Derivatives and Monetary Policy

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I. Central Banking and Derivatives

A widespread perception within the financial community is that central banks deal with derivatives more or less exclusively in the context of oversight. Their policies may be microprudential, in the form of capital adequacy rules for market risks, or may be macroprudential, with a view to counteracting market fluctuations or even systemic risks. Spectacular cases, such as Barings a year ago, reinforce such an impression that central banks focus on oversight when they talk of derivatives.

In addition to prudential aspects, some smaller central banks have gained first-hand experience with derivatives when trying to manage their exchange reserves professionally; this, of course, is a purely commercial function which may be significant in a number of individual cases, but it is not the core concern of a central banker. Only recently did major central banks begin to pay more attention to derivatives in the context of monetary policy. In the case of the Bundesbank, most research work is no older than two years.1 In November 1994, the Eurocurrency Standing Committee of the central banks of the Group of Ten countries published a report, "Macroeconomic and Monetary Policy Issues Raised by the Growth of Derivatives Markets."2 This report is certainly a very good first step towards a better understanding of derivatives and their impact in today's financial environment, but it serves as a starting point only. Further studies of the impact of derivatives on monetary policy will be crucial, given the exploding size of derivatives markets today.
A recent survey by the BIS revealed previously unheard-of orders of magnitude. If one adds up OTC-traded derivatives and exchange-traded products, the outstanding volume approaches 60 trillion dollars, and daily turnover averages two trillion dollars. Although these figures may be rough and imprecise, they vastly exceed previous "guesstimates," and merit much closer attention in the future. Needless to say, additional surveys are needed and are likely to be produced.

Issues arising in the interaction of derivatives and monetary policy can be divided into four categories:

- First, various aspects of the transmission mechanism for monetary policy and the way that it can be affected by derivatives—the most complicated aspect of derivatives and the focus of the Eurocurrency Standing Committee's attention.
- Second, the question of whether derivatives influence monetary targeting and, if so, how.
- Third, how derivatives provide monetary policy-makers with information about market expectations, which would be unavailable, or at least of a lesser quality, without derivatives.
- And finally, the issue of using derivatives operationally for monetary policy purposes.
II. Implications of Derivatives for the Transmission Mechanism of Monetary Policy

The goal of monetary policy is to attain a stable price level by providing the necessary liquidity at appropriate interest rates in order to ensure non-inflationary growth in the economy. The intentions and actions of monetary policy are transmitted into the economy largely through the financial sector. The level of interest rates and expectations about their future course affect the real economy at various levels. The cost of credit for investment or consumption is, for the most part, the focus of attention, but one must also bear in mind that the savings rate is affected by interest rate levels and, last although not least, that the exchange rate of a given country is exposed to interest rate differentials and expectations about their future development.

Given the important variances among financial structures in various countries, the transmission mechanism is certainly not the same everywhere and is subject to structural changes as well. In Germany, long-term interest rates are of greater concern than in many other countries.

In countries where traditional correlations between the money supply and developments in the real economy have broken down, central banks must pursue targets other than the money supply—in practice, principally inflation targets. In Germany, the traditional correlation seems to remain largely intact, albeit with considerable limitations and in a more medium-term context. In this case, the central bank can and does continue to use the money supply as an
indicator for the degree of tightness of monetary policy as well as an intermediate target between interest rates and the price level of the real economy.

As for derivatives, in spite of their huge volume, little is known about how they affect the transfer of monetary policy to the real economy. This may be disappointing but should not come as a surprise, given how little empirical evidence is available on the transmission mechanism itself. While this shortcoming precludes definitive conclusions, it does not preclude some tentative observations.

Transmission through Interest Rates. Owing to their low transactions costs and the fact that they contribute to the perfection of financial markets, derivatives increase the speed of portfolio adjustments and thus lead to the faster transmission of interest rate changes or shifts in expectations. In other words, they provide inexpensive and efficient transportation of information on our modern and globalized highways of capital movements.

On the other hand, financial derivatives are also perfect instruments for use by individual market players to shield themselves against unwanted changes in interest or exchange rates, at least for a while. This applies to both the financial and the real sectors of the economy, which can now separate the interest rate risk of an investment from its production risk. But only in theory could widespread and systematic use of derivatives shift market price risks from one area of the economy to another or from one place in the world to another, which might, in turn, affect the marginal propensity to consume or to save.

In the light of what is known about the use of derivatives, it is not likely, at least not in Germany, that such radical shifts in the ownership of market price risks have occurred. More pointedly, even if the entire domestic economy buys insurance from abroad against market price risks in order to protect itself against its own central bank, it will sooner or later be exposed to the changes engineered by monetary policy, because the insurance obtained through derivatives will expire eventually and because monetary policy so heavily influences the cost of that insurance.

On the contrary, in ever more perfect financial markets, with the use of subtle means a credible central bank may exert the same pressure it did in the past when using "noisier" measures. This is because, owing to derivatives' low transactions costs, market players may even profit from driving prices and rates—which only deviate slightly from the levels desired by the central bank—back to where "they belong."
Transmission through the Exchange Rate. In addition to the interest rate channel, which seems not to be greatly influenced by the growing use of derivatives, these financial instruments may also affect the exchange rate channel. This especially holds true for wide-open economies such as those of the European Union member states, whose ratio of exported goods and services to gross domestic product roughly ranges from one quarter to three quarters, as they are firmly set in a system of more or less de facto flexible exchange rates within the EMS and even de jure flexible exchange rates with the rest of the world.

Unfortunately, the impact of derivatives on this transmission channel cannot reliably be judged, as the “all-other-things-being-equal” condition has never really been in place. Alongside the increasing use of derivatives, the environment for European exchange markets has been changing fast over the last three to five years. The environment has changed from narrow bands to wider bands, or no bands at all, from a very restrictive stance of monetary policy to a quite relaxed one, from belief in “no further changes in central parities” in early 1992 to a de facto floating regime today. It has changed from an ERM where the Maastricht Treaty was virtually ignored to a situation where European Monetary Union seemed virtually certain and approaching quickly, back to where financial markets were more and more in doubt and, now, where markets anticipate EMU as increasingly likely.

Under these circumstances, we must rely on anecdotal evidence as to how institutional investors and the real sector of the economy make use of derivatives and the extent to which this differs from the techniques of hedging or speculating on the “traditional” forward market. Despite theories that derivatives alter substitution, income and profit occurring when exchange rates move, the means to measure their effect remain undefined. It is safe to assume that, even in the total absence of derivatives, financial markets would seek other instruments—possibly less efficient and more expensive ones—to achieve the same effects.

A different issue arises under a regime of truly fixed exchange rates because, by definition, the “exchange rate channel” does not exist. In this situation, the issue is not monetary policy in its very narrow sense but whether derivatives weaken or even undermine central banks’ ability to defend fixed exchange rates? The answer is: technically, yes; politically, no.

In a world with futures and options, it is much easier to engage in “short positions” vis-a-vis a particular country’s currency, even if the seller in this instance has no relationship to that country. As
As an example, the seller may enter an options exchange and buy put options in large quantities. In a world without derivatives markets, it would be more burdensome, costlier and less efficient to take such "speculative" positions.

But it would be intellectually and politically incorrect to jump to the conclusion that derivatives by themselves single-handedly destroy fixed exchange rate systems. Some observers, even in the political arena, depict derivatives as the principal villain in today's financial world. Financial markets, with a few exceptions, do not "attack" currencies and risk large amounts of money, unless they see reason for it. Only if markets sense that exchange rates are not sustainable will they take large positions. As much as derivatives may increase the leverage effect, they are, after all, merely an instrument and not the reason for taking a particular position. In other words, derivatives do not destroy fixed exchange rates, fundamental misalignments do.

Fixed exchange rates contribute to a very different kind of "transmission" of monetary impulses. In the presence of an anchor currency within a region of fixed exchange rates, monetary impulses emanating from the anchor currency's central bank will immediately be "transmitted" to other parts of the region.

The interdependence of interest rates world-wide has also been fostered to some extent by derivatives. In addition to increased professionalism and an enhanced role for institutional investors, derivatives enable fund managers to invest in one country's bond or stock market in the absence of an open position in that currency. Interest rate arbitrage may thus be a simple calculation comparing nominal interest rates minus insurance costs provided by derivatives to exchange rate risks.

Transmission through Bank Credit. Whereas there is no empirical evidence that derivatives have a serious impact through either interest rate or exchange rate channels, some analysts claim the existence of a separate "credit channel" that is subject to central bank control. This view assumes that, at times, there will be no adequate substitute for bank credit in financial markets. When interest rates rise, banks may prefer investments in risk-free securities over bank credit, thus creating some form of "credit crunch."

But a central bank could only use this credit channel to influence the volume and structure of bank credits if it were able to control credit costs or the relevant risk-free interest rate. At least in Germany, where long-term credit plays a significant role, there is strong
reason to doubt the existence of a separate credit channel, given the Bundesbank's inability to directly control long-term interest rates. Experience shows that a central bank which enjoys sufficient credibility in financial markets may even cause long-term rates to fall when raising short-term rates.

However, it is not always known a priori whether this will be the market's reaction if the monetary reins are tightened. Even in financial systems where such a credit channel may plausibly exist, derivatives would most likely tend to undermine it, given their ability to increase markets' perfection and thus their capacity for substitution. This suggests greater significance for the "interest rate channel" than a "credit channel."
III. Derivatives and Monetary Aggregates

There is one area where derivatives pose a serious challenge to the conduct of monetary policy, at least for a central bank like the Bundesbank that employs monetary targets. The intellectual starting point for monetary targeting is the distinction between money and capital. Whereas the former represents the potential demand for goods and services, the latter is safely locked away from consumption and bears no inflationary threat. This important segregation between money and capital—between M3 and the rest—becomes increasingly blurred when derivatives help to create synthetic financial products. For instance, a six-month time deposit should no longer have the same classification on the money-capital spectrum if it is matched by a long position in ten-year government bond futures.

Apart from an increased degree of professionalism and a shorter time horizon for fund managers in general, the growing use of derivatives may thus eventually contribute to destabilizing broader monetary aggregates. For the time being, however, it is still too early to pass final judgment.

But even today, monetary targeting is challenged, although derivatives are not the single most important source of concern. That challenge comes from the increasing degree of remuneration for all non-cash components of the money stock. This is already weakening the inverse relationship between short-term interest rates and monetary aggregates (i.e., negative interest rate elasticity). If that negative elasticity were to weaken much further, let alone to become positive, monetary targeting would encounter serious
difficulty. Changes in short-term interest rates would provoke the opposite of what is desired: raising interest rates would cause monetary aggregates to rise even faster, and vice versa.

This is not an idle worry. Germany's experience over the last two years suggests that this development may already be underway. And this phenomenon is more likely to occur during times when the yield curve is inverted.
IV. Derivatives and Their Information Content for Monetary Policy

A discussion of how derivatives influence the environment in which monetary policy is conducted leads naturally to the question of how central banks can make use of derivatives to improve monetary policy.

Faced with financial markets in which expectations play an increasingly influential role, it may be useful for monetary policymakers to exploit the information contained in derivatives prices. However, central banks must be careful to avoid making this information a guideline for action as this would simply fulfillment of market expectations. Nonetheless, it is quite useful to analyze expectations in order to determine if they are in line with one’s own intentions. If there is a substantial degree of divergence between the two, the central bank does not necessarily have to adjust its policy but can instead provide sufficient and unambiguous signals in order to avoid unnecessary “hiccups”.

A standard procedure for gauging market sentiment is to monitor futures or other forward-type derivatives. Provided that market players are neither risk-averse nor risk lovers—financial economists refer to a “risk-neutral” world—the prices of these instruments represent the market participants’ current expectations, on average, regarding the future value of the underlying instruments. However, illiquidity premiums, term premiums or risk premiums may prevail. In that case, the implied forward rates or prices should not be taken at face value but rather as (slightly biased) ballpark figures for true expectations.
In order for changes in forward prices or rates to be interpreted as changes in expectations, factors which vary significantly over time should be eliminated. Standard futures contracts skew the data because of their varying expiration dates, becoming shorter by the day, and thus “polluting” the information obtained. Forward-type derivatives, on the other hand, have the advantage of standardized maturity dates. Thus the data problem with futures can be avoided by monitoring only forward-type derivatives with constant maturity dates, which also permits the creation of continuous time-series.

As for the money and foreign exchange markets, this implies that forward-rate agreements, or traditional forwards, rather than futures on the respective underlying instruments should be monitored. In bond markets, unfortunately, there are no sufficiently liquid forward-type instruments other than bond futures. Overall, international analysis on money-market spreads focuses to much too large a degree on futures. But even forward-type derivatives merely generate point estimates of the market’s risk assessment and only tell part of the story which derivatives can reveal.

Options open the door to a new dimension in expectations. When analyzing option premiums, it is possible to measure the uncertainty that the market attaches to its own expectations. Currently, there are three methods of extracting such information. First, for most relevant options, it is possible to use a Black-Scholes-type option-pricing model to calculate implied volatilities. This model, named for the two American economists who devised it, attempts to calculate the “fair” price of an option. The model operates on the assumption that, although the future value of an option’s underlying price is not reliably predictable, one at least knows the rules governing how the underlying price will evolve over time and what specific outcomes will likely occur. Under this system, it should be possible to calculate the expense involved for the writer of an option in hedging against unfavorable price movements and thus to infer the option’s value from this.

To be precise, the Black-Scholes model requires that the underlying price is based upon a log-normal distribution, which is determined by price volatility and a limited number of readily-observable variables. Thus, it is possible to determine the option’s value once the (future) volatility is known or to calculate the volatility which is implied by a given option premium. In some instances, it is not even necessary to do the translation. On the foreign exchange market, for instance, option premiums are not quoted in, say, D-mark or dollars but as implied volatilities.
However, these figures can reliably represent the market's expected volatility only if certain crucial assumptions of the Black-Scholes model hold—for instance, normal distribution of daily returns. But this is not always the case, as the so-called "volatility smile" shows. Thus, market participants use the Black-Scholes model more as a kind of common language than as an exact method of pricing options, which is why implied volatilities only represent crude proxies of the market's risk assessment.

A second method of extracting risk assessment information is to look at the prices of risk reversals on the foreign exchange market. The price of a risk reversal is the difference between the price of an option to buy a currency at a price above its expected value far in the future (i.e., a long, "out-of-the-money" call) and the price of an option to sell that currency at an earlier date at a rate below its projected value that is equally out of the money (i.e., a short, "out-of-the-money" put). If the risk reversal price is positive (i.e., the option to buy later is worth more than the option to sell sooner), the market expects the call to be of more value than the put. Loosely speaking, this implies that the market attaches a greater probability to a large rise in the exchange rate than to a comparable drop. This means that prices of risk reversals contain information on the tails of the probability distribution that market players deem to reliably describe the underlying exchange rate's behavior.
V. Can Central Banks Use Derivatives in their Operational Framework for Monetary Policy?

There is clearly scope for central banks to use derivatives in their commercial operations. For example, it may make sense to include derivatives in the management of exchange reserves for the purpose of protecting that portfolio against various types of market-price risks. Or a central bank might want to write options on its foreign exchange holdings simply as a means of generating additional income. For purposes of this discussion, however, all areas of central banking that are not directly related to the conduct of monetary policy will be disregarded.

A number of years ago, the Bundesbank, in connection with its role as the "fiscal agent" of the Federal Government, discussed the efficacy of using interest rate futures. The Bank quickly arrived at the conclusion that buying or selling futures contracts does not put paper into the market. And even if futures could be used for the purpose of "smoothing prices" for the issuer, the Bank would soon become an ordinary market player among many and, additionally, would "pollute" the information contained in such prices.

In either event, the markets would mistake the central bank's actions in the futures market as being driven by monetary policy considerations, and/or the information contained in the price movements of the long bond would be distorted by the central bank itself. This argument, of course, is valid against every type of intervention in the derivatives market. In particular, in the case of a very important central bank, any action might be misinterpreted.
as a constant barrage of signals to the market, which, in turn, will then canvass these signals for clues as to the central bank’s intentions.

There are a number of additional reasons for doubt regarding use of interest-rate-related derivatives for monetary-policy operations. If a central bank were to operate, for example, in three-month futures contracts with the purpose of achieving a particular short-term interest rate level, it would move about in an area of the yield curve over which it has little direct influence. Unlike the situation in the overnight market, it has no monopoly of three-month interbank funds or of three-month interest rate futures. It is therefore by no means certain that a central bank could “control” that part of the yield curve at any given moment, short of investing huge sums of money.

Initially, of course, the signaling effect of intervention in the futures market would be tremendous, and would certainly accomplish its purpose quickly and efficiently. After some time, however, this effect would be diminished and give way to the negative consequences mentioned above.

A more fundamental reason for avoiding use of interest-rate-related derivatives is that a central bank will have to continue to intervene in the overnight money market for a great many reasons. In other words, it would operate in at least two different areas of the yield curve. Some suggest that a central bank should engineer a particular yield curve structure that is best suited to the economic situation at a given moment. That is problematic not only because of doubt about a central bank’s ability to achieve a particular yield-curve structure in today’s world of globalized financial markets, but also because it is practically impossible to say how the yield curve should be shaped in a particular situation.

Even if there were to be a clear relationship between the real economy and a particular yield curve, that curve might quickly be destroyed when it is exploited for monetary policy purposes. It is obvious, therefore, that a practitioner will find no convincing solutions.

At least some central banks have contemplated the use of derivatives—that is, options—in the exchange markets to defend certain parities. In comparison with cash market interventions, they would have the advantage of initially not changing the volume of reserves, and warranting no sterilization in the money market. And they should have more of a lasting effect than outright purchases or sales of the underlying instruments, given the counterparty’s continuous need for hedging. In a nutshell, central banks would
signal their ideas about prices and volatilities in a much more sophisticated way.

On the other hand, if things went wrong, the losses incurred by the central banks would be much higher, with a resulting impact on their credibility. And, of course, signaling very precise ideas about appropriate rates in the exchange markets presumes precise intentions on the part of central banks. This is only true if central banks have to defend precise parities.

But, apart from these more technical considerations, there is some question as to the usefulness of extensive exchange market intervention in the first place. If markets consider rates to be unsustainable, interventions will be of little or no help, be they in the cash market or in the options markets.

Admittedly, the Bundesbank did at one point use options to defend parities, without earning any option premiums and without advising the markets, because it did not know it was doing so.

A fixed exchange-rate system with narrow bands, such as the ERM prior to August of 1993, operates like a gigantic options scheme. When central banks publicly declare their willingness to buy or sell currencies to the entire global financial system in unlimited amounts at preannounced rates, they are, for all practical purposes, writing "options"—either calls or puts, depending on whether their currency is considered weak or strong. The preannounced intervention point is the "strike price" at which central banks, as the writer of the option, have to buy or sell.

In a system of narrow exchange-rate bands, like the 2.25 percent bands of the ERM before August 1993, the likelihood of a central bank having to intervene was, of course, far greater than in today's situation with fluctuation margins of 15 percent. Thus, the "options" written by central banks in the period of narrow bands, for all practical purposes, moved more easily to the point "at the money" than is the case today. Such options, for which the private financial community never had to pay any premiums, have their value further enhanced because they always retain some time value, given the lack of an "expiry date" on the central bank's willingness to defend a certain parity.
VI. Conclusions: Do Derivatives Profoundly Change the Life of a Monetary Policy Maker?

While derivatives contribute to the faster transmission of monetary policy impulses to nearly every segment of the financial sector, they do not seem to have any visible adverse effect on the transmission mechanism of monetary policy. However, further studies in this area will be necessary.

As European economies open up and financial markets become ever more integrated, derivatives will play an increasingly important role. However, they will shield market players only temporarily against the effects of shifts in monetary policy or exchange rates.

Given the aforementioned constraints on central bank intervention within narrow bands, a somewhat radical conclusion must be drawn for Europe. If convergence—in its widest sense—is lacking, rigid exchange rates and narrow bands will be unsustainable no matter what the extent of structural integration. If, on the other hand, there is a high degree of convergence, narrow bands, etc., will be unnecessary, and countries should move directly to monetary union.

A significant impact of derivatives may be in the area of monetary aggregates, a key strategic variable for the Bundesbank so far. If the use of derivatives were to spread substantially further among non-banks, it could eventually result in M3 losing its capability of serving as an intermediate target.

In addition, derivatives are a major source of market information. If the information about market expectations contained in derivatives reveals a large degree of disagreement with the intentions of the
central bank, specific communication on the part of the central bank is called for. If markets read their intentions well, little communication by central bankers is necessary. Operational use of derivatives only makes sense in the commercial areas of central banking, such as the administration of exchange reserves.

All in all, there is no mystery to derivatives, in spite of the huge turnover and stocks outstanding. They do not lead a life independent of other markets or of expectations created and constantly influenced by policymakers of all kinds. The very term "derivative" denotes something that is based upon an already-existing market or measure.

Derivatives, however, do provide "highways" for professional fund managers to allocate their capital around the globe and to take positions in all sectors of the financial markets with the accuracy of a surgeon. And just as surgery does not replace prior diagnosis or subsequent treatment, derivatives will neither replace accurate analysis nor impede the implementation of sound financial and monetary policies.

Yet clearly derivatives are powerful "instruments of influence" that provide private-market players with additional resources less readily available to governments. They are, to that extent, a truly liberal influence of which any civil liberties movement could be proud. If money is "minted freedom" for the individual, then derivatives are multipliers of freedom which contribute to private investor mobility beyond government influence.

That very mobility can be a positive influence on public policy by compelling governments and central banks to face the challenges of competing currencies. Derivatives may serve to limit time spent in pursuit of ill-advised economic policies. In other words, they help to increase competition among central banks and their currencies to produce greater monetary stability in the interest of noninflationary growth. So, in a way, they reward sound economic policies with economic growth.
End Notes


5 If the Black-Scholes model and its assumptions were to describe reality reliably, all the volatilities implied in option premiums within one maturity class should be the same, regardless of the options’ strike prices. However, in practice, the implied volatilities do differ across strikes and increase the more in the money or out of the money the options are. Plotting the implied volatilities with respect to their strike prices yields a curve that assumes the shape of a smile, thus the notion of a "volatility smile."
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