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My remarks focus on the challenges facing monetary policy in a rapidly changing world. I start by examining the nature of economic change confronting monetary policy in its daily execution. In the absence of an unambiguous mandate to maintain price stability and of a clear strategy to sustain it, the ongoing task of identifying the latest economic shocks may easily distract the central bank from the need to maintain a firm sense of direction in the longer run. Next, I advance an interpretation of why the transition to European monetary union—involving, by all standards, a state of acute uncertainty—could be accomplished in the smooth manner in which it proceeded. In this context, I highlight the role of two complementary policy perspectives. These two principles of good policy are conducive to flexible and timely responses to unfolding events and, at the same time, ensure policy against myopia and short-termism and keep it solidly anchored to its medium-term objective.

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### *Cyclical and structural change*

Economic change—and the uncertainty that it brings about—has three dimensions. At the ground level we have *cyclical*, that is transitory and/or nonstructural economic shocks coming along continuously. The theory of economic policy normally assumes that such shocks are "additive" in nature, in that they do not pose a controllability problem for policy. Nevertheless, they have to be properly identified in real time. Econometric theory has spent decades devising sophisticated identifying restrictions to isolate different types of shocks from the tangle that appears in the data. The purpose of these exercises is to trace the propagation profile of exogenous impulses through the economic system. But nothing close to a consensus view has emerged. In fact, inference is often nonrobust across various identification schemes.[1]

As a consequence, central bankers are given little guidance as to the nature of the stochastic disturbances that drive the business cycle on average. Of course, model selection itself is at stake here, as competing modelling paradigms can only be put to a test—and discriminated—by matching their quantitative implications with the dynamic shock responses seen in the data. If the latter can only be generated on the basis of controversial identification restrictions, the empirical benchmark becomes elusive. For all these reasons, central bankers must exercise judgment when they encounter perturbations, and they cannot rely on any single approach to reasoning through the implications of such shocks.

At a higher level, and a lower frequency, we have *structural* change. This induces parameter—i.e., multiplicative—uncertainty, as innovations tend not only to persist, but become embedded in the coefficients through which key variables respond to exogenous forces. Monetary policymakers, again, find themselves at a crossroads. For one thing, it is extremely difficult for them to decompose in real time what is due to structural change and what stems from normal cyclical sources of fluctuation, as these events tend to come together. But, more fundamentally, central bankers perceive the uncertainty surrounding structural variation as of a higher order of magnitude—and of a different nature—compared with the way parametric risk is treated in much

of the literature. I believe this type of our measure of uncertainty is closer, in this case, to a Knightian concept, wherein probability distributions for model coefficients cannot be articulated.[2]

A further source of uncertainty, of a *strategic* sort, stems from the endogenous—at times unpredictable—process whereby agents form their expectations. This process has a strategic, game-theoretic flavor, as the central bank and its way to respond to the events is very much part of the picture, and in some way it is driving the formation of views about the future.

Incidentally, the identification of the disturbances stemming from cyclical, structural or expectational disturbances is further complicated by the ex post statistical revisions, which may at times overturn the empirical platform on which central bankers have to make their decisions in real time.[3] And it should be superfluous to remind the reader of the paramount measurement problems that cloud state variables, such as the output gap, the NAIRU, the steady-state real interest rate, which are of key importance in mainstream macroeconomic discussions.

## *Institutional change*

Complexity reaches its climax in the presence of large-scale *institutional* change, however. This source of change is sufficiently rare in history to escape econometric testing and sufficiently severe to impart a profound discontinuity in the data-generating process. Times of institutional change are times in which the signal extraction problem for central banks is most acute. Structural change may be associated with a widely dispersed range of expectations. These, in turn, may behave erratically and fail to coordinate on a focal point.

The European Central Bank (ECB) has some examples to tell in this regard. When the ECB started conducting policy in 1999, area-wide back data were only scantly available, many statistical indicators were still under construction. More importantly, the presumption was that the creation of the euro area would itself imply a major regime shift. Therefore, the statistical patterns emerging from past data—if and when made available by aggregation of national figures—might not be informative of the structure of the new economic entity or might even be misleading. Under such circumstances, it could not be taken for

granted that private agents could immediately form expectations consistent with the new regime, and, thus, instability in behavior could not be ruled out. In some sense, we were studying the evolution of a moving object, which was changing for the very reason that it was being observed, as in the famous Heisenberg paradox. Real time misperception, false inference, Knightian uncertainty, all the usual professional hazards of central banking, plus something else seemed to be compounded—let's be conservative—by a factor of three.

Indeed, the ECB did preside over a monumental transition. The money market, for one, underwent a historical transformation on the eve of the launch of the euro in January 1999. Eleven national markets, so diverse in terms of participants, operating conventions, settlement structures, credit facilities, had to merge into a unified trading area almost overnight. New payments systems for large-value transactions were implemented. Capital markets traditionally protected by currency fragmentation and national regulations were opened up to arbitrage and straight competition.

Yet, the transition was smooth and the abrupt switch in structural relations, which many observers had seen in the offing, did not materialize after all. Markets immediately recognized the new rules of the game. They adjusted swiftly to the new monetary policy environment. Since 1999, overnight rates have limited their fluctuations on the dates of monetary policy announcements to less than 5 basis points on average, a sign that policy was reasonably predictable.[4] The ten-year break-even inflation rate obtained from French index-linked bonds—a crude measure of inflation expectations—has consistently signaled the degree of credibility of the ECB's monetary policy to maintain inflation in line with its announced definition of price stability. This indicates that markets have perceived our pattern of response to the events as transparent and consistent over time.

All this has to be measured against the magnitude of the disturbances that intervened in the course of the first three and a half years of our existence. Since 1999 the euro area has weathered a number of major economic or financial turbulences worldwide, preserving a degree of monetary and economic stability that would have hardly been conceivable before the advent of Monetary Union. The euro area has gone through a sequence of energy price shocks with only limited and short-

lived impact on inflation expectations. And a long trend of foreign exchange depreciation—recently reversed—as well as a marked correction in stock prices since early 2000 have done little to shake the confidence in the euro as a solid store of value.

### *Anchoring expectations in a changing environment*

How was all this possible? How could uncertainty of the highest degree fail to leave a mark in the records? In my view, the ECB's success in anchoring expectations right from the start has not fallen from the sky nor has it been entirely "inherited" from the past. Instead, I would argue that our success can be attributed in good measure to the ECB's monetary policy strategy and the more general principles that underlie our policymaking. Not least, it has been a reflection of our philosophy that markets are powerful, sometimes overwhelmingly so, but, nevertheless, in need to be guided by a central bank, not meddled with.

First, the way we committed ourselves to the overriding mandate to be the guardians of price stability in the euro area—which we received from an international treaty—anchored expectations in a time of accelerated change. The ECB's announcement of a quantitative definition of price stability—which is symmetric in the sense that it is incompatible with inflation as well as with deflation—was immediately acknowledged by our counterparts. It is important to add that price stability, according to our definition, is to be maintained over the medium term. The medium-term orientation of our monetary policy strategy and our aversion to fine-tuning of short-term developments in prices and real variables has helped to provide a firm compass while the economy was sailing through the uncharted turbulent waters of 1999 and subsequent years. It deflected the risk that amidst exceptional uncertainties, the central bank may itself become an additional source of noise. Ultimately, it provided a degree of leverage over expectations on the eve of the transition to the new currency that could pin them down solidly to the intended objectives of policy.[5] The mandate and the independence that it ensures endowed the new institution with a stock of credibility that facilitated its operations and its interactions with the markets from the first day of monetary union.

Secondly, our strategy has helped to sort through a wealth of conflicting statistics and has provided a reliable road map and a sense of direction.[6] We have built into our strategy two complementary perspectives over the workings of the economy, one in which money and credit are attributed a key role in the formation of prices. And one in which real variables receive pre-eminent attention as the determinants of price pressures in the short term, and where monetary factors are treated only implicitly. Under what we call the first pillar, we thoroughly monitor monetary and credit indicators on the basis of those analytical frameworks that can sensibly incorporate developments in money. Under this pillar, we announce a reference value for M3 growth, which, if realized on average over the medium term, should in normal circumstances indicate that policy is consistent with the achievement of price stability.[7] I shall return to this principle shortly, as it will constitute the focal point of my remaining observations. Under the second pillar, we review a broad set of nonmonetary indicators and assess their implications for price setting over a short- to medium-term horizon.

These two mutually reinforcing perspectives provide robust indications for a policy aimed at price stability, which survive the cross-checking of competing models and the rise-and-fall cycles of fashions in economic thinking.

## *Keeping a firm sense of direction*

But how can a monetary policy framework induce prompt action in the face of ever-changing circumstances and, at the same time, maintain a firm sense of direction? Here, there is clearly potential for destabilizing mechanisms setting in. Constantly bombarded by economic news, a central bank risks becoming hypnotized by the latest indicator, by the markets' likely reaction to the latest indicator, by the markets' anticipation of the central bank's response to the latest indicator, and so on into infinity. This mechanism can lead monetary policy gradually astray from its foremost role of providing a firm medium-term anchor for the economy.

So, at the risk of oversimplifying, let me now turn to consider two general principles of prudent monetary governance that may help central banks to reconcile the need for prompt action and a firm medium-term orientation.

(1) First, a central bank always needs to tailor action upon the origin, the magnitude, and the nature of the shocks that hit the economy from time to time. As I tried to argue above, this is a highly demanding exercise because shocks do not come about with labels. They have to be identified first, in real time. But there are no shortcuts or excuses—no simple rules linking policy to one or two privileged indicators can substitute for an accurate examination of shocks and a careful analysis of their potential for transmission into prices over a sufficiently extended span of time ahead. A corollary to this principle is that the horizon for policy action cannot be set in advance, as I shall argue more extensively below.

(2) Second, a central bank can benefit from keeping an eye fixed on the single long-term compatibility condition that monetary economics has to offer to practitioners, free of model-specificities and restrictive assumptions. Namely, that over a sufficiently extended period of time, money should grow at a rate that is consistent with trend growth in real output and the central bank's definition of price stability. In more general terms, this principle embodies the ancient wisdom of the quantity theoretic law—that it is the growth of money that ultimately anchors the development of prices.

Each one of these two principles—if taken individually—entails some guidance for the monetary policymaker, which, however, is partial. A monetary policy strategy—such as the one adopted by the ECB—can be seen to provide a robust framework for monetary policy decision-making, which heeds these two general principles in a way in which they reinforce and complement each other.

The lesson suggested by the first principle is that disturbances have to be evaluated as they come about, according to their potential for propagation, for infecting expectations, for degenerating into price spirals. And preventive action should not be delayed, as it becomes clear that shocks—whatever their origin—may take hold in the economy and evolve into inflationary or deflationary pressures over the medium term. The time dimension of these possible developments varies with

the type of shock, the initial macroeconomic conditions, the prevailing financial sentiment, the international environment, and many other variables. Therefore, the horizon for monetary policy cannot be set in advance. Sometimes it pays to look far ahead, beyond the average lag of monetary transmission. Sometimes the economy can be expected to return to price stability within a much shorter horizon. In all events, a central bank has to ensure that expectations be quickly reverting to its declared objective of policy.

The policy recommendation implicit in the second principle is simple: Do not ignore the information that monetary developments contain for medium-term price developments, even if the relationship between money and prices may not come through strongly at shorter horizons. This principle also provides an antidote against the pitfalls of exceedingly forward-looking rules.[8] Looking into the future with a vigilant eye, as the first principle suggests, is a fundamental element of good policy. But, by constantly looking ahead, one should not lose sight of the intended trajectory of policy and the need to act consistently over time. One should always be constantly aware of possible inadvertent slippages from the intended long-term direction. In the end, monetary policy needs to ensure a path of money supply that is consistent with maintaining price stability over the medium term. Trends in money velocity can be incorporated in such a longer-term benchmark to account for the evolving structure of the monetary exchange. But, in the end, there can be no sustained inflation without systematic accommodation in monetary aggregates.

The key point that I want to bring out here is that neither of these two principles can stand alone. Both are in need for mutual cross-checking. The first principle suggests that the central bank move its interest rate policy instrument in reaction to the disturbances that are considered to have implications for price stability in the medium term. But these actions—taken at successive points in time—may not prove to be consistent over time and could, thus, cumulatively result in systematic divergence from the desired objective. Thus, the course of policy followed in the attempt to counter perturbations via shock-specific responses needs to be ascertained against the straight line provided by the quantity theoretic reference of the second principle. If

that line turns out to have been departed from for an extended period of time, then policy, sooner or later, has to be brought back onto the right course.

Incidentally, it is worth noting that historical episodes of asset price "bubbles" have tended to be accompanied by strong and persistent deviations from that reference line. Thus, a monetary policy strategy that monitors closely monetary developments and measures them against a medium-term reference growth rate may—as an important side effect—also contribute to limiting the emergence of unsustainable developments in asset valuations. I shall come back to this below. Asset prices, by themselves, are not a suitable goal for monetary policy. In the long run, the relative price of assets is mainly driven by underlying real factors—e.g., technological developments and preferences—which cannot be controlled by monetary policy. But monetary aggregates and credit developments in situations of financial instability can signal to what extent consumption, investment, labor, and price-setting decisions are being affected by conditions of financial disorder, excessive euphoria, or disillusion.

Conversely, the second principle too, if followed in isolation, is subject to potential difficulties. As first pointed out by William Poole more than thirty years ago, there are many short-term shocks to the amount of money demanded for each unit of nominal income, which monetary authorities would do better ignoring and accommodating. These unexplained innovations may be simply related to seasonal noise in the money creation system or transitory forces driving around transactions habits. They may reflect reversible movements in the preference for liquidity, in- or out-flows of foreign exchange transiting through checkable accounts or else. In the case of Europe, it cannot be ruled out that the process of financial integration may have affected the income velocity of monetary aggregates. In these circumstances, having to hit a constant rate-of-growth target for, say, base money on a near-term horizon would result in ample fluctuations in short-term interest rates. And this instability would likely be transmitted to prices and output, causing unnecessary fluctuations in these variables. In this context, the first principle of good policy, prescribing a careful filtering of disturbances, provides important safeguards against such policy-induced instabilities. In fact, it underlies the ECB's decision to adopt a *reference value* for monetary growth, which

is not a monetary target. And it also supports the need to look at monetary developments from a medium-term perspective. Nevertheless, as long as money demand relationships are reasonably stable—as has been the case in Europe in contrast to the United States—information from monetary developments should provide robust indications of medium-term price pressures.

Paraphrasing an expression of Paul Samuelson, we were given two eyes: one to watch money and credit aggregates and one to watch everything else. Ultimately, these two policy perspectives are to be combined in a single strategy that subsumes them both in a unified—albeit complex—and robust framework for action. This strategy lends policymakers an accurate perspective over the economy to respond expeditiously to the events and, at the same time, ensures them against systematic slippage.

### *The controversy over the reference value for money growth*

Our policy approach has encountered some criticism, however. This criticism builds on two premises. First, we sometimes hear that there exist ready-made statistical gauges that summarize and condense all the information that a central bank needs to know about the state of the conjuncture. One of these privileged indicators that has gained prominence is an inflation forecast. Another one is some measure of slack, i.e., the distance between actual and potential activity.

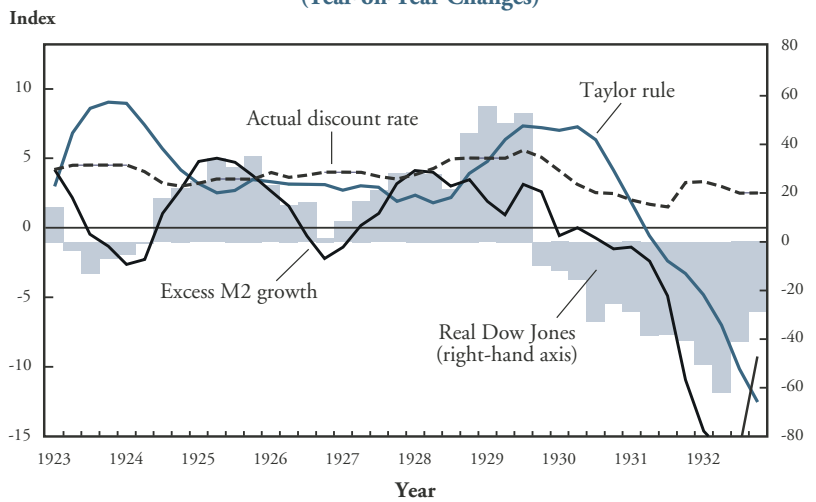
Second, we are told that as long as the central bank moves its interest rate instrument with sufficient vigor in response to, say, an inflation forecast, it does all it is required to pin down prices and keep the economy on track. A rule of the type advanced by John Taylor is a good example of this line of thinking.

The ECB has expressed its reservations on the use of such simple interest rate rules ignoring money elsewhere, and I shall not repeat those arguments here.[9] What I would like to do, instead, is go through a simple, purely suggestive exercise in historical interpretation. Three past episodes are selected, which, in hindsight, are regarded as having involved various degrees of unintentional monetary policy mistakes. I have asked myself the question whether a simple interest rate rule, à la Taylor, had it been available at the time, could have been of help in pre-

*Chart 1*

## THE UNITED STATES IN THE 1920s: EXCESS MONEY GROWTH, REAL ASSET PRICE GROWTH, AND MONETARY POLICY*

**(Year-on-Year Changes)**




*Note: Excess money growth is defined as $\Delta_4 e = \Delta_4 m - [\Delta_4 p^* + \Delta_4 y^*] + \Delta_4 v^*$, where $\Delta_4$ denotes the four-quarter difference operator and m, p*, y*, and v* stand for (logs of) the actual stock of M2, the price objective, real potential GDP, and long-term velocity of circulation, respectively. The price objective is normalized to 1, potential output is obtained applying an HP-filter to actual real GDP, trend velocity for 1923-1930 is constructed by interpolating a linear trend to realized velocity over 1921-1929, and by imposing a structural break afterward to reflect the sharp contraction in nominal GDP, primarily led by a fall in producer prices. The Taylor rule has been calibrated to an equilibrium real interest rate equal to the average real discount rate observed in the first two quarters of 1923, and imposing an inflation coefficient 1.5 and an output gap coefficient of 0.5.

Sources: ECB staff calculations on Friedman and Schwartz (1963-1993) and NBER data.

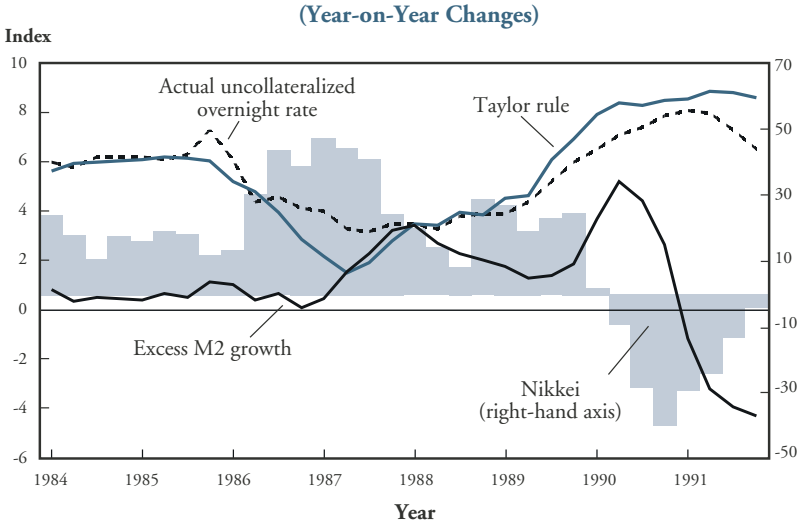
venting those mistakes. And finally, I have tried to figure out whether a policy taking the quantity theoretic equation seriously, and using money stock indicators in addition, could have been instrumental in yielding a better macroeconomic outcome.

These episodes comprise the Federal Reserve System's management of the "Roaring '20s" and of the deep crisis that followed; Japan's monetary policy in the second half of the 1980s in the face of a tremendous asset price buildup; and, finally, monetary policy over the same period in what would later become the euro area. The three episodes are depicted in Charts 1, 2, and 3. In all examples, a measure of excess money growth is used. This is defined as the difference between the

*Chart 2*

## JAPAN IN THE 1980s: EXCESS MONEY GROWTH, REAL ASSET PRICE GROWTH, AND MONETARY POLICY*

**(Year-on-Year Changes)**




*Note: Excess money growth is defined as $\Delta_4 e = \Delta_4 m - [\Delta_4 p^* + \Delta_4 y^*] + \Delta_4 v^*$, where $\Delta_4$ denotes the four-quarter difference operator and m, p*, y* and v* stand for (logs of) the actual stock of M2+CDs, the price objective, real potential GDP, and long-term velocity of circulation, respectively. The Bank of Japan implicit inflation objective has been set equal to a yearly rate of 1.7 percent (the average of the Japanese CPI inflation between 1984 and 1991), potential output is obtained applying an HP-filter to actual real GDP, trend velocity is constructed by interpolating a linear trend to realized velocity over a twenty-year period, starting in 1980. The Taylor rule has been calibrated to an equilibrium real interest rate equal to the average real uncollateralized overnight rate observed in the first two quarters of 1984, and imposing an inflation coefficient 1.5 and an output gap coefficient of 0.5.

Sources: Bank of Japan and ECB staff calculations.

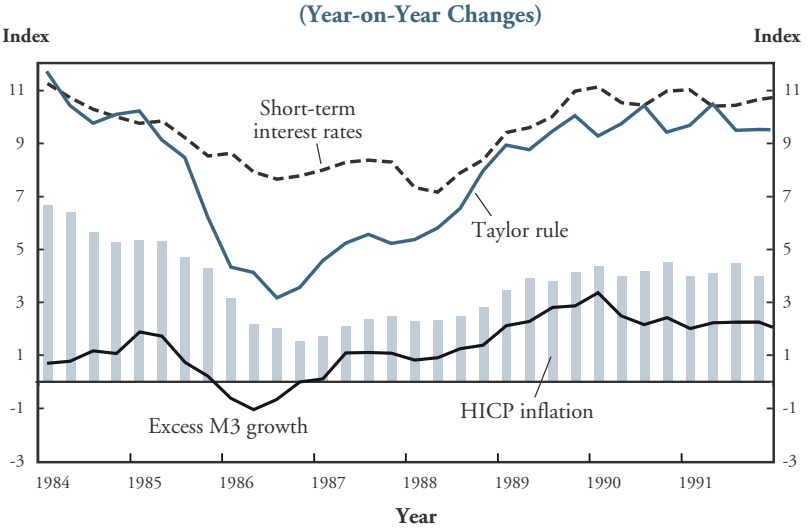
actual growth rate of nominal broad money and the rate that would be implicit in the quantity relation with real income growing at its potential rate, inflation at the central bank's objective, and velocity at its long-term trend.

Needless to say, the list of caveats is even longer than usual. First, there is obviously some selection bias to be discounted: These episodes have *not* been chosen at random. Secondly, in none of these three periods was anything close to a Taylor rule debated in the profession as a viable option for guiding central bank action. The very notions of "potential output," "target inflation," "real equilibrium interest rate," "money velocity trend," although put forward by a number of academics, were either

*Chart 3*

## THE EURO AREA IN THE 1980s: EXCESS MONEY GROWTH, INFLATION, AND MONETARY POLICY*

**(Year-on-Year Changes)**




*Note: Excess money growth is defined as $\Delta_4 e = \Delta_4 m - [\Delta_4 p^* + \Delta_4 y^*] + \Delta_4 v^*$, where $\Delta_4$ denotes the four-quarter difference operator and m, p*, y* and v* stand for (logs of) the actual stock of M3, the price objective, real potential GDP, and long-term velocity of circulation, respectively. The euro-area implicit inflation objective was obtained by an error-correction formula, whereby the level of past realized inflation was corrected by subtracting 7.5 percent of the discrepancy between that level and the "price norm" of 2 percent adopted by the Bundesbank. Potential output is obtained applying an HP-filter to actual real GDP, trend velocity change is set to –1.0 percent per year during the entire period under consideration. The Taylor rule has been calibrated to an equilibrium real interest rate equal to the average three-month real interest rate observed in the first two quarters of 1984, and imposing an inflation coefficient of 2.08 and an output gap coefficient of 0.08. The inflation and output gap coefficients are estimated using a GMM technique during the period 1980-2001.

Sources: ECB staff calculations.

unknown or intentionally ignored in the 1920s at the Federal Reserve Board. And the same concepts, while available and, in fact, widely used by central bank economists in the 1980s, were and are open to all sorts of measurement controversies. To mention only one, regarding the euro area in the 1980s, the "inflation objective" of a group of twelve central banks conducting more or less independent policies is a sufficiently elusive construct to warrant a great deal of caution.

Having said all this, I believe this exercise is, nonetheless, instructive.[10] At a minimum, it illustrates how different statistical gauges can yield conflicting policy signals and how badly central banks can sometimes do if they choose to neglect the fundamental arithmetic

embodied in the quantity relation. Chart 1, for instance, suggests that had the Fed looked at a measure of excess money growth, had it not rejected the then novel normative framework offered by the quantity theory of the business cycle, it would have probably realized that monetary policy was *too lax*, not *too tight*—as suggested by the Taylor rule standard for much of the 1920s.[11] Intriguingly, the measure of excess money growth appears to move in sympathy with the profile of the histograms that represent the growth rates of real stock prices in New York. It becomes positive—and significantly so—in those years in which the market is most buoyant. And it turns negative when the market pauses or falls. Perhaps one can conclude that money was growing too fast in the years immediately preceding the crash, compared with the long-term necessities of an inflation-free economy operating at potential.[12] Perhaps that excess of monetary injection was spilling over into the purchase of financial assets.

However, looking at the discount rate only, to the exclusion of the monetary indicator, and measuring the historical path of the discount rate against the benchmark provided by the Taylor rule, one would draw the opposite indication.[13] While significant by a Taylor rule standard, the degree of tightening was perhaps not commensurate with the surging risk appetite that was driving up market rates and yet luring more and more investors into the financial gamble. The extent of the abrupt policy reversal in the first half of 1929, which many contemporary observers quote as a primary cause of the disorderly fall in the market, is also more apparent from the quantitative than the interest rate indicator.

A similar picture emerges from the Japanese data. While a Taylor rule would have signaled an appropriate-to-tight stance of policy until well into 1989, excess money was building up in the second half of the 1980s, finally at an accelerating pace.[14] Apparently, the Bank of Japan had expressed early concerns that rapid money growth might predispose the "dry wood" needed to set the asset market on fire.[15] Deputy Governor Yutaka Yamaguchi (1999) echoed those concerns in a recent insightful intervention in Jackson Hole. But probably no tightening—in excess to that already apparent in the data—could have been justified to the public on the back of persistently subdued inflation and growing

measures of productivity. Again, it seems that a monetary policy gauge focused on inflation and a measure of slack only—to the neglect of money—would have failed to sound the alarm.[16]

The euro area in the 1980s provides an alternative picture: the connection between excess money growth and goods, as opposed to asset price, inflation. The disinflationary process that had occurred in the first half of the decade, aided by the sharp decline in the international energy prices, was followed by a gradual reversal. Monetary authorities, although not off track by a Taylor rule standard, were slow to spotlight those developments and somehow fell behind the curve. Once more, money rising in excess of its long-term reference value could have warned of impending risks to price stability.

Of course, simple graphical co-movements cannot be emphasized too much, let alone taken to prove any casual relationship. And the obvious objection to my story is that there are other episodes in the history of industrialized countries in which money growing temporarily out of line with fundamentals has failed, ex post, to ignite an asset bubble or to tolerate an inflationary process under way. Furthermore, alternative indicators, such as private credit, may at times outperform broad money in signaling that observed swings in asset prices are abnormal and may prelude to financial distress.[17]

But the absence of a fire does not mean that we should not pay for fire insurance. Rather, the question is whether, ex ante, the probability of a policy mistake is sufficiently large to warrant concerns and, at some point, intervention. These concerns and this threat of intervention on the part of the central bank may be sufficient to deter that risk in the first place.[18]

Of course, there are shocks to money growth that, in retrospect, appear to have been due to pure velocity noise. If we had an all-encompassing model of how real and financial forces interact, if we were entirely confident that our model suffered from no omission of key underlying relationships, incorporated no functional mis-specification, was exactly estimated, then these velocity shocks would be readily recognizable. They would show up as the residuals of the complex money demand equation in the model. But no model and no central bank in the world is at that stage yet. Incidentally, it is a well-known feature of the general equilibrium models in wide use today that the money

demand condition that they incorporate displays a rather poor fit to the data. A central bank cannot place too much trust on the coefficients and the residuals that this equation generates. There definitely seems to be more to the link between money, income, and prices in the data than captured by such simple interpolations. This fact, in my view, should urge us to accelerate our efforts to develop a more sophisticated understanding of how money interacts with price setting and how financial and real variables can influence each other.

So, central banks have to face dilemmas of the following nature. Does a shock to observed money quantities reflect pure noise that will unwind in due course, or does it bear information over the forces driving the setting of prices? Is an observed shift to more liquid portfolios a sign that agents are building up transaction balances in order to finance higher spending and/or in anticipation of higher prices in the near future? Or is it a mere signal of a heightened precautionary motive, a by-product of financial anxiety, of market jitters, which will reverse themselves sooner or later without economic implications? In particular, to what extent is an unexpected surge in money a counterpart to easy credit—which can feed asset market speculation or excess demand, with unsettling consequences stemming from both? The experience accumulated in the 1920s and the 1980s suggests that conditions of easy credit and rapid monetary expansion, while escaping simple checks based on inflation and output gap indicators, can inflict lasting damage on the economy. Suggestively, many stories were told in Japan in the 1980s about the relation between money supply and prices having become unstable and unreliable.

A central bank cannot systematically dismiss shocks of this nature as nuisances. Ultimately, the obvious question to ask is what has changed in the relation linking money holdings and consumption-saving decisions, a connection which, as I argued above, is not well-described in available models. But in a situation of doubt, one should always be reminded that the—provided money is properly measured—quantity theoretic regularity will, at the end, reassert itself. So, if price stability is to be preserved consistently over the medium term, a persistent violation of that regularity should have an impact on policy decisions.

## *Concluding remarks*

I conclude with a number of observations that have been recurrent in my remarks above.

First: There is no simple escape for a central bank from a serious analysis of economic change, which comes in the form of shocks and noise. These changes are often opaque and present themselves in disguise, but they may contain information that cannot be discarded on a priori grounds. There is no escape to a serious analysis of economic perturbations. Certainly, following deceptively simple policy rules of one sort or another is no viable cure to complexity.

Second: The change in money demand is one of the most difficult to decipher. Looking ahead, these shocks may even augment in number and magnitude—as has been the case in the United States and elsewhere in the past—which would make filtering and reading the signals coming from money a difficult undertaking. But the central bank should not deny itself the opportunity to take advantage of all the information that it carries with itself. The conviction that money matters and contains invaluable information for policy is shared across central bankers wedded to different monetary policy strategies.[19]

Third: While looking into conjunctural signals, a central bank should never fall prey to myopia and short-termism. Monetary theory has provided a compass for measuring how the course of policy has deviated in the past and will likely deviate in the future from the straight line consistent with price stability and a sustainable growth path. This quantity theoretic reference should be consulted regularly and taken seriously. Monetary policy cannot react mechanistically to monetary variables, and the weights that a central bank attaches in its considerations to the various headline measures of money supply are state dependent: They cannot be set in advance. Thus, there may be extended periods of time in which observers do not detect reactions to monetary indicators. In our strategy, for example, the weights are conditional on the analysis of monetary shocks, which is conducted under the first pillar. This analysis is aimed at purging the developments in monetary aggregates of the noise with which they are usually observed. This analysis yields more reliable measures that can be used for policy orientation.

But if deviations in these measures of money from the long-run trajectory consistent with price stability are ample and persistent, a central bank should intervene if the anchoring properties of money are to be reinstated and made operative.

## ENDNOTES

[1] Various alternative methods to identify *monetary* policy shocks generally produce comparable qualitative results, in the sense that inference is reasonably robust across a large subset of identification schemes. However, this does not appear to be the case for exercises aimed at identifying shocks to *technology*. Furthermore, there is some disagreement as to the extent to which different shocks have been responsible for output variation in the past. See, among others, L. Christiano and others (1999) and J. Galí (1999).

[2] To make an example of this type of unstructured uncertainty: What is the admissible range of parameter change induced by increased globalization, new technologies, or continuous financial innovation? Are both sources of structural change only going to show up in a faster transmission of shocks cross-border. Or is the emergence of genuinely global financial operators going to fundamentally alter the transmission of monetary policy at a local level? Likewise, the developments of new financial products are a potent force behind enhanced flexibility and macroeconomic resilience. But the very technologies that appear capable of better allocating risk and, thus, containing economic imbalances may also be imparting new forms of vulnerabilities that can intensify the business cycle. Because of their increasing degree of complexity, the new instruments can potentially expose the overall system to heightened risk if miscalculations are large. Again, assigning probabilities to these equally plausible courses of events appears hazardous on a priori grounds.

[3] On the policy consequences of real time misperceptions induced by ex-post statistical revisions, see A. Orphanides (2000).

[4] See V. Gaspar and others (2001), and P. Hartmann and others (2001).

[5] On the connection between a central bank's predominant focus on price stability, its aversion on real fine-tuning, and its credibility assets, see V. Gaspar and F. Smets (2002).

[6] For a more precise description of the ECB monetary policy strategy, see ECB (1999, 2000) and O. Issing (2001).

[7] Interested readers can find a precise account of the methodology that we follow to construct the reference value in C. Brand and others (2002).

[8] A discussion of the problem of excessive forward-lookingness in monetary policy is provided in M. Woodford (2000).

[9] Interested readers are referred to ECB (2001).

[10] The results presented in the charts prove reasonably robust across a number of admissible assumptions and specifications. However, in the case of Charts 1 and 2, the analysis becomes less and less reliable as the horizon is stretched to cover periods following the crash of the stock markets in late 1929 and 1990, respectively. This is due to fundamental uncertainties clouding the way key parameters, such as the perceived equilibrium real interest rate and the expected trend in money velocity, react to the deepening of the economic crisis that ensued in both cases.

[11] In a recent review of this period, T. Humphrey (2000) has argued that the Fed's refusal to endorse the policy prescriptions implicit in the works of I. Fisher in those years contributed to the fatal policy mistakes that have been described in the classical book by M. Friedman and A. Schwartz (1963-1993). The monetary theory of the Great Depression, as expounded in that book, still constitutes the leading

interpretation of that piece of monetary history. The contention that an easy policy was fueling the stock market bubble was always a fixation of various Austrian economists at the time.

[12] That monetary policy should aim at price stability, even under the price-taking rules of the international gold standard, was one of the main principles advocated by I. Fisher in his classic 1911 book on the purchasing power of money. Other prominent monetarists of the time espoused the principle and elaborated monetary benchmarks which, if observed by the Federal Reserve, would have yielded an outcome of price stability: See, for example, the 1924 article written by C. Snyder, an economist at the Federal Reserve Bank of New York. In fact, these theories of "managed money" were consistent with the workings of the international gold standard, as the gold-reserve-to-note-and-deposit-liabilities ratio of the Federal Reserve System—at an average of 65 percent over the 1920s—was considered in excess of what was imposed by the System's international gold-standard commitments. In the words of Friedman and Schwartz (1963-1993): "[The Federal Reserve System's] own gold position plus prevailing international monetary conditions enforced recognition of the difference between its problems and those of earlier central banks. It had to face explicitly the need to develop criteria and standards of monetary policy to replace the automatic operation of the gold standard." (page 240.)

[13] Throughout the 1920s, annualized inflation never exceeded 2 percent (with the exception of the first quarter of 1921, when it strongly rebounded from the profound deflation of 1920), and from the end of 1924 it remained persistently negative for the rest of the decade. Consumer price deflation became perceptible in 1928, when it averaged -1.2 percent. Deflation started accelerating in the course of 1930 to reach a peak of almost –8 percent between the end of 1932 and the beginning of 1933.

[14] B. McCallum (2000) confirms the good fit of a Taylor rule to the actual policy orientation of the Bank of Japan in the 1980s. He also finds that a rule involving a target for base money growth would have provided important insights to the policymakers in those difficult circumstances.

[15] The expression is quoted in K. Okina, M. Shirakawa, and S. Shiratsuka (2001) who provide a comprehensive overview of the period, stressing the role of money as an indicator of market excesses. According to their account, the Bank of Japan had raised the issue of money growing too fast already in 1986.

[16] It is also notable how excess money starts contracting sharply already in the first half of 1991, immediately following the cyclical peak in the Japanese economy. The Taylor rule, instead, persistently points to a need for tightening. It should be noted that Japanese inflation averaged 1.7 percent during the period covered in Chart 2. However, the average increase in consumer prices from the start of 1986—when the early signs of the asset price buildup became visible—to the end of 1989 was a mere 0.9 percent.

[17] The close correlation between domestic credit growth and the change in (a composite indicator of various) real asset prices is stressed in a recent contribution by C. Borio and P. Lowe (2002).

[18] This interpretation of rule cross-checking in terms of insurance against perverse outcomes is consistent with that advanced by a recent paper by L. Christiano and M. Rostagno (2001).

[19] See, for example, M. King (2002), and L. Meyer (2001).

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