

Unconventional Monetary Policy Measures: Principles—Conditions—Raison d’être*

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1. Introduction

It is always a pleasure to be in Washington, at the invitation of the Federal Reserve Board to exchange views with so many of the best brains that academia and central banking can offer. It is a double pleasure and honor to participate in a colloquium celebrating Don Kohn, who has played such a decisive role both in the Federal Reserve System during all his career, culminating as Vice-Chairman of the Board, and in Basel meetings and committees, where his leadership is in all memories.

Don, seen by all your colleagues, the world over, you were admired as the exemplary central banker, demonstrating in all circumstances outstanding cleverness, lucidity, candor, calm, and sangfroid. I say “in all circumstances” on purpose, because we all have had, since mid-2007, the great privilege to experience extraordinary demanding and difficult times—times which are characterized by a succession of shocks that were unseen in the advanced economies since World War II. I am convinced that these shocks were potentially ever graver than those which triggered the 1929 crisis. Had the central banks and the public authorities not embarked on prompt and decisive actions, I trust that we would have experienced not only a great recession but a dramatic, deep, and rapidly unfolding depression.

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I have been closely associated with many crises that have hit various components of the global economy over the last thirty-five years: the Latin America debt crisis of the 1980s, the African debt crisis, the collapse of the Soviet Union, and the Asian crisis, to name only a few. All continents of the world have been successively called to drastically change their strategy, to adjust, and to go back to sustainable policies in the fiscal, structural macroeconomics fields. In this perspective, the fact that the advanced economies were hit in 2007–08 is less surprising. They were practically the only ones that were spared from adjustment since World War II. In a way, it was their turn!

Spinoza famously said, “If you want the present to be different from the past, study the past.” Indeed we are called to study the past and to better understand what happened. This study should apply both to the ancient past and, even more, to the very recent past, marked, since the start of the crisis, by phenomena that were previously unseen. A much deeper understanding of the highly unexpected and strikingly rapid unfolding of monetary, financial, and economic events over the last five years seems to me one of the major preconditions for paving the way for a better future. It is with this in view that I propose to concentrate our attention today upon two major issues: First, on monetary policy in the crisis and the role of so-called non-standard measures. Second, on possible new promising avenues for economic research in light of the crisis.

2. The Principle of Separation between Conventional and Unconventional Measures

The widespread introduction of so-called non-standard monetary policy measures by major central banks has been a defining characteristic of the global financial crisis.

Across central banks, there has been no “standardization” of non-standard measures: approaches are distinct, tailored to the respective economies and their structures. We have seen enhanced credit support, credit easing, quantitative easing, interventions in foreign exchange and securities markets, and the provision of liquidity in foreign currency—to name but a few of the measures taken.¹

¹For a summary, see Borio and Disyata (2009).

These tools have been used to support the functioning of the financial sector, to protect the real economy from the fallout of the financial crisis, and, ultimately, to preserve price stability over the medium term.

There are two distinct views on non-standard measures.²

Some view them as the continuation of standard policy by other means. Once nominal interest rates cannot be lowered further, central banks use other tools to determine the monetary policy stance—that is, to contribute in the desired way to economic, financial, and monetary developments in pursuit of price stability.³

To illustrate this view, I would compare it to—once the end of the road has been reached—engaging the four-wheel drive. Central banks expand their balance sheets and inject liquidity so as to influence the structure of yields and returns and thereby stimulate aggregate demand. This approach would be broadly in line with the theoretical analyses and prescriptions of Friedman, Tobin, or Patinkin. The logic of this approach is essentially sequential: first the standard measures, then the non-standard measures. If this sequential logic were also to be applied to the exit, it would essentially mean unwinding non-standard measures first and subsequently raising interest rates.

Let me suggest a different view of our non-standard measures. Say that key interest rates are to be set at levels we consider appropriate to maintain price stability, drawing on our regular comprehensive assessment of economic and monetary conditions. In other words, in this perspective, policymakers would follow standard practice in this regard. Their interest rates can be more or less significantly positive, or very close to zero, or at zero level.

But whatever the level of nominal interest rates, on several occasions, particularly in times of acute crisis, the monetary policy stance established in this way faced obstacles in being transmitted to the economy. During the financial crisis, market functioning was impaired, at times very profoundly. In response, one might act to overcome some severe malfunctioning that was hampering the channels of transmission of monetary policy. Non-standard measures

²See Trichet (2010).

³For a discussion of this perspective, see Orphanides and Wieland (2000).

would be introduced to help restore a more effective transmission of our monetary policy stance to the wider euro-area economy.⁴

Staying with the image of the road, I would say that the metaphor suggests to remove the major roadblocks in front of us, so that the policy stance can be transmitted to the economy in the intended way. *The logic of this approach is therefore parallel and supportive*: if the transmission of the standard measures is impeded in a very significant way, non-standard measures can offer support. This logic has potentially clear implications for the exit: in this perspective, we can determine standard and non-standard measures very largely independently of one another. Policymakers will not be bound to unwind non-standard measures before considering interest rate increases, or to put interest rates to the zero lower bound before considering the introduction of non-conventional measures. In this perspective, it would be legitimate to make those decisions independently. One set of measures—the so-called standard ones—depends on the medium- and long-term outlook for price stability; the other—the non-standard—depends on the degree of dysfunctioning of the monetary policy transmission through the financial system and financial markets.

With this overview of guiding principles in mind, I would like to discuss in more detail the three crucial elements of the monetary policy discussions during the financial crisis: the pursuit of price stability, the primary objective; the role of standard policy measures in pursuing that goal; and the support provided by the non-standard measures that we have introduced since the start of the crisis. Let us see what we have precisely done in the case of the European Central Bank (ECB).

2.1 Definition of Price Stability

The Governing Council has defined the ECB's primary objective with a definition of inflation of "below 2 percent, but close to 2 percent" over the medium term.

As some of you will remember, such quantification of our definition was initially criticized but over time has become fully accepted.

⁴For a discussion, see Giannone et al. (2012).

Some criticism has proved unfounded. Our definition has not constrained growth: during the first thirteen years of Monetary Union, euro-area per capita GDP growth was slightly superior to per capita/United States' growth during the same period, at about 0.8 percent per annum. Nor has it hindered employment creation: between 1999 and the end of 2011, euro-area employment grew by around 14.7 million net new jobs, which compares pretty favorably with employment creation in the United States over the same period (between 8.5 and 9 million).

What is more, I was also impressed by the precisions given by the Federal Reserve System, under the chairmanship of Ben Bernanke. When describing the longer-run U.S. inflation rate and outlook, the Federal Reserve System mentions as consistent with its mandate a longer-run inflation rate of about 2 percent or a bit below.⁵ The world's two largest central banks in the advanced economies could hardly be more closely aligned with regard to the inflation rates they aim to establish in their respective economies over the medium and long term.

At the same time, it seems to me that our own medium-term orientation has also become more fully understood. We need to look beyond the impact of transient shocks to price developments and thus beyond the previous standard two- to three-year horizon of conventional macroeconomic projections and of the first standard direct inflation-targeting concept. Indeed, we condition our policy-relevant horizon on the nature and magnitude of the shocks hitting the economy. The nature and magnitude of the shocks faced during the financial crisis imply that the relevant notion of medium term should be even significantly longer than in more normal circumstances.

With these definitional issues largely resolved, there are two points that I would particularly like to highlight today.

First, the precise quantitative nature of our definition of the price stability objective has proved crucial in anchoring longer-term inflation expectations. And, as a result, it has protected us against both upside and downside risks to price stability, even in these most turbulent times. The anchoring of private inflation expectations induces a self-correcting mechanism in response to temporary disturbances

⁵See Bernanke (2010).

in price developments, thereby easing the burden on monetary policy. In short, I trust the quantitative definition has helped protect us against the materialization of the risks of deflation, even at the darkest moments of the crisis.

Second, the quantitative definition facilitates accountability. There should be no room for ambiguity in judging the ECB's track record. The average annual inflation rate in the euro area, over the first thirteen years, since January 1999 has been around 2.03 percent.

This represents an achievement that is worth taking note of, not forgetting that we had to cope with several oil and commodity shocks during the period. It is, moreover, the best result in the major euro-area countries over the last fifty years.

2.2 Standard Measures in the Face of Financial Crisis

Changes in the ECB's key short-term interest rates—in other words, standard policy measures—have remained the key instrument of monetary policy in the euro area. I trust that these rates have always been set at levels which the Governing Council has deemed appropriate for the delivery of price stability over the medium term.

In considering the implementation of standard monetary policy measures during the financial crisis, two issues are worth particular attention.

First, the close relationship normally observed between the key policy rate and short-term money-market rates assumed a more complex form during the crisis. It was important to recognize that in times of crisis a broader set of market interest rates, extending beyond the very short-term money-market rates, was relevant in signaling the monetary policy stance, given the segmentation of financial markets, also taking into account that only a fraction of the banks had access to the unsecured Eonia rate.⁶ Hence, the new positioning of the overnight money-market rate—inside the “corridor” signaled by the main refinancing operation and the deposit rates—was considered acceptable in these exceptional circumstances as a means of helping to offset the impaired functioning of the money market and, in particular, the abnormally high level of spreads on the term money-market rates.

⁶See Lenza, Pill, and Reichlin (2010).

The second point I would like to highlight concerns the question of “forward guidance” or “pre-commitment” regarding the future path of key ECB interest rates.

I must confess that I have some difficulty deciding whether we are in two very different conceptual schools on the two sides of the Atlantic or whether it is also a question of semantics and presentation. One school stresses the central bank view on the probability of realizing a certain path of short-term interest rates over a considerable period of time—for instance, the high probability of having very low interest rates until 2014. The second school stresses the importance of preserving price stability over the medium and long term, in line with the definition given by the central bank; in this second concept, one also stresses explicitly the goal of having a low path for an important other indicator, namely the stability of low medium- and long-term inflation expectations in the years to come.

There is no doubt in my mind that the commitment on “low interest rates for a considerable period of time” is conditional. Nobody would trust that interest rates can remain very close to zero level or at zero level whatever happens, over a period of several years. By the way, it is always underlined by the central bank of the first school that the commitment is not unconditional. That has been said clearly by Ben Bernanke on many occasions. And it goes without saying that when one stresses the stability of long-term inflation expectations over time, it means that the interest rates of the main refinancing operations of the central bank of the second school would be designed to deliver this stability, taking into account the changes that might occur in the economic and financial environment. So, in both cases, short-term interest rates can move and should move, depending on circumstances.

You will not be surprised that, all taken into account, I have a clear preference for the “second school” posture of no “medium-term pre-commitment” on the interest rate path together with sticking to a solid commitment to deliver long-term price stability. This also means preserving low medium- and long-term inflation expectations over time and, therefore, all things being equal, helping preserving medium- and long-term nominal and real interest rates favorable to growth, which is, if I understand well, the main goal pursued by the first school of minds.

2.3 Non-Standard Measures in the Face of Financial Crisis

In the very challenging context of financial crisis, standard monetary policy proved insufficient. Standard measures have been complemented by non-standard measures, which have aimed to help restore the effectiveness and transmission of interest rate decisions.

As I mentioned at the outset, the ECB did not embark on non-standard measures because we had attained a zero level and thought that the scope for further standard easing of the monetary policy stance was exhausted. Our first non-standard decision—namely the unlimited supply of liquidity at fixed rates provided appropriate collateral was given—was made August 9, 2007, when the minimum bid rate of our main refinancing operation was at 4 percent. And when the key rate was reduced to 1 percent in May 2009, I remarked, “We did not decide today that the new level of our policy rates was the lowest level that can never be crossed, whatever future circumstances may be.” We judged then—as I understand the ECB does now—that the positive level of our key rates was the right one to preserve price stability over the medium term, whilst at the same time, we considered that non-standard measures were necessary.

Our view was that non-standard measures were required to ensure that the stance of monetary policy would be more effectively transmitted to the broader economy, notwithstanding the dislocations observed in some financial markets.

2.4 Moments of Particular Interest

After the first episode of the crisis, starting from mid-2007 up to mid-September 2008, which I would call the episode of financial turbulences, the bankruptcy of Lehman Brothers marked the start of its second episode, with a dramatic intensification of the financial tensions and a grave impairment of the functioning of the euro interbank money market. Given the crucial role of wholesale money markets for monetary policy transmission, dangers were immediately apparent. The flow of credit to the productive sectors of the economy—households and firms—was at risk, as banks faced massive uncertainty about their access to liquidity and funding, both in euro and foreign currencies.

Concerns about the impact of such tensions on bank credit supply were particularly acute in the euro area, given the preponderance

of bank loans in corporate financing. About 75 percent of firms' external financing in the euro area comes via the banking system, compared with only around 25 percent in the United States.

To contain these risks, prompt and decisive action needed to be taken: full allotment, the lengthening of maturities in liquidity provision, the provision of liquidity in foreign currencies, and a covered bond purchase program to support this systemically important market in Europe. All these measures were aimed at supporting bank funding, maintaining the regular flow of bank credit to the private sector, and, therefore, to the extent it was possible, at helping restore a more correct monetary policy transmission.

Another moment I wanted to stress relates to the emergence of tensions in sovereign debt markets at the end of 2009 and the beginning of 2010. These tensions marked, in my view, the end of the second episode of the financial crisis—namely its post-Lehman intensification—and the start of the third episode. Seen by the ECB, it was a very important moment: the epicenter of the global crisis—which had been, from August 2007 up to the beginning of 2010, located in the United States of America—was crossing the Atlantic. The epicenter of the global crisis was now located in Europe and, more particularly, in the euro area. Again, given the central role played by government bond markets in the financial system, dysfunctionality in these market segments threatened the effective transmission of monetary policy.

We must remain mindful that the euro area consists of seventeen sovereign states. It is not a fully fledged political union or a fiscal federation within a unified government bond market. The Securities Markets Program—as a modest part of the non-standard measures—has been designed, prudently and with limited amount of interventions, to help restore a more normal functioning of the ECB monetary policy transmission channels in economies where the sovereign debt markets were obviously dysfunctional.

3. The Conditions to be Met for Implementing Unconventional Measures

To sum up, the “non-standard” measures are, in my view, first, fully independent from the “standard” measures; second, entirely aimed

at helping restore a better transmission of the interest rate policy in times of abnormal functioning of monetary and financial markets; third, transitory by nature; and fourth, not intended to “fine tune” the transmission mechanism.

It is obvious that if they are not very carefully monitored, they might have the unintended consequence of creating a financial environment which could be abnormally benign for private markets, for commercial banks, and for sovereigns. This, in turn, could contribute to delaying the necessary improvements in rules and regulations of the financial sector, balance sheets repair of financial institutions, structural reforms of the economies, and fiscal adjustment. This is true in all advanced countries. That is the reason why it seems to me that non-standard measures must satisfy the *five following conditions*:

- (i) First, they must be as precisely as possible commensurate with the degree of dislocation and disruption of market they must contribute to counter. It is naturally always a matter of judgment. I have to say by experience that it often calls for an initial diagnosis as lucid as possible, sometimes for a quick and expeditious decision, and for a constant follow-up. In most cases, the non-standard measures must be tailored to avoid the total disruption of markets that could gravely hamper the transmission of monetary policy. If these measures do not avoid the disruption of markets, it would be clear that the measures failed. But if they do avoid this potential disruption, it is always possible to think that they were “overdimensioned.” This is the reason why it is always so important to weigh very carefully the dimension of the measures and be sure that their size is always commensurate to the potential disruption. That is the reason why the Governing Council of the ECB never hesitated to increase or decrease the size—in particular, the duration—of the non-standard supply of liquidity depending on the abnormality in the functioning of the financial system.
- (ii) Second, the measures must be accompanied by messages as forceful as possible to commercial banks to urge them to address resolutely their medium-term recapitalization and balance sheets repair issues. To the extent that banks are, by far, the main instrument utilized for the “non-standard”

- refinancing in the case of the ECB, this message is particularly important in Europe. This calls also for the messages of the central bank to be fully understood and correctly transmitted by the supervisory authorities in each particular jurisdiction.
- (iii) Third, the measures must be accompanied by clear and unambiguous messages, when and where needed, to countries concerned. When the non-standard measures are necessary, in particular, because of disruption of markets due to loss of confidence in the sovereign signature, the messages must be as clear and quick as necessary in order to avoid the failure of the measures themselves and/or the creation of an artificial financial environment that would pave the way for major additional difficulties in the future. The messages sent in August 2011 by the ECB Governing Council to several governments in Europe are cases in point in this respect.
 - (iv) Fourth, in the case of Europe, an additional condition would be to ask the European Institutions as well as the governments to embark collectively on a significant improvement of their economic governance, including the close monitoring of the individual countries' economic and budgetary policies. This condition explains why the ECB Governing Council, which had always called for improving economic governance, had been so vocal on this issue since the start of the crisis and the ensuing decisions to embark on non-standard monetary policy.
 - (v) Fifth, there is a last condition which I believe to be important. To the extent that the combined non-standard measures of the central banks of the advanced economies are creating, at the global level, a very substantial structural change in the monetary and financial environment of the global economy, it seems to me necessary for the full constituency of central banks to call for the appropriate reinforcement of global governance. As long as the non-standard measures are considered necessary by central banks, I am convinced that they are entitled to be the most vocal advocate of the necessary reforms of global finance and the necessary adjustment of global imbalances within the framework of the G20, the decisive contribution of the International Financial Institutions, and the effective mobilization of the central banks and of the Financial Stability Board.

The last important decision made unanimously by the Governing Council of the ECB—at the beginning of December 2011 on the three-year Long-Term Refinancing Operation—meets, in my opinion, the previous five conditions. The duration, in particular, was appropriately dimensioned, taking into account the aggravation of the threat of a major dysfunctioning of the European banking sector as a whole in October, November, and at the beginning of December last year.

As regards the four other conditions, I note that whilst making this decision, the ECB Governing Council and its President, my successor, made loud and clear the importance of reinforcing banks' balance sheet, adjusting individual countries' strategies, and improving governance at the level of the euro area and Europe as a whole. It is clear that in these domains complacency would be the worst possible attitude. It is urgent to implement comprehensively and decisively the decisions already made and the orientations already approved. This includes the fifth condition, namely the reforms that have to be pursued at the global level with full respect for the principle of a global level playing field.

4. Why Large-Scale Unconventional Measures by Central Banks of Major Advanced Economies Appeared Necessary in the Crisis

Not only have the central banks of the advanced economies referred to somewhat different monetary policy conceptual frameworks over the last years, they have also made different decisions since the start of the crisis. A number of them have decreased nominal interest rates to the zero level or very close to zero. Others have maintained their main refinancing rates at a certain distance from the zero lower bound. They have also embarked on significantly different non-standard measures, some engaging in very substantial purchases of private securities; others embarking on large amounts of purchases of treasuries, combined or not with private securities; and still others very much concentrating on the supply of liquidity to commercial banks. It is relatively easy to understand why the nature of the non-standard measures has been significantly different on the two sides of the Atlantic. The financing of the economy is itself structurally different: the banks play a decisive role in the financing

of Europe and the financial markets dominate the financing of the United States.

But one fact is striking. Whatever differences are observed as regards, first, the monetary policy conceptual approaches; second, the decisions taken on interest rates; and third, the various channels that are utilized as regards the non-standard measures, the volume of those non-standard measures is significant in all the big advanced economies concerned.

I suggest that the appropriate metric for measuring the non-conventional monetary policies is the increase of the size of the balance sheet of the central bank which is due to outstanding monetary policy operations. More precisely, I propose to compute this increase since the start of the intensification of the financial crisis, namely since mid-September 2008 when Lehman Brothers collapsed.

According to this metric, the size of the balance sheet of the ECB increased by around +10 percent of the GDP (from around 6 percent to around 16 percent). The equivalent increase for the Federal Reserve System would be around +12 percent of the GDP (from 6 percent to 18 percent) and +15 percent of the GDP in the case of the United Kingdom (from 6 percent to 21 percent). For Japan, the growth since mid-September 2008 would be +12 percent of the GDP (from 15 percent to 27 percent).

These figures call for three observations:

- (i) First, it is interesting to note that the central banks of the United States, the euro area, and the United Kingdom had the same order of magnitude of outstanding monetary policy operations before September 2008: around 6 percent of the GDP. The Bank of Japan appears to be in a different situation, with 15 percent of the GDP. The explanation seems simple: Japan has experienced a situation of crisis for a much longer period of time and had already considerably increased the volume of its non-standard measures to cope with its own long-standing crisis.
- (ii) Second, there are some differences among these four major central banks: the ECB is at the lowest level of increase due to outstanding monetary policy operations. But as already noted, it is striking that—in terms of percentage of GDP—the increase of the central banks' balance sheets observed in these major advanced economies is of the same order of magnitude:

for instance, 10 percent for the euro area, 12 percent for the United States.

- (iii) Third, until now, the non-standard measures, which should be transitory by nature, seem to have become, three-and-a-half years after the intensification of the crisis, a more permanent feature of the advanced economies than was originally thought and than is certainly desirable. Japan, which was the first advanced economy to experience a long-standing structural crisis, is a case in point.

In the present episode of the global crisis of the advanced economies, a common feature of all major economies is that they apparently need a very substantial additional financial intermediation operated by the central bank at a level of 10 percent to 15 percent of the GDP.

Even after the long-standing particular experience of the Japanese economy, no economic analysis had suggested that we could experience such a generalized situation in all major advanced economies. I think it is urgent that academia elucidates the factors that would convincingly explain that present situation and would permit to foresee the future of the unconventional measures.

I see, in particular, two conjectures that could and should be tested. I hope that we will find out that the first is the right one.

According to the first conjecture, we would be experiencing a transitory phase in the advanced economies as a whole. A significant level of non-standard measures would be of the essence during the time when banks and financial institutions would actively improve financial situations and achieve their balance sheets repair, when governments would proceed to adjust their fiscal and macro policies, and when the new national and global rules, regulations, and macro prudentials would be well established and implemented.

This conjecture is fully in line with the five conditions I mentioned earlier for central banks to embark on non-standard measures. I hope very much it is the right one: if it is true, it will mean that the present situation is certainly not a “new normal” and that the present exceptional high level of central bank intermediation is indeed transitory—provided the hard work, which is overdue, is done by the public and the private sector. The exit might be relatively slow and gradual, but it would be certain—again, provided the national, continental, and global “cleaning up” is done.

According to the second conjecture—which I hope will be demonstrated false, but that we have to consider seriously—the present exceptional high level of central bank intermediation could be more permanent. In this perspective, this intermediation could be necessary to counter a hypothetical unfortunate emerging property of the new global financial system: the existence of a quasi-permanent systemic tail risk. This tail risk would not necessarily be the same on the two sides of the Atlantic and in Japan. It could be, for instance, the threat of a seizing up of key financial markets in the United States or the menace of an interruption of the normal functioning of the banking sector in Europe. But, according to this conjecture, a significant degree of potential systemic instability would characterize the present advanced economies. As I said, I hope very much that this second conjecture is wrong.

Why do I say that we have to consider seriously this conjecture? Not only because we see—five years after the start of the global crisis of the advanced economies mid-2007—that non-conventional measures look solidly integrated into policies of all major advanced economies' central banks. Not only because the Japanese economy signals that such a situation can last for an even more considerable period of time. But because our understanding of the underlying causes of the dramatic intensification of the crisis mid-September 2008, and the sequence of events which follows, remains poor.

As long as we do not make sufficient progress in this understanding, we cannot exclude totally the presence of such systemic tail risks in our new globalized economy.

I would like precisely to address now the issue of the necessary improvement of our macroeconomics and finance theory in light of the crisis.

5. New Avenues for Macroeconomics and Finance Theory

In 2010, I had a kind of theoretical “*cri du coeur*”:⁷

When the crisis came, the serious limitations of existing economic and financial models immediately became apparent.

⁷See Trichet (2010).

Arbitrage broke down in many market segments, as markets froze and market participants were gripped by panic. Macro models failed to predict the crisis and seemed incapable of explaining what was happening to the economy in a convincing manner.⁸ As a policy-maker during the crisis, I found the available models of limited help. In fact, I would go further: *in the face of the crisis, we felt abandoned by conventional tools.*

As a matter of fact, we were put in a situation where the absence of clearer guidance from existing analytical frameworks pushed policymakers to place particular reliance on their experience. Experience and judgment inevitably played the key role.

In exercising our judgment, we were undoubtedly helped by one area of the economic literature: historical analysis. Historical studies of specific crisis episodes highlighted potential problems which could be expected.⁹ And they pointed to possible solutions.¹⁰ Importantly, the historical record was useful to suggest what mistakes to avoid.¹¹

But relying on judgment alone inevitably involves risks. We are always in need of macroeconomic and financial models to discipline and structure our judgmental analysis. How should such models evolve?

As I have said on various occasions, the key lesson I would draw from our experience is the danger of relying on a single tool, methodology, or paradigm. Policymakers need to have input from various theoretical perspectives and from a wide range of empirical approaches. Open debate and a diversity of views must be cultivated—admittedly not always an easy task in an institution such as a central bank. I don't think we need to throw out our DSGE and asset-pricing models; rather, we urgently need to develop complementary tools to improve the robustness of our overall framework.

Which new avenues are most promising? Let me mention three important directions that may have been neglected by the literature before the start of the crisis.

⁸See, for example, Caballero (2010).

⁹See, for example, Reinhart and Rogoff (2010).

¹⁰See, for example, Jonung (2009).

¹¹For an example of the guidance offered by economic history, see Bernanke (2000).

First, we have to think about how to better understand and characterize the “homo economicus” at the heart of any model. The atomistic, optimizing agents underlying existing models do not capture behavior during a crisis period. We need to deal better with heterogeneity across agents and the interaction among those heterogeneous agents. We need to entertain alternative motivations for economic choices. Behavioral economics draws on psychology to explain decisions made in crisis circumstances.¹² Agent-based modeling dispenses with the optimization assumption and allows for more complex interactions between agents.¹³ Such approaches are promising.

Second, we may need to consider a richer characterization of expectation formation. Rational expectations theory has brought macroeconomic analysis a long way over the past four decades. But there is a clear need to reexamine this assumption. Very encouraging work is under way on new concepts, such as learning¹⁴ and rational inattention.¹⁵

Third, we need to better integrate the crucial role played by the financial system into our macroeconomic models. One approach appends a financial sector to the existing framework,¹⁶ but more far-reaching amendments may be required. In particular, dealing with the non-linear behavior of the financial system will be decisive, so as to account for the procyclical build-up of leverage and vulnerabilities.¹⁷

These are, in my view, research avenues of rich potential.

In this context, I would very much welcome inspiration from other disciplines: physics, engineering, psychology, biology. Bringing experts from these fields together with economists and central bankers is potentially very creative and valuable.¹⁸ From that standpoint I consider the conference “New Directions for Understanding

¹²See, for example, Diamond and Vartianien (2007).

¹³See, for example, Le Baron (2000).

¹⁴See Evans and Honkapohja (2001).

¹⁵See, for instance, Sims (2003) and Mackowiak and Wiederholt (2009).

¹⁶See Christiano, Motto, and Rostagno (2003).

¹⁷See Geanakoplos (2010).

¹⁸One example of such interaction was the conference “New Direction for Understanding Systemic Risk” organized by the Federal Reserve Bank of New York and the U.S. National Academy of Sciences in May 2006 (see the proceedings reported at www.newyorkfed.org/research/epr/2007n1.html).

Systemic Risk” organized by the Federal Reserve Bank of New York and the U.S. National Academy of Sciences in May 2006 as a seminal one. The ECB, for its part, has given the same attention to the cross-fertilization between economics and other fields of science as I suggested on several occasions, including at the ECB November 2010 Central Banking Conference. Scientists have developed sophisticated tools for analyzing complex dynamic systems in a rigorous way.¹⁹ These models have proved helpful in understanding many important but complex phenomena: epidemics, weather patterns, crowd psychology, magnetic fields, phase transitions. Such tools have been applied by market practitioners to portfolio-management decisions on occasion with success. I am hopeful that central banks can also benefit from such insights in developing tools to analyze financial markets and monetary policy transmission.

An important perspective that researchers in other fields bring to economics is a focus on identifying the features that explain economic systems *as we know them*. A large number of aspects of the observed behavior of financial markets are very hard to reconcile with the efficient markets hypothesis,²⁰ at the heart of most conventional models.²¹ Of course, establishing what the key features are remains an unresolved and difficult problem.²² But I am convinced that a determinedly empirical approach—which places a premium on inductive reasoning based on the data, rather than deductive reasoning grounded in abstract premises or assumptions—lies at the heart of these methods. In operationalizing these insights, simulations will play a helpful role.²³ Using such approaches can help deepen our understanding of market dynamics and the behavior of the economy.

¹⁹Such techniques rely on models built on the law of large numbers, exemplified by the statistical physics underlying modern thermodynamics, or on models that rely on advances in mathematical analysis, as embodied in hydrodynamics and turbulence theory. The main unifying theme is that a complex “macro” phenomenon is explained by postulating some simple behavior of a “micro” element (an atom, particle, or molecule) at the basis of the process under study and evaluating these postulates empirically using statistical and simulation methods.

²⁰See Fama (1970).

²¹See Farmer and Geanakoplos (2008).

²²See Bouchaud (2010).

²³See Bouchaud (2009).

A last remark on the new avenues for research, in light of the “second conjecture” I mentioned earlier: The global financial system has fundamentally changed over the last twenty to thirty years. All over the world, free movement of capital became the norm. Tradable securities have globally largely replaced bank credits since the end of the 1980s. Financial derivatives came into existence thirty years ago only to demonstrate very rapidly their immense potential in all segments of financial markets. Highly leveraged institutions became a significantly large and influential industry, starting from scratch at the end of the 1980s. And, to feed this sophisticated, highly integrated global network, a global industry of financial and economic communication—real time, twenty-four hours a day—has experienced a remarkable expansion. This was made possible, in particular, by the generalized adoption of market economy principles by an overwhelming majority of countries, and by the advances of technology, mainly information technology.

These structural changes have triggered a dramatic increase in interconnectedness of investors, savers, market participants, and all economic agents at the global level. One possibility is that there is a strong link between this concept of interconnectedness of a completely new nature and new emerging properties in the global economic and financial system: for instance, the extreme velocity of shocks transmission and the immediate spreading of global contagion following the bankruptcy of Lehman Brothers, mid-September 2008. That a “global sudden stop” could be triggered by a single, relatively modest, financial event is striking and still calls for convincing explorations.

It is with this in mind that one can read today the famous “beauty-contest” metaphor of Lord Keynes (1936):

It is not a case of choosing those (faces) that, to the best of our judgment, are really the prettiest, *not even those that average opinion really thinks the prettiest*. We have reached the third degree where *we devote our intelligences to anticipating what average opinion expects the average opinion to be*. And there are some, I believe, who practice the fourth, fifth and higher degrees. (emphasis added)

This suggestion that market participants are making their collective judgment through a sequence of thought experiments of first,

second, third, and so on “degrees” is rich and goes beyond the classical analysis of “speculation” and “animal spirits.” It introduces explicitly the concept of sophisticated behavioral correlation. But let us imagine that at times, particularly in times of acute crisis, the Keynesian “intelligences” would not concentrate on the price of a particular asset but on the threat of a systemic risk. Then the theoretical issue would not be anymore the convergence of the herd of market participants on a particular price. The systemic solidity or fragility of a sub-system of global finance or even of the system as a whole would be assessed by highly correlated intelligences *anticipating what average opinion expects what average opinion expects the average opinion to be* (to quote the fourth degree of Lord Keynes!).

In some circumstances in crisis periods, the network of very highly correlated agents going through the sequence of Keynes’s “degrees” could give a very abrupt response to the question on the systemic stability of the financial system. They could simply converge on a yes or no response. We recently learned the hard way—in particular, in 2008—that a “no” response was possible.

As mentioned before, it is urgent that academia elucidates such new properties of the global financial system, amongst many others, to make progress in understanding what has happened in the unfolding of the crisis. Even more importantly, research should strive to identify appropriate ways and means to contribute to systemic stability without having recourse to massive public unconventional actions, decided by central banks and by governments, that appeared necessary in the course of crisis.

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