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Central Banks Use of Derivatives and Other Contingent Liabilities: Analytical Issues and Policy Implications

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Abstract

Whereas some central bank derivatives and other contingent liabilities arise from anomalous circumstances, there are a number of positive reasons that explain their popularity. After analyzing the rationale for these operations, we stress that most of these operations, being off-balance sheet, increase the risk and reduce the transparency of central bank accounts. This in turn makes more difficult the assessment of the financial position of the monetary authority and, by implication, of the macroeconomic conditions of the country. To deal with this issue, we suggest a comprehensive portfolio approach that values, in an economic sense, all assets and liabilities of the central bank.

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Contents Page

I. INTRODUCTION

While central banks have frequently undertaken contingent commitments as part of their regular operation in the economy, it is only recently, through central bank involvement in the derivatives markets, that these transactions have drawn the attention of policy makers, market participants, and international agencies. This renewed interest and the fact that these contingent operations came to light in the aftermath of the Asian financial crisis, increased the interest in the analytics and the measurement of these commitments.

The goal of this paper is twofold. First, to explore the rationale for central banks to undertake these types of commitments—in particular to intervene in derivative markets—and to assess the arguments that are commonly made in favor of and against this sort of involvement. Second, to suggest a methodology to analyze the whole spectrum of central bank contingent liabilities. Specifically, we aggregate all on and off-balance sheet transactions in a single framework so as to be able to draw meaningful conclusions on the consequences of these central bank operations on a number of important policy issues such as the volume of central banks' available reserves, the potential burden arising from instability in the banking sector and the overall solvency of the central bank.

The paper is organized as follows: Section II briefly classifies the different types of contingent liabilities that central banks typically undertake. Section III discusses the rationale for central banks' operations involving contingent liabilities and discusses some of the advantages and disadvantages of these operations. Sections IV and V apply general finance principles to the problem of valuation and aggregation of the risk arising from contingent liabilities. Section VI concludes with some policy implications.

II. CENTRAL BANK CONTINGENT LIABILITIES: CLASSIFICATION

Contingent liabilities are financial commitments that are triggered by the occurrence of an event whose realization is uncertain. This could include a change in valuation and prices of financial assets, a bank failure, a natural disaster, etc. The general definition of central bank contingent liabilities coincides with the standard concept used to classify government contingent liabilities in the context of the fiscal accounts. However, there are a number of distinctive central bank commitments that require a specific conceptual treatment. Moreover, the *concrete quantitative valuation* of certain types of central bank obligations requires a special analytical approach.

A point that is important to stress at the outset is the analytical distinction between the lack of proper economic accounting of some assets and liabilities—that would result in off-balance-sheet items (such as implicit credit subsidies)—and the conceptual and practical consequences of contingent assets and liabilities, i.e., the management of items in the balance sheet that have an uncertain value because their financial implications hinge on the realization of conditions which depend on future uncertain events (such as the provision of credit guarantees).

Typically, contingent central bank liabilities can be divided into ***implicit*** and ***explicit*** categories, depending on whether or not they arise from a legal and/or contractual source. **Explicit** central bank contingent liabilities arise from formal statements in regulations or from contracts entered by the central bank with specific counterparties and can be divided into three types:

1. Liabilities that arise from formal central bank commitments to support the soundness of the banking sector. This includes the provision of liquidity to individual institutions (the central bank's role of lender-of-last-resort), as well as the provision of specific deposit and other guarantees;

2. Liabilities created by central bank operations in non-spot foreign exchange and other financial markets. Specifically, when central bank intervention takes place *in derivative markets,* these operations give rise to potential gains and losses that are contingent both on the state of the world and on other central bank actions. These types of operations could be a very important source of contingent liabilities since they include not only straight intervention in the markets for forward, futures, options, and currency and interest rate swaps, but also monetary operations involving foreign-exchange swaps and repurchase agreements (repos). It should be mentioned, however, that the focus of contingent liability analysis is on the use of derivatives as *policy tools*, i.e., operations designed to influence variables such as the exchange rate or the interest rate. In particular, currency forwards and options and foreign exchange swaps can be used as instruments in the foreign exchange market to affect the exchange rate, while repurchased agreements can be used in the money market to influence the interest rate. This should be stressed, in order to distinguish these operations from the use of derivatives undertaken as part of the routine central bank management of its own foreign exchange reserves; and

3. Other potential guarantees to private sector activities, such as guaranteed repayment of directed credit to selected sectors, export and investment guarantees, etc.

Among the **implicit** central bank contingent liabilities, the most salient is the commitment of central banks to assure the *systemic* solvency of the banking (and financial) sector, over and above the explicit commitment to provide liquidity to individual institutions and to guarantee certain types of deposits and/or other private sector bank assets. These would include the provision of financial coverage over and above the legal guarantee scheme and the bailout and re-capitalization of banks and non-bank financial institutions.

It could be argued that certain macroeconomic central bank commitments such as the preservation of a stable exchange rate regime or, more generally, the attainment and maintenance of price stability should also be considered, in themselves, implicit contingent liabilities and, consequently should also be subject to quantification. While in principle this would seem consistent with the general framework here suggested, we submit that they should not be part of the same analytical framework. This is so because the financial consequences of the event (i.e., deviations from implicit central bank policy targets) are hard, if at all possible, to quantify as they can give rise to numerous types of responses. We

postulate, therefore, that it is only *when specific policy actions can be taken to protect the implicit commitment* and they are embedded in legal norms (such a stock of repo transactions or forward exchange market operations) that they should be considered part of the framework suggested here.

III. The Rationale for Central Bank Operations Involving Contingent Liabilities

The rationale for the involvement of central banks in activities that result in contingent liabilities varies according to the type of operation concerned. Much has been written about the reasons that motivate central banks to assume specific commitments to strengthen the soundness of the financial markets, e.g., about the role of the central bank as a lender-of-last-resort or the rationale for deposit insurance. The main arguments in favor of these institutional devices include the illiquid nature of banks together with the potential for systemic risk (Diamond and Dybvig, 1985) and the existence of asymmetries of information and the protection of the small depositor (Tirole and Dewatripont, 1994). Similarly, the issuing of guarantees for private sector activities has also been the subject of abundant inquiries. In general, the view is that those guarantees are, in fact, of a clear quasi-fiscal nature, and therefore their rationale is of a fiscal nature too. In particular, central banks may be induced to undertake these types of operations to hide undesirable budget outcomes from public scrutiny.

What has been much less well-researched is the rationale for central bank intervention in derivative markets. Therefore, in what follows, we develop in more detail the main arguments that could be used to justify the implementation of these operations.

In general terms, it is possible to assert that central banks tend to engage in derivative operations for the following reasons: (a) to provide additionality to incomplete or illiquid markets; (b) to defend a fixed exchange rate regime or an exchange rate band; (c) to alleviate the conflict between the defense of an exchange rate regime and the stability of the financial system; (d) as an automatic stabilizer of the foreign exchange market; and (e) as an alternative instrument for monetary management under some specific circumstances.

a. To provide additionality to incomplete or illiquid markets. In many countries, the derivative market is not deep enough, and therefore does not provide the range of necessary instruments for appropriate hedging and risk management. In these circumstances, the rate of growth of the underlying market would tend to be lower than desired and central banks' provision of additional innovative instruments and liquidity could be seen as a means of developing both the spot and the derivative markets and of eliminating, or at least smoothing, volatility in the spot market.

b. To defend a fixed exchange rate regime or an exchange rate band. Central banks' engagement in derivative operations, including forwards and swap operations, have also been repeatedly used to reduce exchange rate fluctuations and, more specifically, to protect a fixed exchange rate regime or an exchange rate band. Central banks have two important reasons to

prefer this form of intervention over intervention in the spot market. First, derivatives allow the defense of the exchange rate without an immediate use of foreign exchange reserves and without an impact on the money supply. They are, therefore, similar to sterilized intervention, but they have, *ex ante*, an opposite, i.e., a positive, fiscal outcome.

Second, intervention in the derivative market is an efficient way of releasing some of the pressure that dealers and banks may exercise on the foreign exchange spot market at times of particularly heavy speculative stress. The reasons for this argument are as follows: during normal times, banks and dealers can easily find counterparts for hedging their foreign exchange operations. But at times of uniform expectations, when there is a widespread market belief that the exchange rate would likely change in one particular direction, they may find it difficult to hedge in the derivatives market. In the absence of agents that need to hold a natural long position in the domestic currency, banks and dealers may only be able to hedge synthetically.[1] While hedging synthetically could be, from the point of view of risk management, satisfactory for the dealers, it may create a problematic situation from the central bank's perspective that provides the motivations for stepping into the derivatives markets. Several of the major concerns that central banks have with synthetic hedging are of a particular interest. The first one relates to the impact of synthetic hedging on the foreign exchange **spot** market. Second, synthetic hedging can distort the response of agents to increases in the domestic interest rates.

(i) Impact of synthetic hedging on the spot market. Clearly, during times of turbulence in the foreign exchange market, it is reasonable to expect that a central bank committed to defend a peg would try to avoid additional selling pressures on the domestic currency. However, a dealer hedging synthetically will tend to do precisely that, by short-selling the domestic currency and using the proceeds to buy foreign currency. This would indeed put additional pressure on the spot market that can only be released by increasing the liquidity of the derivative market. A central bank's willingness to sell forward contracts or to write put options is therefore intended to provide dealers with appropriate hedges, removing in this manner the additional pressure that synthetic hedging exerts on the spot market. In other words, central

[1] In a synthetic hedge, dealers aim at replicating, with an opposite sign, the cash flows that emerge from the derivatives transactions in which they have committed. There are two cash-flows to hedge: (i) a long position in the weak currency equal to the total amount of their forward commitments plus their put options commitments times the probability that the put options will be exercised (the hedge ratio); and (ii) a short position in the strong currency. As can be easily seen, these two cash flows, with an opposite sign, can be easily replicated in the spot market by, for example, taking a loan in the weak currency and opening a deposit in the strong currency.

banks may intervene in the derivative markets to prevent speculation to spillover immediately to the cash/spot markets.[2]

(ii) Synthetic hedging and interest rates. Central banks are also interested in containing synthetic hedging since it is well-recognized that these type of operations tend to disrupt the typical central bank defense of a pegged foreign exchange system. Garber (1998) shows that an increase in the domestic interest rate results—for most spot and exercise prices, different assumptions on volatility and different maturity of put options—in an increase in the hedge ratio.[3] This means that an increase in interest rates **raises** the demand for foreign exchange in the spot market on the part of the synthetically hedged agents. Therefore, whether a higher domestic interest rate will succeed or not in reducing speculation, by inducing market participants to continue holding the domestic currency, depends on the relative importance of market agents that are synthetically hedging versus the rest of the market participants that are caught in the interest rate squeeze.

c. *To alleviate the conflict between the defense of a fixed exchange rate regime and the stability of the financial system.* The conflict may arise when expectations of devaluation accelerate, provoking a surge in capital outflows. Given the importance of banks in the intermediation of capital flows, the intensifying pressures in the foreign exchange market could result in serious liquidity problems for the banking system. These problems might be further complicated as the increase in the expected rate of devaluation will lead to higher domestic interest rates. The central bank, in its role as a lender-of-last-resort would tend to provide liquidity loans to banks that have experienced losses due to the higher interest rates[4] in the interbank market and/or to the fire-selling of bank assets when the interbank market dries. However, since lending of last resort cannot discriminate among banks with a legitimate liquidity problem of this sort and other banks that may attempt to borrow from the central bank in order to hedge or to speculate in the foreign exchange market, the provision of liquidity by the central bank may end up feeding the short-selling of domestic currency, increasing in this way the pressure on the foreign exchange market. In other words, central banks may prefer to step into illiquid derivatives markets in order to provide banks and dealers an alternative way to speculate, through forwards or options, without exerting further pressures on the foreign exchange spot market.

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[2] Examples of these interventions are the Bank of Spain intervention in the options (put) market during the 1992/93 ERM crisis and the Bank of Thailand sale of forward contracts in 1997.

[3] The hedge ratio measures the number of units of foreign currency that are necessary to hedge one option. It is also interpreted as the probability that the option will be exercised.

[4] When banks have positive duration gaps, an increase in interest rates will lead to bank losses.

d. As an automatic stabilizer of the foreign exchange market. An at the money (American or European) put option written by the central bank on the reserve currency provides an automatic stabilizer of the foreign exchange market.[5] When there is an inflow of foreign currency and the exchange rate appreciates, the put buyers exercise the option and deliver the reserve foreign currency to the central bank. This mechanism allows the central bank to accumulate reserves precisely when the foreign currency weakens and avoids the negative signaling effect of open central bank intervention in the spot market. The foreign currency reserves accumulated during such episodes of appreciation can be used to reduce outstanding foreign currency liabilities or, when there are pressures on the exchange rate to depreciate, to provide the additional supply required by the market.

e. As an alternative instrument for monetary management under some specific circumstances. Some arguments have also been voiced justifying the use of foreign exchange swaps as an instrument for domestic liquidity management. In particular, in countries running fiscal surpluses or where the outstanding stock of public—including central bank—debt is low, central banks may find it expensive (or disruptive) to inject domestic liquidity using repos based on domestic bonds. For that reason, some countries have resorted to the use of foreign exchange swaps, which are basically repos in foreign exchange currency, as a temporary mechanism to manage domestic liquidity.[6] These operations do not change the level of net international reserves but increase temporarily domestic liquidity.

There is, therefore, a positive policy rationale for central banks to accumulate contingent liabilities through derivative market intervention. However, these operations carry significant risks. Proliferation of contingent liabilities distort the financial statements of central banks and the solvency of the central bank can also be compromised by potential losses. Moreover, intervention in the derivative market may have serious drawbacks. They could be difficult to support when these markets are very thin and they are bound to result in a loss of the informational content that is provided by these markets. In addition, the ability to intervene in the derivative markets at a low cost, and the lack of a material constraint to the intervention levels, could lead to potential postponement of important policy decisions.

IV. VALUATION AND AGGREGATION

One of the main problems posed by contingent liabilities is the issue of how to record them and, in particular how to aggregate these contingent liabilities (that are by definition off-balance) with the on-balance central bank transactions for valuation purposes.

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[5] This is the case of the stabilization scheme adopted in Mexico in August 1996.

[6] The Reserve Bank of Australia has resorted to this mechanism with relative frequency. For example, the need to increase liquidity arising from the Y2K problem led to the doubling of the stock of outstanding forward obligations, matched by a similar increase in the total holding of official reserve assets.

A. Valuation

We propose here to use a portfolio approach to all central bank transactions, as the only way in which both on and off-balance transactions can be aggregated and can provide some meaningful information on variables such as a central bank's available reserves, the potential burden caused by preserving banking sector stability, and the overall solvency of the central bank. In a portfolio approach, transactions are aggregated according to their sign—short or long—and their value. The theory of financial instruments provides the necessary tools for pricing these transactions and therefore the procedures are not reviewed in detail here.[7] However, for illustration, and since there are some operations that are particularly relevant for central banks, we discuss here two specific cases: the value of a currency forward contract, and the value of a deposit insurance commitment. Then, we discuss some examples of proper aggregation in the central bank portfolio.

The value of a currency forward contract

The economic value of a currency forward can be derived from covered interest rate parity:

$$e^{-r_{d,o}} F_{o,T} = S_o e^{-r_{f,o}} \qquad (1)$$

where:

$F_{o,T}$ is the forward rate for the foreign currency, for maturity T, as of the day the contract is signed.

S_o is the spot rate for the foreign currency as of the day of the contract.

rd_o is the domestic interest rate as of the day of the contract.

rf_o is the foreign interest rate as of the day of the contract.

The meaning of (1) is that according to the covered interest rate parity, a forward contract can be viewed as two zero coupon bonds. The left hand sign of the equality represents a zero coupon bond denominated in domestic currency, with face value equal to the forward rate of the foreign currency for maturity T, as of the day of the contract, and with maturity T. The value of this zero is found by discounting the forward rate by the domestic interest rate. The right hand side of the equality represents a zero coupon bond denominated in foreign currency, with face value equal to one unit of the foreign currency (converted into domestic currency using the spot price of the day of the contract). The value of this zero is found by discounting the unit of the foreign currency by the foreign interest rate.

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[7] One of the many textbooks that have addressed this topic is Hull (1999)

We can now rearrange (1) in order to find the value of the forward contract any day after the contract was signed, as the difference between the value of the two zeros, i.e.,

$$e^{-r_{d,t}} F_{o,T} - e^{-r_{f,t}} S_t \neq 0 \qquad (2)$$

Equation (1) shows that the value of a forward, as of the day of the contract, is zero. But for any other day after the original date, the value of the forward contract in the book of the central bank is different from zero and can be determined by calculating equation (2) with information that is generally readily available.

Deposit insurance[8]

Following Merton (1977), a deposit insurance can be seen as the equivalent of a put option held by the banks and written by the central bank on each unit of bank assets, with strike price equal to the value of bank insured debts. The equation goes as follows: if banks become insolvent, the value of bank assets by definition is lower than the value of bank debts. Given limited liability for the shareholders, bank debts will suffer the full loss. But in the presence of deposit insurance, banks have the ability to "exercise the put option", i.e., they "sell" their assets (the underlying asset of the put) to the central bank and they get in exchange an amount equal to the face value of the insured liabilities (the strike price), which is used to pay for bank insured debts.

Following this equivalence the value of a deposit insurance, for each dollar of bank assets, is as follows:

$$G(T) = T\ Be^{-rt}\ \phi(X_2) - V\phi(x_1) \qquad (3)$$

where

$$X_1 = \left\{ \log(B/V) - (r + \frac{\delta^2}{2})^T \right\} / \delta\sqrt{T}$$

$$X_2 = X_1 + \delta\sqrt{T}$$

B = face value of bank liabilities (exercise price)

V = value of the banks' assets

δ = volatility of the banks' assets

T = maturity of bank liabilities

ϕ (.) = is the cumulative probability distribution function for a standardized normal variable, i.e., it is the probability that such a variable will be less than (.).

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[8] In some countries, the insurance fund is not part of the Central Bank accounts and consequently this example does not apply to those cases.

As Merton (1977) indicates, (3) can also be applied to value a government guarantee of loans made to private (financial or non-financial) corporations.

B. Aggregation

Based on the economic valuation of off-balance sheet contingent positions of the central bank, as illustrated above, all central bank transactions can be aggregated. We illustrate this procedure with examples of eight hypothetical central bank portfolios that are described in Table 1 and 2. Table 1 contains the basic information used to construct the balance and the off-balance sheet accounts of the assumed central bank together with the prices and interest rates that were used in order to value the positions. We chose the British Pound as the domestic currency and the DM as the foreign currency. Table 2 is an estimate of the portfolio values of the central bank positions and, from these economic—rather than accounting—values, the true valuation of the central bank equity is calculated. The economic values of the balance sheet items were calculated by converting all notional amounts into BP and discounting these amounts by the relevant interest rate. For the forward positions and the deposit insurance, we used the formulas described above.

The base case or case 1 is the simplest one, where the central bank issues monetary base in exchange for foreign reserves or domestic debt. In addition, there is a loan to the Treasury whose economic value is assumed to be zero.[9] Case 2 refers to a central bank that besides the activities of case one, is also active in the forward market for foreign currency. This central bank intervenes in the forward market in only one direction—it buys domestic currency forward. Case 3 is a base case where the central bank also provides deposit insurance to the banking system. Cases 4 and 5 are identical to case 3, except for the size of the banking system. In case 4, the assets of the banking sector are twice as large as in case 3; and in case 5, the bank assets are three times as large as case 3. Finally, case 6 combines the intervention in the forward market for foreign currency with deposit insurance.

It can be seen that the value of the portfolios, when properly accounted for the economic value of assets and liabilities, is negative in all cases and becomes more negative as contingent liabilities are added to the portfolio. The fact that the central bank equity is negative is not an anomaly. In fact, it is interesting to note that a central bank with negative economic equity is a likely outcome since the usual *accounting* approach to the value of central bank activities does not consider the economic value of explicit or implicit commitments such as deposit insurance guarantees and forward contracts. In addition, most central bank assets are registered at nominal values and are not economically valued (e.g., the probability of repayment of certain loans, the time value of domestic and foreign assets, and the credit risk of reserves invested abroad are not considered). The standard approach usually results, therefore, in an overestimation of central bank equity.

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[9] Under the assumption that the Treasury will not repay the loan, the discount factor is infinite.

Table 1. Data for the Calculation of the Value of Central Bank Portfolios

Balance sheet items:

Reserves are invested in a one-year zero coupon bond denominated in DM.
Face value of reserves: DM 118
Domestic Debt: BP 30
The central bank holds a loan against the treasury for BP30
Monetary base: BP100

Off-balance sheet items:

The central bank is short DM 30 in the forward market. The maturity of the forward is one year.
For the calculation of the deposit insurance guarantee, the following data was used:

- Bank leverage (Bank liabilities to bank assets ratio)= 0.8
- Volatility of bank assets (measured by the standard deviation of annual changes of the value of bank assets): 0.5
- X1 = 0.5964 *
- Value of one put = 0.0515

Prices:

Spot exchange rate. 1DM = BP0.338
Interest rate (BP) = 0.1000
Interest rate (DM)= 0.0839
Forward rate. 1DM = BP0.333

* See the formula in page 11 for an interpretation of this number.

Table 2. Central Bank Portfolios

Positions in the Central Bank Portfolio	Value
1. Base Case	
Foreign exchange reserves	BP36.9
Domestic debt	BP27.27
Long leg of forward	
Loan to treasury	0
Monetary base	BP100
Short leg of forward	
Financial sector guarantee	
Value of the Portfolio	BP –35.84
2. Base Case + Forward	
Foreign exchange reserves	BP36.9
Domestic debt	BP27.27
Long leg of forward	BP9.09
Loan to treasury	0
Monetary base	BP100
Short leg of forward	BP9.36
Financial sector guarantee	
Value of the Portfolio	BP –36.21
3. Base Case + Guarantee	
Foreign exchange reserves	BP36.9
Domestic debt	BP27.27
Long leg of forward	
Loan to treasury	0
Monetary base	BP100
Short leg of forward	
Financial sector guarantee (Bank Assets: BP400)	BP –20.62
Value of the Portfolio	BP –56.39

Table 2. Central Bank Portfolios

Positions in the Central Bank Portfolio	Value
4. Base Case + 2* Guarantee	
Foreign exchange reserves	BP36.9
Domestic debt	BP27.27
Long leg of forward	
Loan to treasury	0
Monetary base	BP100
Short leg of forward	
Financial sector guarantee (Bank Assets: BP800)	BP –41.23
Value of the Portfolio	BP –76.95
5. Base Case + 3*Guarantee	
Foreign exchange reserves	BP36.9
Domestic debt	BP27.27
Long leg of forward	
Loan to treasury	0
Monetary base	BP100
Short leg of forward	
Financial sector guarantee (Bank Assets: BP1200)	BP –61.85
Value of the Portfolio	BP-97.5
6. Base Case + Guarantee + Forward	
Foreign exchange reserves	BP36.9
Domestic debt	BP27.27
Long leg of forward	9.09
Loan to treasury	0
Monetary base	BP100
Short leg of forward	9.36
Financial sector guarantee (Bank Assets: BP400)	20.62
Value of the Portfolio	BP –56.76

Using a methodology based on economic valuation rather than on nominal accounts, we can also estimate the value of specific components of the portfolio. The following are some examples:

- In the case of portfolio 2, we could compute the value of reserves net of forward contracts (in domestic currency) as 36.90+9.09-9.36 = 36.36. It is easy to see in this example that as the domestic currency (the pound) depreciates in the spot market, the economic value of the reserves net of forward contracts decrease. The same happens if the interest rate in pounds increases. This takes place because the value of the long leg of the forward that is worth 9.09 in this example, decreases as the pound depreciates and the interest rate in pounds increases.

- The unit value (per unit of bank assets) of the deposit insurance is BP 0.0515. Notice, however, that the value of the insurance depends on the size of bank assets. When bank assets are BP 400, the insurance is worth BP 20.62; when bank assets are BP 800, the insurance is worth BP 41.23; and when bank assets are BP 1200, the insurance is worth BP 61.85.

The risk of the bank system also has an influence on the value of the contingent liability. To illustrate this point, we can think of a case of rapid deterioration in the quality of bank loans. The value of bank assets, adjusted by risk, goes down and the leverage ratio goes up, making the value of the central bank contingent liability higher.

V. Concluding Remarks

Central banks perform a large variety of operations that give rise to contingent liabilities, defined as financial commitments that are triggered by the occurrence of an event whose realization is uncertain. Since these operations cover a wide array of areas, the motivation for central banks to engage in these types of activities also arises from a myriad of reasons. We provide here a taxonomy to classify these operations and elaborate on their analytical aspects, as well as on the operational motivations that induce central banks to utilize these instruments.

We conclude that whereas some of the central bank contingent liabilities arise from anomalous circumstances,[10] there are a number of positive reasons that explain their apparent popularity. While some of these positive implications are well-recognized—particularly those that arise from the central bank role in guaranteeing the stability of the banking sector—the constructive aspects of central banks' involvement in derivative markets are less understood. We attempt here to provide a broader and more positive perspective, but at the same time, need to stress that since most of the operations that give rise to contingent

[10] Such as those that simply reflect quasi-fiscal operations transferred from the government budget to the central bank for purely political or "cosmetic" reasons.

liabilities also tend to be off-balance sheet, they reduce the transparency of central bank accounts. This in turn may result in serious problems regarding the proper assessment of the financial position of the monetary authority, and by implication, of the overall macroeconomic conditions of the country. We suggest, therefore, that a comprehensive portfolio approach, which values, in an economic rather than purely accounting sense, all on and off-balance sheet assets and liabilities of the central bank should be adopted. We provide some examples of how this could be done, particularly regarding some contingent liabilities that are characteristics of central banks.

While proper valuation and aggregation of central bank financial positions would solve some of the transparency problems posed by contingent liabilities, it should be pointed out that their presence in the central bank portfolio would also tend to increase financial risks. In addition to reducing, *ceteris paribus*, the net equity of the central bank, as shown in our illustrative examples, it is sensible to assume that formal risk indicators would tend to rise in tandem with the volume of these type of liabilities. It would indeed be a useful research endeavor to attempt a full quantification of these effects, using available central bank information.[11]

[11] A possibility is to utilize risk measurement methodologies such as Value-at-Risk. For a framework regarding this type of application in the context of central bank portfolios, see Blejer and Schumacher (1999).

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