

**Report on derivatives markets:
stabilizing or speculative impact on
Chile and a comparison with Brazil**

**Randall Dodd
Stephany Griffith-Jones**



UNITED NATIONS



We thank José Luis Machinea and Ricardo Ffrench-Davis for all their encouragement and intellectual support that has made this report possible; the Inter American Development Bank for financial support; and Rodrigo Heresi for valuable research assistance. We are grateful to colleagues at the Central Bank, Superintendencia de Bancos, several private banks and Banco Estado, as well as to SOFOFA and several major companies, for their information and valuable insights. We would especially like to thank Carlos Mussi, Enrique Marshall, Manuel Marfán and Esteban Jadresic for their comments and suggestions. Esteban Jadresic and Alejandra Marinovic graciously organised a seminar at the Central Bank; Felipe Alarcón facilitated access to data on derivatives from the Central Bank. We appreciate the useful comments received at Seminars at CEPAL and Central Bank of Chile, and at a Workshop organized by Andrés Concha at SOFOFA, with operators and users of derivatives market. Any mistakes are our own responsibility.

United Nations Publication

LC/W.134

Copyright © United Nations, May 2007. All rights reserved
Printed in United Nations, Santiago, Chile

Applications for the right to reproduce this work are welcomed and should be sent to the Secretary of the Publications Board, United Nations Headquarters, New York, N.Y. 10017, U.S.A. Member States and their governmental institutions may reproduce this work without prior authorization, but are requested to mention the source and inform the United Nations of such reproduction.

Contents

Abstract	5
Introduction	7
Part I	
1. The importance of derivatives markets.....	9
2. Comparison of Chilean and Brazilian derivatives markets ..	11
3. Derivatives instruments	13
4. Structure of the derivatives market.....	16
5. History	21
6. Regulation and how it is shaping derivatives markets.....	24
Part II	
7. Derivatives and international capital flows	29
8. Can certain investment strategies impact the exchange rate?	35
9. What do derivatives markets mean for the hierarchy of volatility	37
10. Regulatory proposals to improve Chile's derivatives markets	42
11. Concluding remarks.....	44
Definitions and abbreviations	47
References	49

Tables

Table 1	Size of Chile's derivatives markets, 2005	10
Table 2	Comparison figures for Chile, 2005.....	11
Table 3	Bolsa de mercadorias & futuros	12
Table 4	Nominal exchange rates and net positions	39
Table 5	Annual change in net forward FX positions	40
Table 6	Pension funds: changes in foreign investment and hedging	41

Figures

Figure 1	Chile's OTC derivatives trading volume	22
Figure 2	Net positions, copper price and nominal exchange rate, 1998-2005	38
Figure 3	Non-financial companies	38

Abstract

Derivatives markets in Chile and Brazil play a large and growing role in their financial markets and overall economic activity. Of special importance is Chile's over-the-counter market in foreign exchange derivatives which has become an established market with dealers, high liquidity and low bid-ask spreads. These derivatives markets have helped many firms lower their risks and lower their borrowing costs. At the same time, they pose new challenges to the stability of Chile's economy. This report focuses on Chile, and to a lesser extent on Brazil, to provide an analytical description of the growth of derivatives markets and an economic analysis of their role in the economy. The first part includes a discussion of the various derivatives instruments, the different market participants and the manner in which prices are determined in these markets. Also included in this descriptive analysis is a discussion of Chile's regulatory framework for derivatives and how they have shaped the growth and stability of the markets. The second part of the report includes an economic analysis of what derivatives markets mean for the cost and risk of foreign borrowing, the stability of international capital flows, pro-cyclical linkages to exchange rate movements, the use of derivatives in certain hedge fund investment strategies, and the potential risks to the stability of Chile's financial markets. Using a unique data base of derivatives' daily open position for Chile, provided by the Central Bank, we analyze their impact on the exchange rate during particular periods. It also includes a discussion of derivatives' use in speculative flows between Chile and Brazil.

Introduction

In order to properly introduce the subject of derivatives markets before commencing to analyze their role in the economy, this report will provide an extended description of these markets. Part I of the report then offers a brief comparison of derivatives markets in Brazil and Chile, followed by a detailed analytical description of Chile's derivatives markets and how they operate.

The analytical description in Part I explain the importance of derivatives markets, the structure of those markets and how they operate. The structure of the markets includes the role of derivatives dealers, brokers, end-users or customers and any bilateral or multilateral trading facilities. End-users can be hedgers or speculators, and these include pension funds,¹ exporters, importers, hedge funds and unknown others. Part I will also briefly describe the role of regulation in these markets. All together it is hoped that the picture painted in Part I will prove useful to policy makers, the media and scholars to better understand the changing character of Chile's financial markets.

Part II will provide a policy analysis of various issues raised by the growing role of derivatives markets in the Chilean economy. This will include an analysis of their interaction with exchange rate fluctuations, response to external shocks, whether or not their impact is cyclical, how they deal with capital surges and droughts, and how they serve as conduit for certain hedge fund investment strategies.

¹ The term pension funds is used throughout the paper to refer to "fondos de pensiones" which are privately owned retirement funds that are different from the private, employer provided pension funds in the US.

As often is the case, there is a caveat. Some derivatives markets are non-transparent, and Chile's over-the-counter derivatives market suffers from this fate. It is therefore not possible to make assurances that the picture is 100% complete. This work does nonetheless reflect a great deal of information collected from a wide array of sources. This includes very valuable data from Chile's Central Bank, its bank superintendent authority, its pension fund regulatory agency and the Bank for International Settlements (BIS).² It also includes many hours of interviews with senior representatives from foreign banks, local Chilean banks, 'investment companies', pension fund managers, independent financial consultants, bank regulators, central bank staff and managers, and pension fund regulators.

² Banco Central de Chile or BCCH, Superintendencia de Bancos e Instituciones Financieras or SBIF, and Superintendencia de Administradoras de Fondos de Pensiones or SAFP.

Part I

1. The importance of derivatives markets

Derivatives markets serve two important economic purposes: risk shifting and price discovery. Risk shifting —more commonly called hedging— is the transfer of risk from one entity who does not want it to another entity that is more willing or able to bear it. Derivatives trading can help determine or ‘discover’ the price of certain assets, commodities or types of risk that would not otherwise occur because of transactions costs, dispersion of markets for the underlying item or the conglomeration of many risks into one whole asset. One of the most important price discovery functions is the determination of the price of the underlying item, e.g. an exchange rate, over time. Derivatives markets can serve to determine not just spot prices but also future prices (and in the case of options the price of the risk is determined).

Risk shifting is important for a variety of economic agents. Importers and exporters hedge their foreign exchange exposure so that their importing costs and exporting revenues became less volatile. Firms borrowing in foreign markets hedge the local currency value of their hard currency debt payments. Of special importance for the case of Chile are the pension funds who invest a substantial share of their assets abroad and then hedge the value of these foreign currency assets back into pesos. Lastly, there are hedge funds and other entities that might use derivatives markets for investment strategies such as profiting from the large interest rate differential between Chile and Brazil.

One of the implications of efficient risk shifting is the ability to raise capital more cheaply in capital markets. The development of Chile's cross-currency swaps market has enabled some large corporations and banks to lower their cost of borrowing without increasing their exchange rate risk. They borrow abroad in hard currency at interest rates lower than in Chile, and then use derivatives to shift out of foreign currency exposure and back into peso liabilities at an effective peso interest rate that is lower than borrowing directly in the Chilean capital market.

Table 1 shows the outstanding amounts of derivatives at year end 2005 and the trading volume for the year 2005.

Table 1
SIZE OF CHILE'S DERIVATIVES MARKETS, 2005
(billions of US\$)

	Outstanding Amount	Trading Volume
Commodities	15.9	18.4
Copper	15.8	18.0
Interest Rate	11.0	5.9
Fixed rate	6.7	
Foreign Exchange	24.4	382.8
Local		254.3
External		128.4
Total amounts	51.3	407.1

Source: Central Bank of Chile.

The efficiency of derivatives markets in discovering prices and providing risk shifting functions is linked to their liquidity and trading volume. For this reason size matters, and the size of Chile's derivatives markets is large and growing rapidly. Annual trading volume in foreign exchange derivatives—the largest segment of Chile's derivatives markets—increased from \$113 billion in 1998 to \$383 billion in 2005. That amounts to a 240% increase, and the trading volume for the last quarter of 2005 was at an annual rate of \$419 billion which amounts to a 31% rate of growth from the last quarter of 2004.

Central Bank data shows that daily trading volume in the foreign exchange derivatives market to be \$1.7 billion in the formal market alone. This does not include the “informal market” and it does not include off-shore transactions or transactions between residents who are not registered as part of the formal market because they are not subject to the reporting requirement of the formal market.

Chile's interest rate derivatives market, in relation to the size of the capital market, is also large and growing. Outstanding amounts of interest rate derivatives grew from \$4.7 billion at the end of 1998 to \$11 billion for 2005. That represents a 136% increase over the seven year period—although most of the increase came in the first few years.

Commodity derivatives grew at a comparably much faster rate. The vast majority of commodity derivatives are based on copper although the data also shows some trading in derivatives on gold and silver. The outstanding amount of these derivatives grew from \$2.38 billion in 1998 to \$15.9 billion in 2005—a 569% increase. Most of this growth occurred in just the last three years as outstanding amounts ranged between \$2 billion to \$4 billion until 2002.

As a point in comparison to the large presence of derivatives in the Chilean economy, the following table 2 illustrates how the outstanding amounts and trading volume compare to other key financial and economic stocks and flows.

Table 2
COMPARISON FIGURES FOR CHILE, 2005
(billions of US\$)

FINANCIAL STOCKS	
Derivatives outstanding	51.3
Domestic credit	88.0
Money stock (M2)	44.8
International reserves	16.9
Market capitalization (2004)	117.1
Total foreign debt	46.5
Net stock of foreign investment	57.8
Gross stock of foreign investment	81.8
OUTPUT AND INVESTMENT FLOWS	
GDP	115.2
Exports	40.6
Imports	32.6
Net direct investment flows	6.2
Net portfolio flows	-2.9

Source: Central Bank of Chile and International Financial Statistics.

2. Comparison of Chilean and Brazilian derivatives markets

In order to help put the descriptive analysis of Chile's derivatives markets in some context, it is useful to compare it with that of Brazil.

The first and most apparent difference between the two countries' derivatives markets is the development of Brazil's derivatives exchanges.

Derivatives trading in Brazil can be traced back to 1917 when derivatives on agricultural products —mostly coffee and cotton— were traded on the Bolsa de Mercaderia de São Paulo (BMSP). A greater variety of agricultural futures were added starting in the 1970s, and the 1980s witnessed a tremendous period of growth and innovation with the introduction of new derivatives contracts.

Innovation was not limited to agricultural derivatives, but with the introduction of new derivatives exchanges came the introduction of futures and options on financial instruments. In 1979, Brazil's two stock exchanges (both the BOVESPA and BVRJ) started trading futures and options on individual stocks. The BMSP then added futures on gold to their agricultural futures in 1980. The Brazilian Futures Exchange (Bolsa Brasileira de Futuros-BBF) was created in 1983 and offered trading in futures and options on stocks and stock indexes. Next in 1986, the Bolsa de Mercadorias e de Futuros (BM&F) was created to trade forwards and futures on gold and futures on stock indexes.

Thus by the end of the 1980s there was direct competition between three derivatives exchanges that were trading similar products —competition in a business where there is a natural monopoly because trading volume gravitates to liquidity which adds to the most liquid market and drains it from less liquid markets.³ By 1997 the three exchanges had merged to form a single futures exchange with the old initials of BM&F but with a new national name of Brazilian Mercantile and Futures Exchange. Also following this economic logic, the stock exchange in Rio (BVRL) merged

³ Trading operations such as bucket-shops and electronic communication networks (ECNs in the US) sometimes continue to exist because they 'steal or borrow' the price discovery that occurs on the liquid exchange.

into the BOVESPA in São Paulo to form a single national stock exchange (which also trades some derivatives instruments).⁴ These two exchanges are now amongst the largest derivatives exchanges in the world.

Table 3
BOLSA DE MERCADORIAS & FUTUROS

DERIVATIVES PRODUCTS TRADED ON THE BM&F
Agricultural: forwards, futures and options
Live cattle
Feeder cattle
Sugar
Coffee, Arabica and Robusta-Conillon
Ethanol
Soy beans
Corn
Gold: forwards, futures and options
Stocks and Stock Indexes, including Brazil 50 index and IBOVESPA
forwards, futures and options
Interest Rates: forwards, futures and options
External debt of Brazil
Inter-bank deposit rate
Inflation rate
Foreign Exchange: forwards, futures and options
US dollar, EURO and US dollar volatility
Carbon Emission Credits

Source: BM&F Clearing House.

Further market development involves the role of BM&F as a national clearing house for currency, bonds, other assets, commodities and carbon emission credits. It also offers a range of types of derivatives contracts that include forward, futures, options, flex options and swaps. It recently opened an electronic trading platform that allows small market participants to trade on the exchange by offering them smaller sized contracts called ‘minis’. Today the vast majority of derivatives contracts traded on the BM&F are on interest rate products while those on exchange rates are a distant second.

In addition to this development of its exchange traded derivatives markets, Brazil also has developed a robust over-the-counter (OTC) market. The Bank for International Settlements (BIS) offers scant data on derivatives markets in developing countries, and those in Brazil and Chile are no exception. Based on available data, the BIS reports that daily trading volume in foreign exchange derivatives is roughly the same in Brazil as in Chile —\$1 billion per day.⁵ On the other hand, the BIS reports that Brazil also has roughly \$1 billion per day in OTC trading in single-currency interest rate derivatives.

In comparison to the \$2 billion a day in average daily trading volume on OTC markets in Brazil, the BM&F clearing house reported that on a recent day there was \$31 billion in trading volume on the exchange.

⁴ The authors are indebted with Carlos Mussi for his historical account and analysis of Brazil’s derivatives exchanges.

⁵ Note that figure is in contradiction to currency data from the Central Bank of Chile.

The US Futures Industry Association's most recent global survey of derivatives exchanges shows that Brazil's BOVESPA and BM&F rank as the 8th and 10th largest in the world when measured by the number of derivatives contracts traded. BM&F's futures contract on the overnight inter-bank loan rate was ranked tenth in the world based on the number of contracts traded.⁶

One of the key distinctions between the exchange traded derivatives and the OTC market is that the exchanges have a clearing house. Clearing houses serve several very important functions. First they raise the credit quality of trading throughout the entire market. Raising the credit quality or trading counterparties serves both to improve the systemic stability of the market and allows small market participants to trade with the major financial institutions because they all must trade with collateral (also known as margin) instead of relying on capital. Secondly, the clearing house facilitates the post-trading process. This first involves trade confirmation, then position netting, then the efficient management of collateral (margin) and lastly the settlement of payments and deliveries. The recent scandal of the credit derivatives market in New York involving long delays in the confirmation and clearing of credit derivatives trades is in sharp contrast to the functioning of a clearing house which settles daily and payments are made promptly—in the Brazilian case on a T+1 basis through the central bank.

Brazil's BM&F exchange's clearing house also serves to register OTC derivatives. This is critical for establishing the legal certainty of the trades as well as creating detailed market information that can improve transparency and be used by authorities for market surveillance. Sometimes the clearing house acts as a guarantor of the OTC contracts, and sometimes it acts only to register them.

Thus Brazil's derivatives markets are comprised of both exchange traded and OTC traded derivatives, while Chile's market is comprised entirely of OTC markets.

3. Derivatives instruments

A good general definition of a *derivative* is the following.

A derivative is a financial contract whose value is derived from an underlying asset or commodity price, an index, rate or event. They commonly go by names such as forward, future, option, and swap, and they are often embedded in hybrid or structured securities.

The main types of derivatives include forwards, futures, options and swaps. They can be combined with one another, such as swaptions or options on futures, and they can be combined with securities to form 'hybrid' instruments or structured securities. Futures and options are traded on exchanges where a centralized trading floor or platform allows for everyone in the market to trade on a multilateral basis. It is considered multilateral because everyone can see everyone else's quotes and execution prices. Derivatives exchanges are usually regulated and have a clearing house.

In contrast to exchange trading, forwards, swaps and options are traded over-the-counter (OTC) in bilateral derivatives markets where one or more dealers serve as market makers. These markets do not have a central trading floor or platform, and they are often unregulated. All of Chile's derivatives markets are organized as OTC markets and the foreign exchange derivatives markets are subject to some degree of regulation for its role in the formal foreign exchange market.

The forward contract is the most basic of derivatives contracts. Its use dates back to the third millennium B.C. in Mesopotamia, and it is currently the predominant contract used today in Chile's OTC derivatives markets (see Swan, 2000).

⁶ Futures Industry Association, survey for January-February 2006.

By far the most prominent derivatives instrument traded in Chile's derivatives markets is the forward contract on foreign exchange. A forward is the obligation to buy (or sell) a specified quantity of a specified item at a specified price or rate at a specified time in the future. Consider the following example. Firm X enters a forward contract with firm Y on January 1 to sell Chilean pesos (CHP) forward for US\$1 million (or in other words buys dollars with pesos) at 600 pesos per dollar (\$0.001667) for delivery on April 1. On the settlement day, firm X will transfer CHP600 million to counterparty Y and will receive in return \$1 million. The transaction will represent a gain for firm X if the spot exchange rate at the time of settlement, the price of pesos expressed in US\$, is lower than the contracted price of \$0.001667. A higher spot price or exchange rate would represent a loss for firm X. A forward contract does not necessarily require any transfer of funds, currency or collateral between the counterparties at the origination of the transaction. Counterparties can arrange for collateral to be used to assure that the other side perform on the contract. In the above example, no transfers occurred until the April 1st date.

Making delivery, or receiving the delivery, of foreign currency as part of foreign exchange forward trading is sometimes unnecessary, expensive, inconvenient or subject to taxation or capital controls. In order to avoid the unwanted transactions costs, derivatives market participants sometimes trade foreign exchange forwards that are "cash settled" in one currency. These are known as non-deliverable forwards (NDF). The NDF market in Chilean peso-US dollars has developed in off-shore markets —mainly in New York and London. An NDF performs the same risk shifting functions as a normal forward contract, but it is settled by a single payment in US\$ that is equal to the US\$ value of the difference between the forward rate and the spot exchange rate on the terminal date of the contract. It functions like a conventional forward contract, but instead of paying pesos for dollars, the losing side pays to the winner the dollar amount of the gain on the contract.

Consider the following example. Firm X enters a 90-day NDF to sell CHP forward for US\$ 1 million at \$0.001667 in order to hedge a future payment on foreign debt or for imported merchandise. The contract is settled on the 90th day, and the spot exchange rate turns out to be \$0.001515 (or 660 pesos to a dollar). The price of pesos has fallen by \$0.000152, and so firm X —the short seller of pesos— will receive gains on the NDF. The amount will be equal to US\$90,900 or the savings of CHP 60 million valued at the new exchange rate of \$0.001515. That gain is paid in US\$ by the long side of the forward (the purchaser of pesos).

The current daily trading volume in the NDF market in Chilean pesos is estimated to be \$0.4 billion. There are no reporting requirements for this portion of Chile's derivatives market —if one can refer to it as Chile's since it is off-shore— and so these figures are only estimates. The NDF market interacts closely with the deliverable forward market in Chile. When dealers in the NDF market lay-off their exposures with transactions in Chile's "formal" foreign exchange market then that transaction is subject to reporting requirements and will then be included in official figures.

Another important type of derivative instrument in the Chilean market is the cross-currency swaps (CCS). It is also known as a foreign currency swap and is distinct from the foreign exchange swap. CCS are designed to exchange a stream of payments in one currency for a series of payments in another currency. The stream of payments is generally chosen to match that of a bond or loan. In that case the CCS is an exchange of interest rate and principal payments equivalent to a fair trade of a dollar bond for a peso (or UF) denominated bond of the same maturity. It amounts to a fair trade of a US\$ bond with a coupon rate of x% for a Chilean U.F. bond with a coupon rate of y%. The interest rate payments may be based either on fixed or floating interest rates.

A typical example of a 10-year CCS exchanges fixed Chilean U.F. peso payments for variable US dollar payments. The dollar payments are typically equal to LIBOR plus a spread, the U.F. peso payments are usually at a fixed rate, and there is a final exchange of pesos for dollars

reflecting the principal payments. The CCS against US dollar LIBOR is “priced” by choosing the fixed peso rate and the “spread” so that the present value of the contract is zero.

In Chile, the most likely use of CCS by hedgers is to swap floating rate US\$ debt obligations, e.g. those linked to a floating rate such as LIBOR, into a fixed peso or UF rate. Interviews with representatives from several large corporations in Chile indicate that the CCS has low spreads and tenors (maturities) of up to 12 years. This allows the market risk on long-term LIBOR debt to be shifted into fixed rate peso obligations.

Options are another part of the Chile’s OTC derivatives market. An option contract gives the buyer or holder of the option (known as the long options position) the right to buy (sell) the underlying item at a specific price over a specific time period in the future. In the case of a call option, the holder has the right to buy the underlying currency at a specified exchange rate—known as the strike or exercise price—at a specified time in the future. If the spot market price of the currency were to rise above the strike, then the holder would be able to exercise the option and buy at the lower strike price. The value of exercising the call option would be the difference between the higher market price and the lower strike price. If the market price were to remain below the strike price during the period when the call option was exercisable, then the “out of the money” option would not be worth exercising and it would expire worthless.

In the case of a put option, the option holder has the right to sell the underlying item at a specified price at a specified time in the future. A put option on foreign currency allows the holder to sell at the exercise price, and thereby to profit if the market price falls. A put option acts as a form of price insurance that guarantees a floor or minimum price. Like an insurance policy, the price paid for the option is called a *premium*. Keep in mind that an exchange rate is the relative price of two currencies, and so a put on one currency is a call on the other.

Whereas the holder of the option has the right to exercise the option in order to buy or sell at the more favorable strike price, the writer or seller of the option (known as the short options position) has the obligation to fulfill the contract if it is exercised by the option buyer. The writer of an option is thus exposed to potentially large losses. The writer of a call option is exposed to losses from the market price rising above the strike price, and the writer of a put option is exposed to losses if the price of the underlying item were to fall below that of the exercise price.

Consider the following example. An importer buys a put option on the Chilean peso against the dollar with an exercise (strike) exchange rate of 600 pesos to the dollar (\$0.001667 per peso). The notional principal is \$1,000,000, it is exercisable over a 6 month period, and the premium is 5% of the notional principal (i.e. \$50,000). If the peso depreciates to 660 to the dollar (\$0.001515 per peso), then the put can be exercised for a gain by selling the pesos (buying dollars) at \$0.001667 instead of the lower spot rate.

There is a large variety of different types of options, although it is not certain which are being traded in Chile. There are path-dependent options such as barrier options (especially knock-in and knock-out options) and “Asian” options which can be exercised at the average price or the minimum (maximum) price during the exercise period. There are also options on swaps called swaptions which allow the options holder the right to enter into an interest rate swap at a specified fixed rate.⁷

Due to the non-transparent nature of OTC derivatives, it is not possible to determine exactly which varieties of options or other derivatives are being traded in Chile’s derivatives markets. There is evidence from Central Bank data that there are single currency interest rate swaps and forward rate agreements and there are commodity based derivatives—especially on copper prices.

⁷ Additional information about derivatives instruments can be found at “Primers” at www.financialpolicy.org.

Interviews with representatives from several major corporations revealed that they sometimes prefer to use options as a means to hedge when they are especially uncertain about the direction of change in the exchange rate. This is relevant in situations where the peso has experienced an extended period of appreciation but the continuation of that trend is unlikely. Whereas derivatives such as forwards or CCS would lock in the value of the peso for a specific period into the future, an option position would enable a hedger to protect against a fall in the peso's value while at the same time avoiding the loss of benefits from an appreciation in its value.

The options market in Chile is substantial and growing rapidly. Its growth has been delayed because of restriction on the offering of options by banks and restrictions on their use by pension funds. These restrictions arose from prudential concerns that led to a gradual introduction of options into the Chilean market. Previously, the extent of options trading in Chile's markets was limited to the efforts of off-shore dealers and on-shore but unregulated bank affiliates called "investment companies." Recent changes in banking regulations (September 2005) will allow banks registered in Chile to begin offering options once they have demonstrated their adoption and implementation of value-at risk (VAR) models. Reportedly, it was the introduction of risk models by banks that will then be validated by the bank regulator (in preparation for the implementation of Basle II Capital Accord), as well as the existence in practice of options, that encouraged the bank regulator to allow formal introduction of options, for banks which they consider have a proper assessment of risk. Initially, reportedly it has only been Banco Santander that has developed this type of model and was authorized to develop options in the formal market. This has restricted the growth of this formal market. Although they can be expensive in comparison to forwards and swaps, options fill a useful role in risk management.

4. Structure of the derivatives market

Chile's derivatives markets are organized as "over-the-counter" markets. OTC markets are organized around a set of dealers who form the core of the market by posting bid and ask quotes and by taking the opposing side to every trade. Dealers are thus known as 'market makers.' The market is also comprised of customers or end-users who trade derivatives in order to hedge or speculate. Some OTC derivatives markets have brokers who improve the flow of information in the market. These brokers are most likely to work in the inter-dealer market where dealers trade exclusively with one another. In some cases they also help end-users to find the best prices available from dealers and other end-users in the market.

The end-users are the final customers in the derivatives marketplace. They trade in order to hedge some existing risk, to adjust their hedge due to a change in the market or to speculate. End-users include smaller and medium sized banks that unlike the larger banks do not act as derivatives dealers. Pension fund managers and other institutional asset managers are end-users; they employ derivatives to manage the risk on their portfolios. End-users also include non-financial corporations who use derivatives to hedge their market risk as well as to structure their financing so as to lower borrowing costs. Non-financial corporations might face the risk of exchange rate volatility if they are importers or exporters, and they might face commodity price volatility if they are producers or heavy users of commodities. End-users also include hedge funds who use derivatives as part of their investment strategies.

OTC derivatives markets are organized differently than exchanges. The OTC markets have traditionally been organized around one or more dealers who "make a market" by maintaining bid and offer quotes to market participants. The OTC market is usually bifurcated between an inter-dealer market where dealers trade exclusively with one another and a customer market where end-users trade with one or more of the available dealers. In the inter-dealer market, dealers maintain price quotes to each other and allow a dealer to quickly lay-off the risk of buying or selling to a

customer. This market is the more liquid of the two, and the bid-ask spread is smaller than that offered by dealers to their customers. The difference in bid-ask spreads is a key way in which dealers consistently make money through trading volume.

Trading in OTC markets is bilateral in that price quotes and trades are made principle to principle and are not observed by others in the market. In some cases, brokers play a role in providing marketwise information. In some of Chile's derivatives markets there are brokers working in the inter-dealer portion of the market to provide multilateral information on price quotes and execution prices. Brokers often provide electronic bulletin boards, managed by brokerage firms, to provide their clients (i.e. the dealers) with the ability to instantaneously post quotes to every dealer in the broker's net work. Presently these screens show bids, asks and execution prices on forward foreign exchange contracts, cross-currency swaps and interest rates swaps. The broker screens are generally not available to non-dealers and so end-users are usually unaware of changes in prices and the bid-ask spread in the inter-dealer market.

Dealers cannot trade through the screen or over the electronic system. Instead the screen is just for relaying information, and the dealer must trade through the broker or call other dealers directly over the phone in order to execute a trade. (Note that some dealers also use an instant messaging arrangement in order to ask for quotes and even accept the quotes.) Dealers can also use direct telephone calls to the broker and other dealers to post quotes and inquire about quotes that are not listed on the brokers' electronic bulletin board screens.

Although it is not currently operating for derivatives transactions, there are two electronic trading platforms in Chile that allow dealers to post quotes and to execute trades in the spot foreign exchange market. These electronic platforms in the spot market handle a large quantity of small and sometimes large transactions and replicate the experience of an exchange —except that it is not open to everyone.

The second portion of the OTC market is comprised of the bilateral trading between dealers and end-users. This market is voice negotiated although dealers might offer their customers some proprietary electronic conveyance for observing their quotes and submitting buy and sell orders electronically. These dealers provided electronic screens are thus bilateral. If a customer wants to get a more complete view of the market they will need to contact several dealers in order to observe the range of market prices.

Although electronic bulletin boards and dealers' trading facilities have recently made substantial changes to the trading process in OTC markets, it is not truly multilateral until participation is extended to everyone in the market. Derivatives exchanges and stock exchanges are fully multilateral and this allows everyone buying and selling in the marketplace to observe the same quotes and trade at the same prices. Trading between dealers and customers remains a bilateral market because only one party is posting quotes and only the dealer and the customer know the price at which the trade actually occurs.

However, it should be pointed out that the bilateral negotiation process that occurs in OTC derivatives markets is often automated. Dealers have direct phone lines to other dealers as well as to their major customers. This enables them to have near-instantaneous communication. A market participant can call up a dealer, ask for quotes, hang up and then repeat with another dealer in a matter of a few seconds. This amounts to a quick survey of several dealers in just a few seconds in order to determine the prevailing price quotes in the market. A quick series of such calls can give a dealer or an active investor a view of the market that is close but not exactly the same that in a multilateral market. After all, a quick survey of market quotes is not as useful as seeing the prices at which all other trades are being executed. Also, clearing is conducted bilaterally in OTC markets. Even if trades are brokered, the counterparties must ultimately confirm and settle trades on a bilateral principle to principle basis.

(a) Derivatives dealers

There are reported to be 15 or 16 dealers in Chile's derivatives markets. A dealer is defined in economic terms as a market participant who is actively making price quotes, and is executing buys and sells at the quoted prices. Designation as a dealer is also a regulatory matter. Chile's regulations governing the use of derivatives by pension funds limits who is an eligible derivatives counterparty for their private pension fund managers, and this for the most part designates who are the dealers in Chile's market. In addition, Chile's banking regulation also puts some limitations on the ability of banks to act as dealers. At present, banks are required to demonstrate the adaptation of internal risk management models prior to their being allowed to act as options dealers.

While there are possibly 16 dealers in Chile's derivatives markets, not every dealer is the same size or acts as a dealer in every type of derivative product. Major dealers, of which there are five, include Santander Santiago, JPMorgan Chase, HSBC, Deutsche Bank and Banco de Chile. Thus four of the five major market players are foreign owned subsidiaries, although they are regulated by the Chilean authorities.

Chile's markets are also comprised of unregulated "finance companies" (Sociedades Financieras) that are affiliates of the foreign-owned banks. These finance companies trade and often operate as dealers in Chilean derivatives markets. (This has been especially the case for options trading—which until recently was forbidden for Chilean banks—and for other derivatives transactions that might involve high capital requirements for the regulated affiliate). Local Chilean owned banks that serve as derivatives dealers, such as Banco de Chile, do not operate a 'finance company.'

There are also derivatives dealers in external markets such as those in New York and London. These dealers often trade in NDF contracts in order to facilitating trading without having to regularly clear payments through Chile's banking system.

(b) Brokers in derivatives markets

The role of the brokers in OTC derivatives market is to consolidate information and to allow the major participants to trade with anonymity. Dealers often want to conceal their investments strategies and are concerned that the strategy will be revealed when they conduct large sales or purchases in the market. For instance, they might be concerned that the market will move away from them as they try to execute large volumes of transactions. By trading through a broker, a dealer can maintain their anonymity and benefit from a centralization of market information by posting their quotes and hitting other dealers' quotes through the broker.

Chile's inter-dealer derivatives market has three brokers. These are Tullett Prebon, GFI and Lopez-Leon. GFI also claims to broker NDF on Chilean pesos and other Latin American currencies (www.gfigroup.com). Lopez-Leon, with a location in Santiago, claims to broker swaps, foreign exchange forwards and swaps, and interest rate swaps (www.lopezleon.com).

(c) Customers or end-users in derivatives markets

Customers, who are also known as end-users, are those trading derivatives for the purpose of hedging, or speculating, but not with the expectation of immediately reversing the transaction to capture the bid-ask spread in the market. They are not market makers, even though some active participants such as pension funds and hedge funds provide a great deal of liquidity to the markets.

Pension funds are the largest and the most important customers in the market. Not only are they important for the mere size of their derivatives transactions volume, but also for their critical

role as the largest long-peso hedgers in the markets. They generate a great deal of trading volume as they role over their short-term foreign exchange forward positions, and this provides an enormous amount of liquidity in the market. In regards to their role of long-hedgers, developing countries are generally faced with more short-hedgers than long-hedgers in their foreign exchange markets. This arises from hard currency denominated foreign debt and sometimes from importers hedging more than exporters. Moreover, the general expectation in the market, which is that the local currency will depreciate against the US dollar or other major currencies, does not promote long-hedging. More recently, the experience of the Chilean and Brazilian currencies appreciating against the US dollar may function to correct this.

Long-hedgers are critical for ‘completing’ derivatives markets, and Chile’s financial regulations requiring their privately managed pension funds to hedge their foreign investments back into Chilean pesos has made a major contribution to the development of deep foreign exchange derivatives markets in Chile. More specifically, the regulation requires pension funds to hedge a minimum portion of the foreign exchange exposure arising from the foreign investments in their portfolio. The exposure ceiling is measured as a percentage of the present value of the foreign assets, (the amount of foreign assets varies for each different type of fund). In practice, Chile’s private pension funds have in fact hedged more than that required by regulation. One reason for this comes from their incentive to report less volatile returns to pension fund investors (and they are required by regulation to regularly report their returns).

Without pension funds’ participation in the markets, it would be very difficult for derivatives dealers to manage the risk arising from market making because most other hedgers in the Chilean markets are likely to want to short-hedge the peso. And even hedge fund investment strategies (described below in Part II) begin by short-selling the Chilean peso.

One pension fund manager we interviewed said that the firm conducted about \$40 to \$50 million of foreign exchange forward transactions a day. Central Bank data shows that during the second half of 2005 monthly sales of peso-dollar forwards by pension funds reached US\$2,000 million, with a net forward outstanding position of pension funds reaching US\$12,000 million by December 2005. Most of these transactions were conducted in the short-term maturity portion of the forward market, and in particular they were concentrated in the 30 to 60 day range of maturities. Although the market offers good prices in one-year maturities, the market is reportedly lacking in sufficient depth to allow pension funds to roll-over their large positions without moving market prices away from them.⁸ The term “good prices” refers to the low bid-ask spread in the market. The bid-ask spread for 60 day forwards is not significantly different than that for one year. It does not refer to the steepness of the forward curve that defines the difference between spot, forward and distant future prices. As a result, pension funds find it cheaper to operate in the 30 to 60 day range of the forward market.

Non-financial corporations, especially large corporations with strong credit ratings, use derivatives markets to hedge or as part of their financial strategy to lower borrowing costs by issuing debt in international markets. International credit markets are very deep even for long maturity debt issuances, and the nominal rates are usually much lower than those denominated in Chilean pesos. This allows firms to raise large amounts of funds with a single issue, and to borrow for longer maturities. Chilean firms often pay relatively small credit risk premiums (interest rate spreads) when they borrow at a variable rate in these credit markets. Borrowing internationally in US dollars or Euros does, however, result in foreign exchange exposure. In recent years, highly rated corporations have begun using cross-currency swaps to avoid this risk by swapping back into fixed rate peso or U.F. peso payments. The combination of low US dollar interest rates, low credit

⁸ The term ‘moving prices away from them’ means that the process of buying back pesos (from expiring contracts) and selling them forward tends to drive down the forward price if the market is not sufficiently deep.

spreads and the CCS rate allow the firm to effectively borrow in long-term fixed peso interest rates at a lower rate than would be possible in Chile's domestic credit market.

A related point that bears on the accuracy of the data and financial statements, these corporations sometimes hedge through their parents or affiliates and this is often conducted through off-shore markets.

Another important use of derivatives is by large corporations that borrow abroad through foreign currency debt (usually US dollars) but have little or no foreign exchange revenue; they use derivatives markets to reduce their net foreign exchange exposure.

The medium sized firms are unlikely to be able to borrow abroad and thus unlikely to have foreign currency denominated debt to hedge. Their participation in derivatives markets is most likely to hedge exchange rate exposure arising from their participation in or exposure to the import or export business.

Small and medium enterprises involved with importing or exporting, however, could benefit greatly from hedging. This is particularly important for exporters who could become priced out of the market by a strong and possibly stronger value of the peso. The inability to hedge may discourage firms from investing for the purpose of exporting since profit rates could be quickly wiped out by a currency appreciation.⁹

In interviews, bank regulators stated that less than 15% of small and medium term enterprises (SMEs) that export are estimated to use derivatives. Corroborating information comes from a study by Cowan, Micco and Yáñez (2006) of SMEs in manufacturing in 2004. It showed practically no use of derivatives by SMEs for hedging. According to this study, derivatives are only used intensively by a limited number of large firms. This is a source of growing concern in certain circles, and business institutions like the Banco Estado, SOFOFA and the Association of Banks are disseminating information about derivative markets to SMEs.

Improving the risk management practices of SMEs may require even greater efforts. There are possibly deeper economic issues regarding the cost of, and access to, such instruments by SMEs. Furthermore, as Cowan, *et al.* conclude, the main mechanism by which exporting firms hedge their currency risk is through external borrowing in dollars.¹⁰ SMEs, however, have less access to both US\$ debt and to derivatives. The Cowan, *et al.*, study shows that manufacturing SMEs which export have foreign exposure equal to 31% of sales (it is reduced to 27% if the effect of US\$ borrowing is included). Derivatives markets, however, do not appear to play a significant role in reducing their foreign exchange exposures. This points to the need for further research into the obstacles faced by SMEs using derivatives to improve their risk management, and into possible policy measures designed to improve their access to these markets.

(d) Other market participants such as hedge funds

It is not possible to know all the various entities who participate in OTC derivatives markets, but many of the participants are known because of regulatory disclosure requirements. Pension fund regulation requires that derivatives dealers become eligible derivatives counterparties for the pension funds. This offers some indication of the identity of the major derivatives dealers in the Chilean market. And then of course the pension funds are known to participate as they are required to hedge a substantial portion of their foreign exchange exposure. In addition, banking regulation requires that banks demonstrate their ability to efficiently manage foreign exchange risk prior to

⁹ We thank Ricardo Ffrench-Davis for this important point.

¹⁰ Cowan, *et al.* (2006) study used a sample of almost 5,000 firms, of which almost half are SMEs.

their being allowed to act as dealers in options. That provides another source of information of who is participating in the markets. Publicly-traded non-financial corporations must also disclose some aspects of their derivatives activities in their financial statements.¹¹ Privately held businesses have no such reporting requirements. Foreign non-bank entities participating in the market also have no such reporting requirements. Individuals using the Chilean derivatives markets to hedge—or speculate—face no such reporting requirements. Off-shore participants in the NDF market do not report. In short, it is possible to identify some of the derivatives dealers, the pension funds and with case-by-case analysis the major non-financial corporations who are using derivatives markets. Otherwise there is a substantial short-coming in the data. Other customers, although not identified, include hedge funds who use derivatives markets for a variety of reasons. There are also likely to be some high net-wealth individuals who have access to the markets.

Hedge funds and investment banks are believed to play a significant role in Chile's derivatives markets, however the lack of transparency and the lack of reporting requirements mean that the particulars are unknown. They are believed to be engaged in investment strategies that capture the interest rate differential between the Chilean peso and the Brazilian real (called the 'carry trade') and that between Chilean peso interest rates and copper prices.

5. History

There was very little use of derivatives markets for hedging in Chile prior to the late 1990s. This was not because there was less need for hedging. After all, Chile had large amounts of foreign currency debt and a large share of the economy was linked to traded goods. Chile also faced significant risks from exposure to variations in the price of copper and other commodities. The lack of hedging, instead, was due to the limited availability of suitable derivatives instruments.

Many of Chile's financial and non-financial companies had large net foreign exchange exposures. They were surely aware of the risks from potentially large exchange rate movements despite the presence of an exchange rate band and of the relative stability of the peso.¹² After all, companies with unhedged net foreign exchange positions made large losses in the wake of the 1994 Mexican crisis and the 1997 Asian crisis.

Since the late 1990s, Chile's derivatives markets have grown rapidly in total volume, depth and in the variety of derivatives instruments. Most of the major companies interviewed for this report stated that they hedge any significant net foreign exchange exposure arising from foreign indebtedness. Figure 1 illustrates the tremendous rise in hedging activity during this period. Note that foreign subsidiaries in Chile said that they did not generally hedge their profit remittance payments and that hedging of the payments, if any, was conducted by the parent holding company.

Also, the private pension fund managers substantially increased their foreign investments starting in the late 1990s and they are required by regulation to hedge a large portion of the exchange rate risk on those foreign investments.

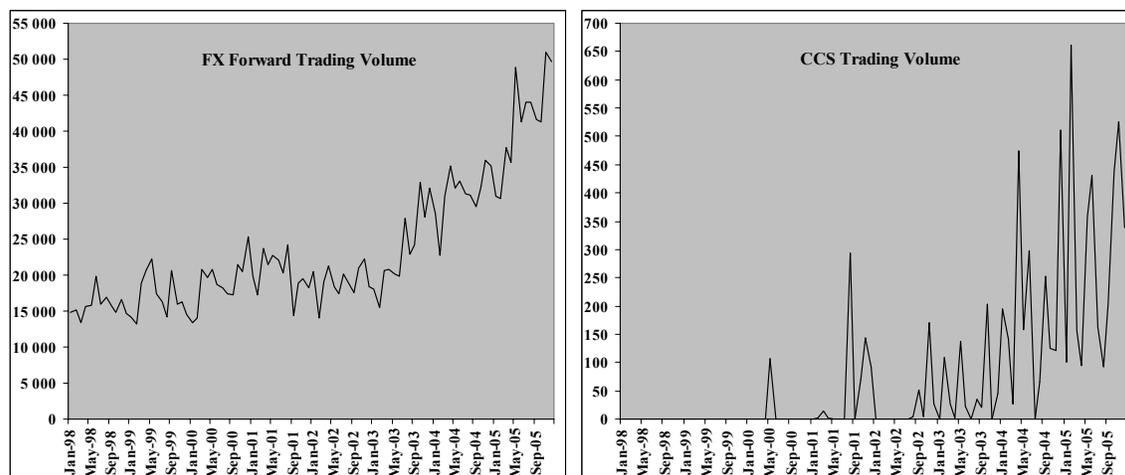
There are additional reasons why an increasingly large number of companies in Chile hedge their net foreign exchange exposure: rating agencies punish them if they are not fully hedged; shareholders look for more stable earnings; and banks want to see such exposures hedged when

¹¹ The IMF, in their FSSA Report from August 2004, pointed out the failure of Chile's securities disclosure requirements to meet international standards in regards to stating the fair value of derivatives positions.

¹² The Chilean Central Bank set a 'band' within which the exchange rate was allowed to fluctuate and beyond which it would elicit a policy intervention by the Central Bank.

they lend to them.¹³ Adding to this is the reduced cost and increased availability of derivatives transactions.

Figure 1
CHILE'S OTC DERIVATIVES TRADING VOLUME
 (Monthly, US\$ millions)



Source: Central Bank of Chile.

The growth of Chile's derivatives markets is marked by a few important milestones. The most significant development has been the growth of the OTC forward market in foreign exchange. This market together with that for cross-currency swaps had \$383 billion in trading volume and \$24.4 billion in open positions at the end of 2005 (recall table 1 and figure 1 above).

The growth of this market can be largely attributed to the growth in foreign investment by pension funds and their hedging of their foreign investment positions back into pesos. Today they have amassed over \$12 billion in net foreign exchange forward positions that they roll-over approximately every 60 days.

Another key development was the introduction of the long-term cross-currency swap (CCS). The figure above illustrates the growth in trading volume for this long-term derivative instrument. Providing long-term hedging instruments is often a challenge for market makers, and this is especially true in developing countries. The major problem in developing countries is the persistence of an unbalanced market —too many short-hedgers compared to long-hedgers and speculators. Chile had large amounts of long-term obligations in US dollars that peso earning firms wanted to shift into peso obligations, but there was not nearly an equivalent amount of interest in shifting from peso obligations into US dollar payments. This one-sided market was a deterrent to dealers in offering CCS to the market.

According to interviews, the solution to this problem was found in a series of transactions starting in the year 2000 whereby a highly credit rated entity would borrow in Chilean pesos and then swap these peso obligations into US dollars.¹⁴ The first of these was conducted between the World Bank and Chase Manhattan Bank. In June 2000, The World Bank (I.B.R.D.) issued a 5-year, CHP 55 billion bond denominated in Chilean pesos but whose repayment was calculated so as to equal a U.F. interest rate. The actual payments were to be made in US dollars but in amounts

¹³ Interview material.

¹⁴ This account draws from interviews with Vicente Monge of JPMorgan.

determined by the U.F. rate. Next the World Bank entered into a cross-currency swap with Chase that swapped fixed U.F. payments (equivalent to the bond payments) for payments based on US\$ LIBOR plus a spread. This provided Chase with a long-dated peso obligation, and this allowed it to offset the risk of offering the opposite CCS contracts to large Chilean firms that wanted to shift their US dollar denominated debt payments into fixed U.F. peso payments.

Next, in November of 2000, Chase acted as underwriter for the government of Uruguay to issue a 7-year, CHP 82 billion bond at a fixed U.F. rate (and payable in US dollars). The Uruguay government and Chase then swapped the U.F. peso obligations into US dollars, thus giving Chase a 7-year tenor on a fixed U.F. peso obligation. This too was used to offset the risk of offering 7-year CCS to other banks and non-financial firms in Chile. In March 2001 another similar transaction, this time between the government of Uruguay and J.P. Morgan, extended the maturity of the local currency bond and the equivalent CCS to 10 years.

The next big step came in 2002 when CODELCO issued long-dated U.F. denominated debt in Chile's capital market and then swapped it into US dollars with a CCS. (CODELCO wanted US dollar obligations to match its export earnings, and it benefited from a more favorable credit spreads in Chile than in international markets). This both gave Chase a long-dates peso obligation to offset the risk of offering CCS in Chile's derivatives market but it also demonstrated that a Chilean firm could cheaply issue long dated instruments in Chile's capital markets.

A similar series of transactions followed with the energy firm ENAP whose revenues embodied significant US dollar exposure because the changes in the price of gasoline in Chile immediately reflects both changes in the global price of gasoline in dollars plus changes in the US\$/CHP exchange rate.

Yet another major event in the development of Chile's derivatives market was the introduction of capital controls in the form of Unremunerated Reserve Requirements (URR) —*encaje*— on capital inflows. This posed a serious challenge for derivatives dealers in the foreign exchange market. That market regularly balances itself by using the spot market and the peso or dollar credit markets in order to create synthetic short or long positions to lay-off the risk from exposure to unequal amounts of long and short transactions in foreign exchange derivatives. In order to avoid the cost of URR, foreign owned banks in Chile could use their internal lines of credit with their parents or affiliates in New York or London to replicate these synthetic transactions without actually transferring funds into or out of the country.

What this facilitated was the development of the NDF¹⁵ market whereby off-shore entities could take positions long or short in the peso and then later settle the trades in US dollars – thus not having to transfer funds into or out of Chile. It also enabled local Chilean derivatives dealers to manage their risks without generating an expensive cross-border transfer of funds. Though this technically did not violate the capital controls because there were no capital movements across borders, it did allow the transfer of risk across borders without the usual ties to the actual movements of funds. It allowed banks to avoid paying the cost of URRs (*encaje*), and thereby diminished the impact of capital controls on reducing destabilizing effects of exchange rate fluctuations.

As mentioned above, there was little hedging by Chilean firms prior to the East Asian crises of 1997-98. It was limited availability of instruments, and lack of market depth that made hedging more expensive. For instance, large forward sales of pesos for dollars would move the market away from the hedger as it drove down market prices.

¹⁵ NDF, or non-deliverable forward, see description of contract above in Market Instruments section.

While Chile suffered the effects of the East Asian Crisis in 1997, there was comparatively less impact from the Brazilian crisis of 1999. This was due in part to many Chilean corporations having hedged their exchange rate exposure.

There was even less disruption to the Chilean economy during the Argentinean crisis—in part because the crisis was seen coming for some time and because more firms were hedged.

6. Regulation and how it is shaping derivatives markets

(a) Regulatory authorities

Chile's regulatory framework for derivatives is comprised of three main regulatory and supervisory authorities. They have a direct role in shaping and overseeing the derivatives markets. One is the central bank (BBC) that regulates the "formal" foreign exchange market, and another is the bank supervisor (SBIF).¹⁶ The central bank's regulations require financial institutions and non-financial corporations to report all spot, forward and other exchange rate derivatives transactions. This provides information on prices, trade size, maturity, liquidity and position sizes, and this provides for better surveillance of these markets. The central bank enforces the reporting requirements by guaranteeing only those transactions conducted through this 'formal' market to be convertible. In practice, transactions are normally convertible and the formal market does not pick up transactions by individual and by foreign or off-shore entities. Nonetheless it does provide detailed information on the vast majority of the market, and the aggregate of the data ultimately made available to market participants to improve their understanding of the pricing process.

The SBIF establishes regulations that govern how banks can act as derivatives dealers. In addition to conducting normal bank examinations, the SBIF sets capital adequacy requirements with respect to derivatives positions, oversees use of accounting norms for derivatives, and regulates how banks treat customers with foreign exchange exposures. In regards to capital adequacy, banks' net foreign exchange exposure is currently limited to 20% of capital and reserves. There are also daily risk exposure limits of 4% of capital.

SBIF recently drafted regulations that allow banks to act as dealers in options. First, however, they are required to demonstrate that they have adopted adequate value-at-risk models for managing the greater amount of risk. There is much greater credit risk and market risk from trading options. The greater credit risk comes from the upfront payment of premiums in options contracts, and the greater market risk comes from the highly exponential relationship between options prices (i.e. premiums) and that of the underlying item.

The third regulatory agency is the supervisor of pension fund managers (SAFP).¹⁷ It sets the maximum foreign exchange exposure limits for pension fund managers (and thus the minimum hedging requirements), requires that pension hedge with dealers that are registered with Chilean authorities, and prohibits pension funds from posting collateral with Chilean banks (although they can use it in external markets).

(b) Shaping markets

Prudential regulation in the sphere of financial markets is usually thought of as a defensive policy tool that is designed to protect the financial system and the economy as whole from disruptions and crises that originate in, or are transmitted by, the financial institutions or financial markets. This study of Chile's derivatives market offers an additional lesson into the role of

¹⁶ Banco Central de Chile, and Superintendencia de Bancos e Instituciones Financieras (www.sbif.cl).

¹⁷ Superintendencia de Administradoras de Fondos de Pensiones (www.safp.cl).

prudential regulation. In this case, certain regulations have proven very important in the creation and development of deeper and more efficient foreign exchange derivatives markets in Chile.

Markets do not always arise and develop on their own, nor do they always become 'complete'. This can be explained as a result of asymmetric information, costly or critically unavailable information, and various types of externalities. It can also arise due to behavioral reasons such as bad habits, and economic reasons such as the lack of a critical mass (market is unaffordable until sufficient participation raises liquidity and lowers transactions costs).

Markets are not black boxes in which buyers and sellers are mysteriously matched with efficient prices which equilibrate the quantities they wish to buy and sell. Markets have microstructures that are comprised of the institutions through which market participants can post their bid and offer quotes, negotiate or otherwise match quoted prices at which transactions can be executed, and then the transaction settled through the payment of cash against delivery of asset or fulfillment of obligation.

Whether due to intelligent design or just good fortune, several key provisions in Chile's regulatory framework made critical contributions to the creation and development of Chile's derivatives markets.

Given Chile's policy of private social security or pension funds, the efficient and prudential management of these funds requires some degree of international investment in order to obtain a sufficiently diversified portfolio for the citizens in an economy strongly affected by copper prices. In this context, the decision by the regulatory authority SAFP to set limits on the foreign exchange exposure from foreign investments by the pension funds had the effect of creating a strong and persistent demand for long forward positions in the OTC foreign exchange derivatives markets. This regulatory measure helped to create a more balanced market and a more deep and liquid market by adding an enormous volume of end-user activity to the market, and the resulting achievement makes it the most important regulatory feature for Chile's derivatives markets.

Another important regulation for the development of derivatives in Chile was the SAFP's requirement for pension funds to conduct their derivatives trading only with registered derivatives dealers. This had the result of establishing a network of recognized dealers that were subject to public oversight and surveillance.

Yet another import regulation to help promote the development of the derivatives markets was the decision by the SBIF (national banking supervisory authority) to establish capital requirements for Chilean banks that allowed lower capital charges on loans to borrowers who hedged their foreign exchange exposures. This regulatory measure also promote greater participation in the derivatives markets and it worked not by placing requirements on the end-users but by placing regulatory incentives on the lenders to end-users.

In addition to the above regulatory measures that played key roles in developing the market, there is another regulatory measure that will likely prove helpful in promoting the growth—and stability—of Chile's derivatives markets. That measure is the recent change to bankruptcy laws that allows derivatives counterparties to treat their derivatives claims against another firm on a net basis.

This is of profound importance in the way that credit exposure is treated. Consider two derivatives counterparties that have traded many different derivatives between them and as a result have a large amount of outstanding positions between them. This is likely the case for two derivatives dealers or a dealer and one of their major customers. At any one time, the marked-to-market value of these derivatives will show that some are gains to one firm and some are gains to the other firm. The value of gains less the value of losses is the net amount that one firm owes, or is owed by, the other firm at that moment.

What happens if one of them becomes insolvent and is taken to bankruptcy court. The solvent firm wants to collect on their profitable trades with the bankrupt firm, but faces the likelihood that the firm will not have enough remaining assets to make all the payments on the derivatives. A possibly bigger problem is that the failed firm will want to collect fully on its winnings, which it can because its counterparty is not insolvent, but not fully pay on its losses because it is bankrupt. In the absence of netting arrangements, the ongoing solvent firm might find that the net gains they had when their counterparty went bankrupt have become net losses because it has had to pay fully on its losing trades while only collecting partially on its winning trades.

Netting provisions can prevent this by allowing a counterparty to sue in bankruptcy court for only its net claims against the bankrupt counterparty. Even if they do not collect the net gains in full, they are protected from any net losses because they cannot be forced to pay on losses unless they are in excess of gains on other trades.

Allowing derivatives counterparties the legal certainty of netting in bankruptcy court will greatly improve the ability of dealers to make markets in OTC derivatives. It will also help prevent the failure of one major counterparty to inflict substantial losses on other counterparties by making them settle gross instead of net. On the other hand it will likely reduce the amount of capital held against derivatives positions by banks. Chile bank regulators do not require Chilean banks to hold, i.e. to take a capital charge, against the gross amount of the derivatives contracts that have a positive market value. (They are not allowed to reduce their exposure to any one counterparty by the amount of losses on derivatives with that counterparty.) The netting provision will result in bank regulators allowing Chilean banks to hold capital only against the net value of their exposure to its various derivatives counterparties.

(c) Regulatory issues

A regulatory measure that is frustrating the development of Chile's derivatives market is the accounting treatment of the use of derivatives for hedging. Several of the representatives of non-financial companies complained of this problem. They pointed out that the accounting treatment resulted in their reported earnings appearing to be more volatile—instead of less—as a result of using derivatives to hedge. In other words, instead of reported earnings reflecting the economic reality that the firm was reducing the volatility of its profits by hedging, it instead made those profits look more volatile by requiring the changes in the value of hedge be reported differently than the value of the item being hedged.

Consider the treatment of cash flow hedges.¹⁸ Firms are required to report gains or losses on the hedge irrespective of whether the underlying payment has occurred. Thus losses on a derivatives

¹⁸ See Fernandez (2006) for further discussion.

contract used to hedge a planned sale might end up being reported prior to the time when sale occurred. If the hedge extends across two reporting periods, then it might show up as a substantial loss in the first period and a substantial gain in the second period just because it ended up at the same initial price. The firm benefits from having its sale price hedged over the two periods, but it loses because its financial statement shows the appearance of a volatility of gains and losses.

Another important regulatory issue pertains to the use of collateral in Chilean derivatives markets.¹⁹ At present they are devoid of collateral requirements and almost devoid of the use of collateral in actual market practice. Non-financial firms describe in interviews that they do not use it. Pension funds, as pointed out by interviews with pension fund managers and supervisors, are prohibited from posting it with domestic counterparties. Banks claim that requiring collateral it would discourage customers. Market participants and bank regulators also point out in interviews there are no provisions in their derivative contracts that allow one counterparty to demand collateral from another in the event that credit exposure grows or exceeds credit exposure limits. Altogether, this results in a market that is seriously lacking in collateral that is needed to ensure the prompt and complete performance on a large and growing amount of derivatives transactions.

The lack of adequate procedures for the use of collateral not only poses greater systemic risk for the financial system, it also impedes the growth of the market. It impedes growth in two ways. First, the proper use of collateral could facilitate small and medium sized enterprises to participate in the market—currently these small cap firms are deterred by a marketplace that trades on capital. Second, the use of collateral will eventually enable pension funds to make full use of hedging in regards to their investment strategies by allowing them to employ longer dated foreign exchange derivatives and interest rate swaps and options that can be combined with their fixed income securities portfolio.

¹⁹ Collateral is also known as margin, and is usually in the form of cash or liquid government securities.

Part II

7. Derivatives and international capital flows

Derivative markets are enormous and rapidly growing, and their expansion to developing countries raises important new questions about their role in economic development.²⁰ Their impact on international economic stability should be considered as important, or as potentially important, as that for foreign bank loans and portfolio investments. Despite their size and prominence, derivatives markets have only recently come to the fore as a concern for international policy makers and researchers.

The most important economic policy issue raised by the growth and development of Chile's derivatives market is their impact on international capital flows. These concerns have focused on four basic questions. These are:

- Whether or not risk-shifting and price discovery, the two key economic functions of derivatives markets, encourage or discourage the net flow of capital to developing countries?
- Whether or not using derivatives to hedge the foreign exchange risk of investing in developing country generates a comparable amount of capital outflows?

²⁰ See Financial Policy Forum, Special Policy Briefs 24, 25 and 27.

- Whether or not there is any cyclical dimension to the role of derivatives in international capital flows or in the determination of exchange rates?
- Whether or not derivatives markets make developing country financial systems more vulnerable to instability and thereby discourage the flow of capital to developing countries?

The first question asks whether the economic benefits of derivatives markets, namely price discovery and risk-shifting, have a positive effect on the volume and stability of international capital flows. The second, and for many the most important issue, is whether hedging activities offset or neutralize the benefits of capital inflows by generating an equal amount of capital outflows. These concerns have been raised by economic studies that have identified reciprocal capital outflows arising from hedging activities.[add citations] The third issue is whether derivatives trading aggravates or exacerbates capital flows and especially in regards to cyclical capital flows or highly volatile capital flows. These concerns were raised by some of the financial crises that hit developing country financial markets during the 1990s.²¹ This study looks specifically at recent events in Chile and Brazil in which the investment strategies of hedge funds and investment banks appear to have substantial pro-cyclical pressures on exchange rate movements.

The fourth issue is whether the derivatives markets, especially inadequately regulated derivatives markets, make financial institutions and financial systems more vulnerable to market distortions and disruptions and thereby discourage international capital flows.

(a) Does it encourage greater international investment?

Regarding the first issue, the economic benefit of foreign capital inflows is that they augment domestic savings so as to finance additional investment. It can also, in the form of foreign direct investment, facilitate technology transfers and can add to the availability of foreign exchange. Derivatives can promote greater international investment by improving asset pricing and especially by facilitating risk management. Sometimes securities, loans and other assets are traded in markets that are characterized by transparent trading or centralized pricing or benchmark pricing. In these circumstances, derivatives markets can improve upon the efficiency of the price determination process. For example, farm products are often sold by their producers in many different and dispersed markets so that the prices established in these markets do not otherwise result in a national price or a benchmark price. Derivatives markets can do this. Similarly, bank loan rates might not be known nationally, but derivatives trading on various interest rates can set nationally known benchmarks. In Brazil, the future on the overnight interest rate has the largest trading volume on BM&F derivatives exchange.

Price discovery also allows for the various types of risk associated with an investment to be broken down and priced separately. It allows the credit risk to be priced separately from the foreign exchange risk and from the interest rate risk. For example, buying a Euro denominated corporate bond involves, at the least, foreign exchange risk, interest rate risk and credit risk. Derivatives markets can price the dollar-euro exchange rate into the future, they can price the single currency (euro) interest rate risk, and credit derivatives can price the credit risk. Investors and speculators can then know the value of these risk components and then hedge or take risky positions in those components if desired.

Hedging or risk shifting gives new meaning to “from the haves to the have nots” —it involves the redistribution of risk from those who have and do not want it to those more willing or able to bear it. This need not necessarily be viewed as safe versus reckless or prudent versus fearless. For example, a farmer hedges by selling coffee futures while Starbucks hedges by buying

²¹ Several studies are discussed in Dodd (2002).

coffee futures. If the farmer sells to Starbucks (who buys), then both reduce their risk through the same transaction. While this eliminate of risk does not happen in all cases, it does occur to the extent that the derivatives market is comprised of both short hedgers and long hedgers. In other cases of unequal amounts of long and short hedgers, the parties taking the risk hold it on speculation.

What effect does this have on international investment decisions? More efficient pricing of assets and the risk component of assets should encourage more foreign investment because they would be more confident that they are paying efficient or fair market prices and receiving market efficient rates of return on their investment (i.e. they are getting what they pay for).

Risk shifting should attract more foreign investment because investors who do not want all the various types of risks associated with owning a foreign asset can now make the investment with the reasonable expectation of being able to hedge away unwanted risk-components such as exchange rate risk or credit risk.

In these ways derivatives markets can clearly encourage greater foreign investment in developing countries, but whether they actually do so depends upon how well the derivatives markets themselves perform in those financial markets. The following explores the circumstances under which this is more or less likely to occur.

(b) Does hedging negate the benefit of capital inflows?

Derivatives markets in developing countries are often different from those in developed countries. Investors in developing countries, both foreign and domestic, need to hedge primarily against a fall in the value of the local currency. Almost no one wants to take additional long positions²² in the local currency, i.e. no one wants to hold pesos or rupees unnecessarily. This makes it hard to create derivatives markets because trading requires both a buyer and a seller—one party to take the long side and another to take the short side. There are, of course, periods when developing countries' currencies have appreciated, such as the experience in recent years, but the more usual market condition consists of expectations of a depreciating currency value. This one-sidedness of the marketplace, due to more short-hedgers than long-hedgers, is a challenge to complete derivatives markets.

So in the “normal” situation if investors want to hedge against a decline in the value of the local currency, what can they do? Who will take the long side? Or in other words, how can a derivatives market exist in local currency exchange rate risk?

If there are more short hedgers than long hedgers in a derivatives markets the only way for all the short sellers to find long buyers is for speculators or arbitragers to take positions in the market. And if no one wants to speculate by holding the local currency risk outright, then what? The answer can be found in how derivatives dealers manage their ‘book’ or portfolio of derivatives trades so as to maintain a flat or nearly flat book of positions. They do not sell short unless they can offset the position by buying long, and vice versa. When there is no one to sell short to, then the dealer is reluctant to buy long and market trading volume and liquidity suffer.

One solution to this dilemma is for the derivatives dealer to create a synthetic short local currency position to lay off the risk of taking the long position in the derivatives market. Creating such a synthetic short position is simple. It involves the following steps:

- Borrow local currency through a bank loan.

²² The term ‘long’ refers to an investment position that is equivalent to holding the local currency. “Long” is what you own or buy, and “short” is what you owe or sell.

- Buy dollars with the local currency in the spot foreign exchange market.
- Invest dollars in dollar assets abroad, and ideally do so at a maturity which matches that of the loan.
- This leaves the dealer 'short' because it owes the local currency required to repay the loan.

What this means is that the dealers in derivatives markets, in so far that they use synthetic positions to manage their 'book,' generate a capital outflow as they take out local currency loans and invest it abroad in dollar assets. Thus if the foreign investor who is bringing capital into the developing country (whether as DFI or portfolio investment) tries to hedge the local currency risk, and the derivatives market requires the use of synthetic short positions in order to complete the market, then the act of hedging capital inflows will result in similar amounts of capital outflows.

A similar outflow might occur if a Chilean (or Brazilian) firm were to borrow abroad in foreign currency and then hedges its exchange rate risk by selling pesos for US dollars in the forward market. If a dealer in the foreign exchange forward market were to use a "synthetic" forward to complete the market, then an offsetting capital outflow would occur. In both cases this would negate the effect of foreign capital inflows augmenting domestic savings as a source of investment or alternatively financing additional imports.

The problem identified in this example is that the use of peso credit to purchase US dollar assets amounts to a capital outflow. The amount of the outflow is roughly equivalent to the amount of capital inflows that are being hedged. Thus the benefit of foreign capital inflows augmenting domestic savings is off-set to the extent that those foreign capital inflows are hedged in a manner that leads to reciprocal capital outflows.

It should be pointed out that the sale of dollars for pesos to repay the peso loan is a reversal of the reciprocal capital outflow, and that the hedging activity would thus not result in a capital outflow *over time*. This point, however, overlooks the fact that so long as the foreign investment is hedged, the derivatives dealer in turn will lay-off its side of the hedge and that this might entail *maintaining* or rolling-over in succession this peso loan and dollar asset transaction until the hedging has ceased. In this way the capital outflow backing the dealer's position would possibly last as long as the hedged foreign investment. If so, it would offset the benefits arising from augmenting savings as long as the foreign investment was hedged.

This problem of offsetting capital inflows, though real and present is likely to diminish as the foreign exchange derivatives markets grow larger and deeper so that synthetic positions become less and less necessary to complete the market. This does not mean that the situation will never repeat again, but rather that it will become less frequent or significant. However, when the market becomes one-sided and there are more buyers (or sellers) of the peso in the derivatives market, the problem of off-setting flows returns.

A closer inspection of the functioning of Chile's derivatives markets indicates that dealers face many opportunities to lay-off such short peso positions with other entities that are long hedgers or are otherwise taking long positions in the foreign exchange derivatives market. This arises in part from a somewhat unique feature of the Chilean market in which Chile's pension funds are required to hedge a large share of the exchange rate risk from their foreign investments. When they hedge their foreign currency denominated assets back into pesos they become long hedgers.

Additional long hedgers in the Chilean market include exporters who earn hard currency revenue but must cover most of their expenses and payments in pesos. Other entities might be taking, or be willing to take, long positions in the Chilean peso for speculative purposes. Together these amount to a sizable opportunity to lay-off short hedging positions without having to engage in the series of credit market and spot foreign exchange market transactions needed to create a

synthetic position. If derivatives dealers do not take out peso loans to make dollar investments, then there is no capital outflow resulting from the hedging activity.

What about the role of the market for NDF (non-deliverable forward foreign exchange contracts)? Might the NDF market affect whether hedging results in capital outflows? It is not likely because it is economically the same as the regular foreign exchange forward market. The NDF operates to save on the transactions costs of making and taking delivery of the underlying currencies, and these costs are often greater for off-shore entities. NDF can also be used to handle accounts between affiliates within a conglomerate bank. In this case, capital may not move in a physical or even financial transaction sense but merely by the Chilean subsidiary showing an increase in dollar assets and the parent showing a dollar liability. Transactions costs are affected by certain tax policies as well as capital controls, and so the NDF market also reflects efforts to avoid those policies. The NDF market is thus often a source of frustration for policy effectiveness.

In summary, hedging can negate the benefit of capital inflows to augment domestic savings and provide additional foreign exchange (it might nonetheless transfer technology or have other collateral benefits or costs). Also, hedging will not negate the benefit of capital inflows if and when the derivatives market has equivalent amounts of short and long hedgers—or otherwise long speculators—so that the market can be completed without resorting to creating synthetic positions.

(c) Do derivatives markets play any cyclical role in international capital flows?

There are several ways in which derivatives markets can potentially add to the cyclicity or volatility of international capital flows. This potentiality does not mean that they necessarily will have that effect. Nor does it mean that the likelihood of these effects cannot be reduced by properly designed regulations. The point of discussion in this section is to identify these vulnerabilities, analyze how they occur and then start to explore how proper regulatory measures can help remedy the problem.

One way in which derivatives markets can aggravate volatility and pro-cyclicity is when market participants with short US dollar (or other hard currency) positions act to hedge that exposure only after the forward or spot exchange rate depreciates, or when pressures for such a depreciation are building up. This arises when Chilean entities with US dollar debt or Chilean importers or foreign investors in Chile—all of which are likely to have net foreign exchange risk exposure—do not maintain a hedged position but instead plan to enter into hedged positions if the situation changes. This is a simple variant of what is known as ‘dynamic’ hedging. This result is a pro-cyclical market pressure from selling pesos when the value is declining and not selling (or buying back) when prices are rising.

Another source of pro-cyclical market pressure comes from the investment strategy pursued by hedge funds, and investment banks, to profit from the carry trade of borrowing in Chilean pesos and lending in Brazil real. This works in a pro-cyclical way when the hedge funds sell Chilean peso to commence the investment while the peso’s value is falling or when they unwind their positions when the peso strengthens (we discuss more thoroughly below). This results in selling pesos when the value of the currency falls and buying when it rises. These actions are in contrast to the claims made by many defenders of speculation who insist that speculators are contrarians who sell when the price gets high and buy when the price gets low.

In addition to the peso-real carry trade investment strategy, hedge funds engage in a similar investment strategy using the copper futures markets (if the forward price curve for copper is flatter than peso interest rates or the forward price curve for the peso-dollar foreign exchange forward, then a short copper position is cheaper—and the carry profits greater—than these other two alternatives).

Yet another pro-cyclical impact from foreign exchange derivatives markets can occur they are used to increase foreign exchange exposure —i.e. speculate— instead of hedging. This can add to financial sector vulnerability and can result in a faster, deeper financial crisis (Dodd, 2002).

(d) Do derivatives improve financial stability?

Greater financial stability will encourages greater capital inflows, while reduced stability should do the opposite. The question hinges on whether derivatives help or harm financial sector stability.

Some have argued that derivatives markets make a financial system more stable. The former chair of the US Federal Reserve, Alan Greenspan, has repeatedly argued that large scale use of derivatives by banks has made the US financial system and the overall economy more stable. The basic point is that banks and key financial institutions use derivatives to improve their risk management. This allows them to pursue their best business opportunities while avoiding unwanted or unwarranted risks by transferring it to others through derivatives markets. The result is a system of financial institutions that are more safe and sound. Greenspan cites the lack of failures by financial institutions during the last US recession as evidence for this constructive role.

Others have argued that while hedging can make firms more safe and sound, the OTC derivatives markets often do not operate according to safe and sound financial practices and that their large and growing economic role makes financial systems overall less stable.²³ Derivatives markets operate at lower prudential standard than most traditional banking, securities or insurance markets. Examples of this include the following.

- Derivatives provide greater leverage and cheaper exposure to market risk – this means that it is easier to take larger risks, that losses can rapidly escalate, and that rare events can have greater impacts than they otherwise would. It also means that losses due to market risk become greater credit exposures and greater potential credit losses.
- The greater leverage arises from the absence of collateral requirements and lower effective capital requirements. Inadequate collateral and capital leave derivatives markets more vulnerable in times of stress. This is one of the more significant problems with Chile's derivatives markets.
- OTC derivatives markets face greater exposure to liquidity risk. OTC markets can dry up at the worst time as dealers withdraw from markets and other participants hesitate to trade with any dealer viewed to be “at risk.”
- OTC derivatives markets have poor clearing and settlement arrangements and this results in greater exposure to operations risk.
- OTC derivatives markets do not have adequate anti-fraud and anti-manipulation prohibitions and enforcement authorities.

In sum, derivatives have the potential to encourage international capital inflows. They can improve pricing efficiency and provide means for investors to better manage their risks so as to encourage greater amounts of investment.

That potential may not be realized, however, and derivatives market may end up discouraging capital flows. This is more apt to happen if markets are perceived as disorderly or lacking safe and sound business practices, and this is more likely to arise when derivatives markets lack adequate regulation and supervision. It is also apt to happen in underdeveloped markets where dealers generate capital outflows in order to create synthetic short positions to complete markets. In order to

²³ Dodd (2004 and 2005).

assure that derivatives market function to encourage international capital flows and not hinder them, they need appropriate regulatory measures that will promote their efficient and orderly use by maintaining prudential standards for safety and soundness.

8. Can certain investment strategies impact the exchange rate?

One investment strategy that came up in many interviews with market participants was the peso-real carry trade. This hedge fund and investment bank investment strategy involves taking a short-position in Chilean pesos and a long position in the Brazilian real in order to capture the difference in Chilean and Brazilian interest rates. This strategy is premised on the notion that the inherent currency risk is limited by the correlation between the real and the peso. The correlation means that a reduction in the value of the Brazilian real would be offset by gains on the short peso position. Indeed, the Chilean peso exhibited a high level of correlation with the Brazilian real according to the LACI index of JPMorgan and Bloomberg. This correlation, combined with the fact that Chilean Peso interest rates were amongst the lowest in the region, implied that the peso became the currency of choice for a carry trade with the real (interview material, Beltran Del Ramon, *et al.*, 2005).

There are a few different ways to execute this strategy. One way is to sell the peso short in the forward market, and buy the real long in the forward market. The non-deliverable forward market for Chilean pesos serves this purpose.

Another way is to borrow the Chilean pesos at the low peso interest rates and then buy US dollars in the spot market, and then real with the dollars, and finally invest in a liquid asset in real. The gains will be the difference in the real and peso interest rates and any change in the exchange rate when the positions are reversed. If the correlation of the exchange rates holds perfectly, then the profit would be the difference of the interest rates.

This strategy, according to interviews, was popular with hedge funds and foreign investment banks in the early part of 2005. When the peso began to strengthen against the real (hence becoming uncorrelated), these positions were unwound in June and July of that year (see in figure 1). The peso initially strengthened as a result of sharp increases in the price of copper and the real weakened due to political problems linked to charges of alleged corruption in the Brazilian government. The unwinding of these positions —positions which are large, and which exceeded \$5 billion, see figure 1— had the effect of putting further upwards pressure on the peso, thus acting in a pro-cyclical fashion to push the value of the peso beyond what was warranted by the fundamentals (including the higher price for copper).

As shown in figure 1, the net offshore position of banks and non-banks increased again in October 2005, which coincided with a slight depreciation of the peso. This would seem to provide initial evidence that changes in net offshore positions affect the exchange rate, and that the unwinding of positions strengthened the Chilean peso.

Further empirical evidence is provided by econometric analysis conducted by the staff of the Chilean Central Bank (Marinovic, 2006; Selaive and Alarcon, 2006). The former (Marinovic, 2006), adopting an approach based on the microstructure of the exchange rate market, focuses on the fact that the level of Non-Deliverable Forwards²⁴ between Chilean residents and non-residents for peso-dollars have significantly increased. Her econometric analysis shows that for the 2004-06 period, the level of NDFs contributes, at a significant level, to explain the evolution of the nominal exchange rate, particularly within the next week and the periods up to two months. According to Marinovic's estimates, an increase of 1% in the net positions of NDFs on average during 2004-06

²⁴ Non Deliverable Forwards (NDFs) are the instruments used for the peso-real carry trade by offshore actors, as described above.

leads to a depreciation of the peso of 0.02% during the following two months. This is because an increase of one standard deviation (60%) in the change in net NDFs is associated to a depreciation of the nominal exchange rate by approximately 1.2% in the next two months.

Selaive and Alarcon (2006) provide complementary analysis. They find a significant statistical daily association between NDF positions and the exchange rate for the second half of 2005, when a fall of US\$100m of the NDF positions—equal to around 2% of the total outstanding amounts at the end of 2005— was associated with to an appreciation to the US\$. For previous periods, changes in NDF positions were not significant, whilst the price of copper was significant for the whole 2001-06 period.

Selaive and Alarcon *op. cit.* correctly stress that, as NDFs have increased their share within the foreign exchange derivatives market in Chile (to 34%), they have become an important proportion of the total spot and forward foreign exchange markets. As a consequence, it is an important channel through which NDFs influence the exchange rate through their effect on the supply and demand of foreign exchange. There may, however, be other special transmission channels from NDFs to the exchange rate, such as asymmetries of information and difference in the behavior of agents (Lyons, 2004).

The key point is that offshore (or NDF) positions are large (they are reportedly in excess of US\$6 billion) and their magnitudes fluctuate significantly. Large changes of these positions, by hedge funds and other international financial institutions, can lead at times to an exacerbation of cycles. This is of special concern for recent periods of exchange rate appreciation. Excess currency appreciation can be damaging to Chilean exports. Alternatively, these large positions could lead to excessive exchange rate depreciations under different circumstances.

There are two particular additional sources of concern about these activities. One is that they are driven basically by the search of very large short-term profits and are not linked to differences in countries' fundamentals. Secondly, these activities by international—mainly US and European— hedge funds and investment banks are totally unregulated; even if they were regulated nationally, this may not be sufficient, and international coordination may be required to make such regulation effective, though it may not be easy to achieve. Institutions like the BIS, the Financial Stability Forum or the IMF could provide support for such measures.

9. What do derivatives markets mean for the hierarchy of volatility?

This section addresses several key questions about derivatives, volatility and their role in the macro economy. One key question for this study is whether derivatives markets are more or less volatile than that for loans, portfolio investments in stocks or bonds, of foreign direct investment, and whether they change the volatility of those various types of capital flows? Do they in fact undermine the idea of a hierarchy of volatility? A related question is what is the impact of derivatives on the exchange rate market, and is there a cyclical effect?

Any answer depends firstly on how volatility is measured —year to year, month to month, day to day or moment to moment. This is an important distinction. A market price may have little year to year volatility, but experience comparatively greater intraday movements. For example, the S&P500 index was largely unchanged over the calendar year 1994, but it did exhibit considerable intraday and day to day volatility. Alternatively, a market can have serious year to year volatility, but exhibit relatively small day to day movements. For example, the US dollar-euro exchange rate has moved up and down considerably since 2000 —moving more than 50% from January 2002 to the end of 2004. However there are very few days when it has changed as much as 2%. The point is that volatility may be significantly higher at one frequency than another, and comparison across derivatives and various types of capital flows needs to address these distinctions. *The volatility we are most concerned with in this study relates to major changes in trends.*

Consider first the case of non-financial corporations that face exchange rate exposure from external debt denominated in hard currency and revenues denominated in Chilean pesos. At times they have been largely unhedged in regards to this exchange rate risk —a condition that might be called passive speculation on the peso. This changed starting in 1998 as they began to increase their hedging on a very large scale. Figure 2 on Net Positions shows that their net outstanding forward positions *increased* by US\$ 4,115 million from 1998 to the end of 1999. This hedging, which increased the sale of pesos in the forward and CCS markets, was concurrent with the depreciation of the peso exchange rate during that period. Hedging, in this instance, appears to have contributed to the pro-cyclical movement in the exchange rate.

Econometric analysis of daily data supports the claim that there is a strong explanatory link between the amount of daily net positions of corporations and the level of the Chilean nominal peso-dollar exchange rate for the 1998-99 period (see table 4). The results, which are significant at 95%, hold both for contemporaneous analysis (zero lag, or $K=0$) and for lags of five days ($K=5$). As can be seen in figure 3, net positions of the non-financial corporations increased dramatically during 1998-99, but varied far less after 1999. According to interviews, the leveling of net positions is thought to reflect non-financial companies having become sufficiently hedged. This explains a far lower, though still significant at 95%, R^2 for the whole 1998-2006 period.

Figure 2
NET POSITIONS, COPPER PRICE AND NOMINAL EXCHANGE RATE, 1998-2005

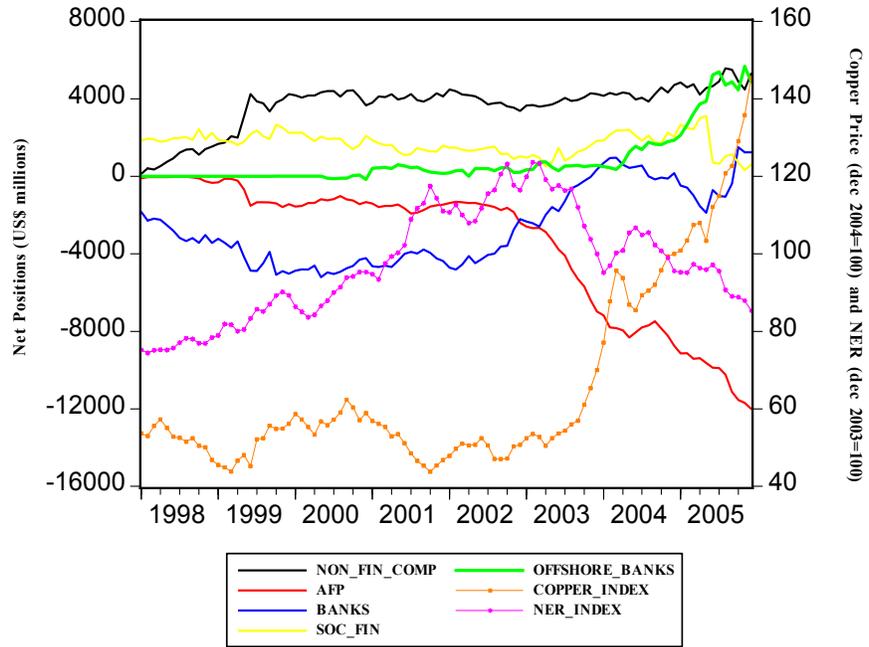


Figure 3
NON-FINANCIAL COMPANIES

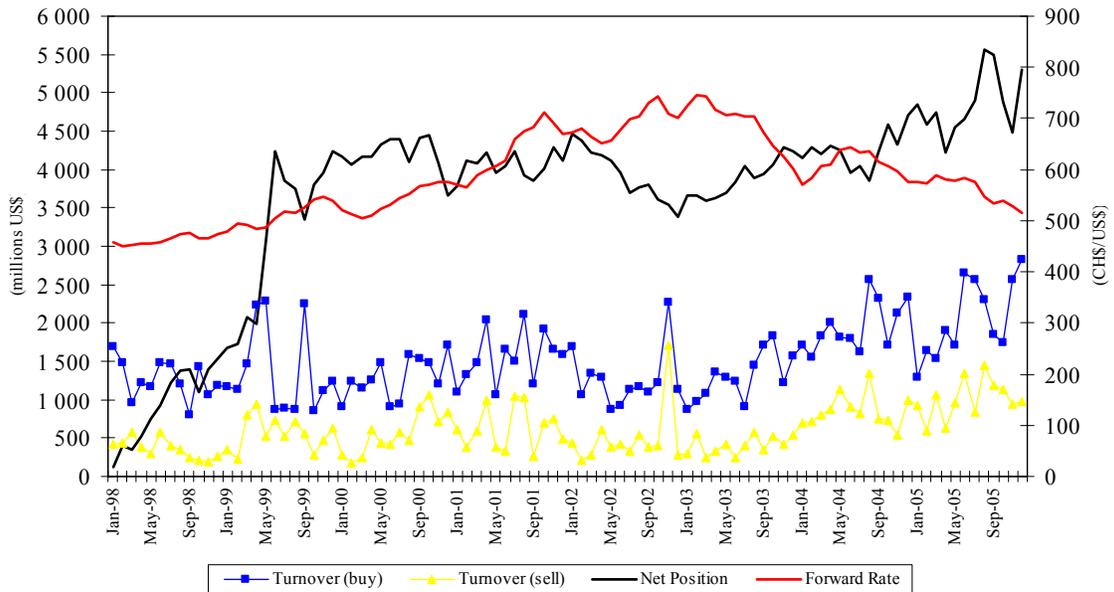


Table 4
NOMINAL EXCHANGE RATES AND NET POSITIONS

$$NER_t = \alpha + \beta NETPOSITION_{t-k} + \epsilon_t$$

		1998-99	1998-2006
		Positions	Positions
k=0	Parameter	0,017948	0,025326
	S.E. N-W	0,001101	0,002751
	R ²	0,83	0,15
k=5	Parámetro	0,018102	0,025486
	S.E. N-W	0,001058	0,00274
	R ²	0,84	0,15

Source of data: Central Bank of Chile.

S.E. N-W = Standard error of Newey-West.

Note: The estimates we carried out with daily data on the level of nominal exchange rate (NER) and the level of the net positions of non-financial corporations; we used minimum squares corrected for heterokedasticity and autocorrelation via Newey-West standard errors. Bold font figures reflect that all the parameters are significant at 95% confidence levels.

Therefore, if derivatives are widely used for hedging, e.g. foreign direct investors with local currency revenues are hedged (as many large firms currently claim to be as they expressed during detailed interviews and as is consistent with figures 1 and 3, which show the stability of non-financial corporations net positions) then the hierarchy of volatility still holds, as these foreign investors would not exert much additional pressure on the foreign exchange market in times of crisis. In that case, foreign direct investment would continue to be less volatile than short-term flows.

The use of derivatives to hedge foreign exchange exposure, and thereby reduce the impact of exchange rate volatility during critical moments of instability, would support efforts —regulatory and otherwise— to encourage if not require borrowers as well as firms in the tradable goods sectors to hedge such risks.

There may be a case therefore for ensuring that companies (especially large ones) with considerable dollar liabilities and peso incomes are hedged from the start. This could be achieved via direct or indirect regulation. In markets such as the current Chilean one, such hedging is not at all expensive. It would be advantageous, both for the firm (for whom unhedged positions are potentially very costly, as was shown by big losses of some companies in Chile in 1998-9), and from a macro-economic perspective, as it will avoid additional pro-cyclical pressure on the exchange rate, both in times of large inflows and especially in times of large outflows. This is an important lesson that other developing countries can draw from the Chilean experience.

There would seem to be a similar case for encouraging or requiring that foreign investments by Chilean firms be hedged, in times of downward pressure on the peso, as clearly was the case in 1998-9 in Chile (Ffrench-Davis and Tapia, 2001 and Zahler, 2006), with a rapid and pro-cyclical increase in foreign investment by Chilean pension funds.

Table 5
ANNUAL CHANGE IN NET FORWARD FX POSITIONS
(US\$ millions)

	Financial companies	Pension funds	Non-financial corporations	Banks
1998	412	-233	1 407	-1 599
1999	-4	-1 107	2 708	-1 590
2000	-162	115	-581	874
2001	-513	-132	464	-93
2002	-545	-942	-745	2 575
2003	801	-4 577	864	2 593
2004	207	-1 768	464	241
2005	-1 427	-3 254	599	680

Source: Central Bank database. Author's calculations.

There may therefore be a case for restricting the scale of the outflow of pension funds during certain periods (as suggested by Zahler, 2006) and Fontaine, 1996) or to only allow such large outflows in periods of expected depreciation if such additional foreign investment by pension funds is hedged. For the latter, regulations would need to be lifted that currently somewhat restrict hedging by Chilean pension funds, especially for using long-term instruments. This would help make it cheaper for pension funds to hedge and would allow longer term hedging. However, as discussed in what follows, hedging of pension fund outflows in periods of expected appreciation of the peso would be undesirable. It may therefore, not be easy to use regulations on hedging by pension funds, to increase their stabilizing or counter-cyclical role, unless such regulations are changed through the cycle. This may be too complex to implement effectively.

Specifically in the period 1998-99, hedging by pension funds was partial, as there was an increase in investment abroad by Chilean pension funds of US\$4,162 million between December 1997 and 1999 (see table 6), whilst the net increase in outstanding foreign exchange forwards was only US\$1,340 million (which represented only 32% of outflows). Therefore, the net impact of pension fund outflows during that period was US\$2,822 million, which implied that significant additional pressure was exerted on the peso to weaken. In interviews it was argued by pension fund managers that pension funds initially needed some foreign exchange exposure, and therefore did not hedge their initial increased investment abroad that was facilitated by further liberalizing the capital account; this limited hedging however was mainly encouraged by the fact that it was more profitable to invest abroad and not to hedge, given the expectations of the peso falling, in the wake of the Asian and Russian crises. It is worth pointing out, that this lower level of hedging is consistent with the self-fulfilling expectations of capital outflows of pension funds driving down the value of the peso.

Table 6
PENSION FUNDS: CHANGES IN FOREIGN INVESTMENT AND HEDGING
(US\$ millions)

	Investment abroad	Changes in net outstanding forward
1998	1 399	-233
1999	2 773	-1 107
2000	-1 759	115
2001	734	-132
2002	1 332	-942
2003	5 727	-4 577
2004	5 330	-1 768
2005	8 000	-3 254

Source: SAFP and Central Bank.

Thus, during 1998 and 1999, there was a combination of non-financial big companies (mainly in the telecommunications and energy sector) hedging on a significant scale, by buying dollars forward, and pension funds investing abroad on a large scale (with partial hedging) implying that due to both factors, there was major pressure on the peso to weaken from these flows, both on the spot and the forward market, which it did. This contributed to the need for a sharp macroeconomic adjustment that led to a fall in GDP of 1% (Ffrench-Davis and Tapia, 2001).

The situation changed starting in 2000. Large companies report that for the last several years they have had their net foreign exchange exposure more completely hedged. This is reflected in the relatively small changes in their net outstanding forward positions (see table 1) over this period. On the other hand, pension funds hedged around 80% of their investments abroad in 2003 (see table 6). This foreign investment would only exert limited countervailing pressure to moderate the significant strengthening of the peso. However, in 2004 and 2005, there were again large outflows by pension funds, but there was a smaller proportion of hedging (see again table 6), of 40% or less during those two years, which implies that the outflows by pension funds did have an effect in slowing the important appreciation of the peso.

Therefore, hedging of their large investment abroad by pension funds is stabilizing the exchange rate in times of expected peso depreciation, but implies less of a stabilizing role of pension fund outflows in times of expected appreciation.

What becomes increasingly important for Latin American countries is not just how derivatives are regulated, but also how (and how much) their use by firms, pension funds, etc is regulated, so their impact is not too pro-cyclical, or (ideally) could be neutral or even counter-cyclical. This is quite difficult, as derivatives are currently not very regulated, the aim of this limited regulation is not linked to macroeconomic concerns e.g. of pro-cyclicity, and in some cases, regulations on hedging would have to be changed according to cycles of exchange rate trends, and/or capital flows. Further research and policy discussion seems to be required.

10. Regulatory proposals to improve Chile's derivatives markets

The goal is to ensure that derivatives markets are sound, safe and efficient. That is, to help ensure sound institutions and stable financial systems; to ensure safe markets that are free of fraud, manipulation and predatory practices aimed at consumers and small investors, and to promote efficient markets—the focus of which is pricing efficiency and transactions costs.

The regulatory framework is built upon three pillars.

- (i) Registration and reporting requirements.
- (ii) Capital and collateral requirements.
- (iii) Orderly Market Rules such as position limits, price movement limits (sometimes called circuit breakers), requiring dealers to maintain bid and ask quotes throughout the trading day.

More specifically, these regulatory measures should look like the following.

(a) Registration and reporting requirements

Regarding registration requirements, registration is a means to insure that all financial institutions meet minimum standards, that the regulatory authorities has a census of all relevant financial institutions, and it provides an easy way to identify illegitimate businesses and for the regulatory author to shut down illegal activity. Minimum standards should include a sound business plan, that the firm be well managed, that it meets capital requirements and that its key employees be certified as competent and trustworthy.

Key individuals, such as a financial institution's representative agents and "appropriate persons" as well as independent brokers, agents and investment advisors, should be registered or licensed. The registration of individuals sets minimum standards for people that carry fiduciary responsibility for the firm or customer accounts are critical to the process of preventing and prosecuting fraud. In many cases, registration should require that applicants pass an examination of competence. Registration allows regulatory authorities to conduct background checks on individuals—who act as brokers, agents or salespeople—who have fiduciary responsibility over the firm's or their customers' accounts. The background checks should test for past criminal conduct because individuals convicted of fraud should not be allowed to act as brokers or other responsible persons (front-line representatives of financial institutions).

Reporting requirements should apply to all derivatives dealers and major market participants (this is effectively the case in Chile's foreign exchange forward market because of pension fund reporting and the central bank's formal market requirements). These entities should also be required to keep proper records for five or more years.

Especially important are large trader reports. The information acquired by the regulatory authority through these reporting requirements should help their efforts in market surveillance. The public interest is best protected when the regulatory authority has sufficient information to police malfeasance and help prevent market disruptions caused by fraud and manipulation. Up to date financial information on firms and markets should also give the government an early warning of firms that were in trouble due to taking a large losses on big market.

Well informed investors are the key to establishing efficient financial markets, and reporting requirements are essential to providing them with the relevant market information they need. Businesses, taken individually, have incentives to hoard information or report it in a selective manner. Reporting requirements assure markets that corporations provide all appropriate information under uniform rules so that the public has the potential to make rational, fully informed investment decisions. In order to bring off-balance sheet activities into the same light as balance sheet activities, derivatives activities would be reported by notional value (long and short), maturity, instrument and collateral arrangements. This will enable investors to better determine whether the firm was under- or over-hedged, and whether they were primarily acting as a producer or wholesaler.

(b) Capital and collateral requirements

Require minimum capital requirements for all derivatives dealers and set minimum collateral requirements for derivatives transactions. Collateral requirements for financial transactions function much like capital requirements for financial institutions: both provide a buffer against financial failure, and both provide incentives to economize on risk-taking by raising the cost of holding open positions. Collateral requirements apply to all transactions, not just some institutions, and thus govern to entire market place. Adequate collateral usage will reduce the need for capital by reducing the collateral adjusted exposure to counterparty credit risk. These prudential measures help prevent liquidity or solvency problems at one firm from causing performance problems that impact other transactions and other firms. In so doing it reduces the costs of the externalities of risk-taking by reducing the likelihood of default on transactions and thereby reduces the market's vulnerability to a freeze-up or

(c) Orderly market rules

This set of regulatory measures is designed to improve the efficiency and stability of the market place by protecting it from abuse and providing assurances—or at least helping to avoid—some of the disrupting type of events.

One, strictly prohibit fraud and manipulation in financial markets. Create market surveillance and enforcement authorities, make violations punishable by civil and criminal penalties, and adopt “know thy customer” and “truth in lending” type rules for dealers.

Two, foster market day. In dangerous situations, the dealers sometime withdraw from the market and this has liquidity by requiring OTC derivatives dealers to act as market makers by maintaining binding bid and offer quotes throughout the trading the consequence of turning a disruption into a crisis.

Three, employ “circuit breakers” and price limits for trading on OTC derivatives markets in order to protect the financial systems from disruptions and short-term volatility. These features are regularly used—and the practice is widely approved—on securities exchanges and futures and options exchanges, but are lacking in OTC markets.

Four, encourage or promote the establishment of a clearing houses. Clearing houses are an effective means of improving the efficiency and stability of derivatives markets. They greatly reduce the credit risk and trading risk inherent in making trades and holding positions. By acting as the counterparty to every trade, they offer a AAA credit rating for everyone's credit exposure arising from derivatives positions.

They also reduce operational risks involved with trading by providing trade confirmation services, and by acting as an arbitrator to settle disputes regarding trades or the settlement of trades without the delay and costs of court proceedings. In performing these critical services, clearing

houses mitigate several problems. Firstly, they reduce the number disputed trades because the trade is confirmed daily, and any dispute can be mediated by the clearing house acting as a third party. Secondly, they reduce the number of incomplete settlements, known as “fails,” because of the enhanced ability to economize on the payments and securities needed to make delivery. Thirdly, they improve market liquidity by creating a high standard for credit rating on exposure in the market.

These regulations are as important as the derivatives markets they are designed to govern. These measures will both promote the use of these markets for risk management while discouraging their misuse. Markets that are deeper, more liquid and that are governed by orderly market rules are more efficient in their price setting activities than those characterized by disruptions and distortions. By establishing a more solid foundation for these markets they will help prevent or at least diminish their role in financial disruptions and pro-cyclical economic activities. The Chilean case is already a positive example of how financial market regulation can improvement a market place, and these additional regulatory measures will help make sure that the growth of this market is accompanied by improvements in the regulatory framework and positive economic results.

11. Concluding remarks

This report shows that derivatives markets are large and growing rapidly, and that they are playing an increasingly important role in the economies of Chile and Brazil. The report focuses primarily on Chile in exploring how that important role is in some cases positive, especially when it reduces exposure to foreign exchange risk, and in other cases negative. The positive role comes about from the use of derivatives to reduce existing risk —primarily foreign exchange risk from foreign borrowing, foreign investing and international trade. This reduction of risk exposure means lower magnitudes of economic disruption from financial crises abroad or any substantial movement in the exchange rate.

The negative consequences of derivatives markets in Chile include their potential to generate reciprocal capital outflows and exacerbate trends in the movement of the exchange rate. The amount of the former can be reduced through a deepening of the market, and well targeted regulatory measures may prove helpful —as they have in the past— in increasing market participation from a variety of different economic interests and viewpoints. However the stability of these markets and their regulatory framework has not been tested by a financial crisis in Chile. Moreover, some market participants —or some types or market activities— appear to be problematic in that they appear to be having a pro-cyclical impact on the market. The participation of hedge funds and some other financial institutions in the pursuit of certain investment strategies seems to be adding upwards pressure to the peso when it has undergone recent periods of appreciation. The report also identified certain periods when it appears that non-financial corporation were hedging in anticipation of a depreciation, and this selling of pesos in the forward market put further downward pressure on its value.

Some of the other specific issues addressed in the report include the following. Derivatives may alter the hierarchy of volatility of capital flows, making long-term flows potentially more volatile. In 1998-99, large foreign investors, heavily hedged their external debt exposure fearing a peso depreciation. This contributed significantly, in a self-fulfilling, way to a depreciation. However, this anticipatory selling can be avoided, to a significant extent, if these large enterprises were required to hedge any significant foreign exchange exposure. This would have both positive macro-economic effects, protect the firms profitability, enhance their capacity to invest and deepen the Chilean derivatives market. Such well designed regulation to encourage hedging would help create a more balanced market in derivatives instruments and provide better hedging opportunities

for all sizes of firms in the economy. A more balanced market would seem to be less likely to generate reverse capital flows as derivatives dealers seek to balance the risks on their trading book.

This key policy lesson is perhaps more important outside Chile (where large companies are already hedging their currency exposures) for example in some other Latin American countries where derivatives markets have yet to, or are only beginning to, develop.

At the same time, new and possibly dangerous sources of volatility are opened by certain uses of derivatives. For example, the speculative use of derivatives by hedge funds and some other financial institutions can potentially lead to significant losses that would cause credit losses at derivatives dealers who make up the core of Chile's financial sector. These investment strategies may also have important pro-cyclical effects on the exchange rate.

Definitions and abbreviations

Affiliate – another firm related by being either the parent or another subsidiary of the same parent

Bullet bond – semi-annual or annual interest payments (called coupon payments) and entire principal and coupon is paid on date of maturity

Collateral (also known as margin) – cash, government securities or other assets posted to counterparty in order to help guarantee full performance on the derivatives contract and thereby reduce counterparty credit risk

Counterparty – the entity enters into the other side of the derivatives contracts and takes the opposite position

Formal foreign exchange market – in Chile the Central Bank requires reporting of most foreign exchange transactions in order that convertibility is guaranteed

Lay-off risk – to enter into another similar but opposite transaction in order to reduce the overall exposure

LIBOR – the rate at which off-shore or Eurodollar banks are willing to lend (London Interbank Offered Rate)

Long-hedge – entering into a long-position in a derivatives contract to hedge an already existing short position. For example, an airline buying heating oil futures in order to hedge their requirement to purchase jet fuel in order keep their planes flying

Offset risk – see lay-off risk

SAFP – Superintendencia de Administradoras de Fondos de Pensiones, www.safp.cl

SBIF – Superintendencia de Bancos e Instituciones Financieras, www.sbif.cl

Short-hedge – entering into a short-position in a derivatives contract to hedge an already existing long position. For example, a corn farmer hedges his crop (a long position) by selling corn futures

Spread – the difference between bid and ask quotes, or the risk premium above a risk-free or other benchmark rate

“Take a position” – a phrase meaning to enter into a transaction (or series of) in order to potentially profit from a future price movement

UF or “Unidad de Fomento” – Chilean pesos indexed to inflation at an official CPI rate

References

- Chan-Lau, Jorge A. (2005), "Hedging Foreign Exchange Risk in Chile: Markets and Instruments." *IMF Working Paper* WP/05/37, Washington, D.C.
- Cowan, Kevin (2004), "Currency Mismatches, Balance Sheet Effects and Hedging in Chilean Non-Financial Corporations." Paper prepared for the Octava Conferencia Anual del Banco Central de Chile: *Vulnerabilidad Externa y Políticas de Prevención*.
- Cowan, K., A. Micco and A. Yáñez (2006), "Descalces cambiarios en empresas manufactureras chilenas", *Informe de Estabilidad Financiera*, primer semestre 2006, Banco Central de Chile.
- De Ramón, Beltrán, *et al.* (2005), "Toma de Posiciones Largas en Mercados Emergentes (Brasil) y su Impacto Sobre el Tipo de Cambio." *Gerencia de Mercados Financieros*, Banco Central de Chile.
- Dodd, Randall (2002), "The Role of Derivatives in the East Asian Financial Crisis", in John Eatwell and Lance Taylor (editors), *International Capital Markets: Systems in Transition*. Oxford University Press. It also appears in *The Financier*, vol. 6, 1999.
- ____ (2003), "Derivatives, The Shape of International Capital Flows, and the Virtue of Prudential Regulation" in Ricardo Ffrench-Davis and Stephany Griffith-Jones (eds.), *From Capital Surges to Drought*, Palgrave Macmillan Publishers, New York.
- ____ (2004), "Derivatives Markets: Sources of Vulnerability in U.S. Financial Markets." In *Gerald Epstein (editor), Financialization and the World Economy*. Edward Elgar Publishers and The ICAFI Journal of Derivatives Markets.
- ____ (2005), "The Virtues of Prudential Regulation." Forthcoming in Stiglitz and Ocampo (editors), *Capital Markets Liberalization. Overview Book*, Oxford University Press, 2005. Also available as *IPD Working Paper 7, Capital Market Liberalization* www0.gsb.columbia.edu/ipd/pub/DoddPrudentialRegulation3_8_04.pdf.

- Fernandez, Viviana (2006), "Emerging Derivatives Markets." *Emerging Markets Finance and Trade*, vol. 42, No. 2 (March-April).
- _____(2003), "What Determines Market Development? Lessons from Latin American Derivatives Markets with an Emphasis on Chile." *Journal of Financial Intermediation*.
- Financial Policy Forum, *Special Policy Briefs* 24, 25 and 27, at www.financialpolicy.org.
- Fontaine, J.A. (1996), "Are There (Good) Macroeconomic Reasons for Limiting External Investments by Pension Funds? The Chilean Experience." In S. Valdes-Prieto (ed.). *The Economics of Pensions: Principles, Policies and International Experience*, Chapter 9, Cambridge University Press, New York.
- Ffrench-Davis, R. and H. Tapia (2001), "Three varieties of capital surge management in Chile", in R. Ffrench-Davis (ed.), *Financial crises in 'successful' emerging economies*, Brookings Institution, Washington, D.C.
- Ffrench-Davis, R. and S. Griffith-Jones (eds.) (2003), *From Capital Surges to Drought: Seeking Stability for Emerging Economies*, Palgrave Macmillan, New York.
- IMF Country Report No. 05/316 (2005), Chile: Selected Issues. Washington, D.C. (September).
- IMF (International Monetary Fund) (2004), Chile: Financial System Stability Assessment, including Reports on the Observance of Standards and Codes on the following topics: Monetary and Financial Policy Transparency, Banking Supervision, and Securities Regulation, IMF (Washington).
- Jadresic, Esteban and Jorge Selaive (2005), "Is the FX Derivatives Market Effective and Efficient in Reducing Currency Risks?" Working Paper 325, Central Bank of Chile.
- Moguillansky, Graciela (2003), "Non-Financial Corporate Risk Management and Exchange Rate Volatility in Latin America, in Ffrench-Davis and Griffith-Jones (2003). Persaud, Avinash. 2003. "The Stability of Capital Flows Associated with Foreign Direct Investment." draft paper prepared for UNCTAD.
- Swan, Edward J. (2000), *Building the Global Market: A 4000 Year History of Derivatives*. Kluwer Law International.
- Working Group of the Capital Markets Consultative Group (2003), "Foreign Direct Investment in Emerging Market Countries." Working Group comprised of staff and management of HSBC, IMF, World Bank and the Capital Markets Consultative Group.
- Zahler, Roberto (2006), "Macroeconomic stability and investment allocation of domestic pension funds: the case of Chile", in R. Ffrench-Davis (ed.), *Seeking Growth under Financial Volatility*, Palgrave Macmillan, London.