely sudden hikes in the interest rate – reduce liquidity and risk provoking a financial crisis. Differently said: excessive liquidity might not be a problem, but insufficient liquidity is always a problem when there is leverage in the economy.
- Unexpected changes in the rate of inflation always have distributional impacts, but unexpected reductions in inflation increase the real value of debt and may lead to defaults. Since banks are leveraged, this is the route to financial crisis.

At the very end of his exhaustive revision on the literature on the question of the indeterminacy of the price level under contemporaneous monetary policy orthodoxy, Cochrane says that “If inflation is, in fact, stabilized in modern economies by interest rate targets interacted with backward-looking IS and Phillips curves, economists really have no idea why this is so”. Indeed, the most striking conclusion of a review of current mainstream theory of monetary policy is that it is disturbingly inconclusive. In 1970, Milton Friedman, the most vocal and influential defendant of monetarism and the Quantity Theory of Money, said that: “As it happens this interpretation of the depression was completely wrong. It turns out, that on reexamination, the depression is a tragic testament to the effectiveness of monetary policy, not a demonstration of its impotence. But what mattered for the world of ideas was not what was true, but what was believed to be true.”³⁰

Friedman might have been wrong on many issues, but was probably right with respect to the power of misguided monetary policy and absolutely right about what matters in the world of ideas.

³⁰ M. Friedman, The Counterrevolution in Monetary Theory (1970) I.E.M