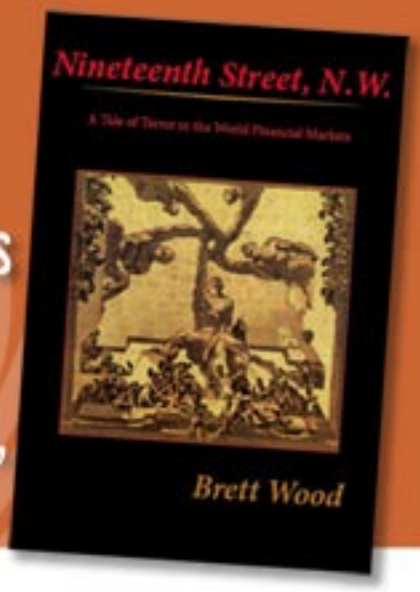

The Economics of *Nineteenth Street, N.W.*

Could it really Happen? *Nineteenth Street, N.W.* is, of course, a work of fiction—yet much of it is based on fact. This essay looks at the economics behind *Nineteenth Street, N.W.* to help explain how and why financial crises occur, and how they could be exploited by terrorists intent on inflicting harm—not just on a single country, but on the whole world economy. The first part of the essay reviews some of the financial crises that have afflicted many emerging market countries[1] in recent years.[2] The second part speculates on how a terrorist group could engineer financial crises as a way of drawing world attention to their cause. The references provide further reading on financial crises.

Financial Crises

Indonesia's financial crisis, alluded to in Chapter 2, was part of a wider array of financial crises afflicting East Asia. The trouble started when the Bank of Thailand was forced to devalue the Thai baht on July 2, 1997. The crisis spread quickly to Indonesia, Malaysia, Korea, and the Philippines. It even threatened to engulf Hong Kong and Singapore. But these East Asian emerging market countries were by no means alone in suffering major financial crises; others have included Mexico (1994), Russia (1998), Brazil (1999), Turkey (2001), Argentina (2002) and Uruguay (2003). What made the East Asian crisis unusual was its origins in the private sector (banks and corporations over-borrowing), rather than the public sector (the government living above its means). It was also rare for an entire region to be engulfed in crisis at the same time—a region that, hitherto, had been known for its stellar economic performance.

While each financial crisis is unique, its effects are usually much the same: a devastating impact on the economy and on the lives of ordinary citizens caught up in the chaos. In Indonesia, for example, Gross Domestic Product (GDP)—the most common measure of economic well-being—fell by 13 percent in a single year. (By comparison, during the first year of the Great Depression, U.S. GDP fell by about 10 percent.[3]) The economic collapse had widespread repercussions, with the proportion of the population living below the poverty line increasing by 20 percentage points as jobs were lost and the price of food, clothing and other basic necessities more than doubled.[4]

But economic dislocation is just part of the story in a financial crisis: the social and political upheaval is often worse. Thus, in Indonesia, "rhetoric against Chinese Indonesians heated up in January and February [1998], and strong pressure was placed on large Chinese Indonesian companies to buy rupiah, as they become scapegoats for the economic crisis. There was a spate of riots in small towns across the country,

apparently sparked by higher food prices, with ethnic Chinese shopkeepers often the targets."[5] Social unrest continued until a second series of riots broke out in May 1998, following the shooting by police of four student demonstrators. The riots are estimated to have resulted in at least 500 deaths, 4,940 buildings and 1,026 homes being damaged or looted, and 1,120 cars and 821 motorbikes being set ablaze.[6] These riots resulted in the eventual ouster of President Suharto, who stepped down on May 21, 1998, handing power to Vice-President Habibe.

Similarly, when Argentina's currency collapsed and the government defaulted on its bonds in December 2001, riots broke out in more than 20 cities across the country, with thousands of Argentines sacking supermarkets and looting shops. The riots killed 27 people and brought down the government of President Eduardo Duhalde (Argentina's fifth president in the space of two weeks). Violence erupted again in early January 2002 when the government imposed a freeze on the withdrawal of almost all bank deposits, and the Argentine people realized that, once again, they had been robbed of their life's savings.[7] A fifty-nine-year-old woman who could not get her dollars out of her account walked into the bank, doused herself with alcohol, and set herself ablaze.[8]

* * *

So what causes these crises? In essence, they occur when investors lose confidence in a country's currency and no longer want to hold it. For a foreign (e.g., an American) investor to want to put his money in a country like Thailand or Turkey or Indonesia, he must expect it to be worth his while. His expected return, taking account of the risk that the currency will depreciate, must be greater than what he could get by keeping his money at home. For instance, suppose that the investor can get an interest rate of 5 percent per year by holding US treasury bills but 15 percent per year by investing in Thailand. Is it worth investing in Thailand? At first glance, sure—he makes an extra 10 percent per year by putting his money in Thailand. But if he expects the Thai baht to depreciate by more than 10 percent over the course of the year, it is not a good deal. Taking account of the fact that the baht he earns will be worth 10 percent less in U.S. dollar terms, would be less than what he could earn by simply keeping his money in the United States.[9]

The key here is the *expected* depreciation of the currency. If the Thai baht is expected to remain fixed against the U.S. dollar (as it should under a fixed exchange rate regime[10]), then the money starts rolling in. And that is precisely what happens in the run-up to most financial crises.[11] Private capital flows to emerging markets increased almost tenfold between 1990 and 1996, reaching more than US$ 300 billion by the eve of the Asian crisis.

The trouble is, if there is the slightest whiff of a devaluation, there will be a mad scramble to get out of the currency before it collapses.[12] The reason is obvious: continuing the example, the investor's 10 percent profit turns into a 20 percent *loss* if the Thai baht devalues by 30 percent before he is able to get his money out.

Thus while capital flows are generally beneficial—allowing emerging market countries to finance productive investments while earning investors a good return on their money—they can also be fickle, suddenly fleeing the country in a self-fulfilling "run" on the central bank's reserves. If confidence in the currency is lost and investors believe that it will depreciate or be devalued, then they will want to pull out their money to avoid the capital loss before that happens. But the very act of pulling out their money puts downward pressure on the exchange rate, and—if the central bank runs out of reserves—could lead to the depreciation that had been feared.[13] The extreme sensitivity of capital flows to changes in investor perception, together with the risk of triggering a self-fulfilling run, is why they can easily undermine exchange rate stability and cause financial crises.

This is what happened in East Asia. While these economies had been among the fastest growing for many years, their banks and corporations had also been borrowing heavily in foreign currency, often short-term, and with high leveraging (meaning their debt was high in relation to their equity). At the same time, the central banks did not hold sufficient foreign exchange reserves (especially relative to the massive foreign borrowing by banks and corporations). In this setting, currencies became extremely vulnerable to shifts in investor sentiment for three reasons. First, there could be self-fulfilling runs on the central bank's reserves since, if other creditors are pulling their money out, each creditor has an incentive to join the queue before the foreign exchange reserves are exhausted. Second, as the central bank runs out of reserves, the exchange rate depreciates, making it more difficult for firms that have borrowed in foreign currency to repay their loans, ultimately driving them into bankruptcy. Third, the heavy indebtedness of banks and corporations poses a dilemma for the central bank, since raising interest rates to try to lure back foreign creditors also risks precipitating more bankruptcies and undermining confidence further.

Given these vulnerabilities, it was perhaps only a matter of time before a crisis struck. In the event, the crisis was first triggered in Thailand on July 2, 1997, when the central bank ran out of foreign exchange reserves and was forced to let the Thai baht depreciate by 25 percent. Thereafter, the crisis spread rapidly through the region; by year's end, the currencies of the afflicted countries had lost between one-half and two-thirds of their value against the U.S. dollar. The local currency value of foreign debt had more than doubled, bankrupting many corporations and causing massive unemployment and economic collapse. While other emerging market financial crises differ in their specifics—for example, in Turkey and in most Latin American crises, it was the government rather than banks and corporations, that had over-borrowed—the mechanics and basic economics are generally the same.

* * *

So what should a country facing such a crisis do? Governments often delay taking preventive and corrective measures, including going to the International Monetary Fund (IMF), which was set up to help countries facing financial crises.[14] The delay is natural: politically, few governments want to admit that the country is in an economic mess, and IMF loans come with "conditionality"— measures that the government is required to adopt before IMF funds are disbursed.[15] Once the government does turn to the IMF, however, a program of economic measures is quickly cobbled together, along with emergency financing.[16]

The first decision in designing a program is whether to try to defend the exchange rate at its current level or let it depreciate and make a stand at a lower level. While there are theories to help determine the "correct" level of the exchange rate—including Purchasing Power Parity or Fundamental Equilibrium Exchange Rate models (see Appendix 1)—what matters most in a crisis is investors' confidence. If confidence can be restored, there can be a virtuous cycle: investors come back, buying the currency, leading to an appreciation of the exchange rate, and therefore the prospect of higher returns in U.S. dollar terms—inducing further capital inflows.

But restoring confidence is easier said than done. Typically, in a currency crisis, the central bank will raise interest rates. This reduces the supply of domestic currency, putting upward pressure on the exchange rate. It can also raise demand for the currency by offering investors a higher rate of return, inducing capital inflows which put further upward pressure on the exchange rate.

While interest rates rose sharply during the East Asian crisis, they fell shy of the very high nominal interest rates seen in some other currency defences.[17] Thus interest rates in Indonesia peaked at about 80 percent per year, compared to about 10-15 percent per year prior to the crisis. But inflation was also very high, so that in real terms, interest rates were quite low and even negative during the early part of the crisis.

Nevertheless, the high-interest rate defence was extremely controversial during the Asian crisis, especially in Korea where, in early 1998, interest rates rose to 30 percent per year in nominal terms and 20 to 25 percent per year in real terms. In theory, higher interest rates should induce capital to return to the country. But interest rates also raise the debt burden on corporations, increasing the likelihood that they will go bankrupt, which naturally deters investors from lending to them. If fears about such bankruptcies dominate, raising interest rates can have the perverse effect of inducing greater capital outflows and further weakening the exchange rate.[18]

Beyond raising interest rates, the other way to help restore confidence in the currency is to provide the afflicted central bank with foreign exchange reserves. This is the purpose of loans from the International Monetary Fund and bilateral creditors (such as the U.S. and Japanese governments). In the Asian crisis, such loans were exceptionally large by historical standards but arguably too small in relation to these countries' financing needs. To help boost confidence, therefore, the official community tried to fool the markets with phantom financing packages. During the Korean crisis, bilateral creditors announced a "second line of defence," amounting to some $23 billion (on top of IMF, World Bank, and other multilateral funds of $34 billion). Ironically, if the announcement of a large financing package is successful, it obviates the need for the money, since private capital inflows resume spontaneously. This is what makes it tempting for the official community to announce a larger financing package than is actually available. While this can be a successful strategy, it is also a risky one, since the market may call the bluff. If it transpires that the financing does not really exist, confidence is likely to collapse further.[19]

Indeed, trying to bluff the markets is great if it works—but disastrous if it does not. One of the factors that deepened the Thai crisis was that the market learned that the Bank of Thailand did not even have the reserves it claimed on its books. Over the previous few months, it had sold them in the forward market in a desperate bid to prop up its currency. (Under a forward contract, the seller promises to deliver the foreign exchange in the future—usually 30 or 90 days later, according to the contract—and therefore does not have to cough up the foreign exchange immediately.[20]) In Korea, markets learned that the Bank of Korea (BoK) no longer had the reserves it claimed, having lent them to the country's ailing banks, which were not in a position to repay them when the exchange rate was under attack and the BoK needed them back—with equally disastrous consequences for confidence.

Finally, neither raising interest rates nor providing the country with foreign exchange reserves will restore confidence unless the underlying problems are tackled. In some cases—such as Argentina and Turkey—this meant cutting the government's deficit. In East Asia, it meant clamping down on lax financial sector and corporate governance, increasing prudential regulation, and closing down problem banks. But closing banks is always a tricky business, especially in the midst of a crisis. In November 1997, for example, Indonesia closed sixteen banks, including several owned by the President's family. The closure of such politically well-connected banks contributed to a sense of panic, with depositors inferring that if banks belonging to the President's family were being closed, then there had to be others that were weak and would be closed as well. Confusion about deposit insurance and uncertainty about which banks were vulnerable led to a full-scale run on the country's banking system as depositors panicked that their bank would be the next to close—and without a government guarantee, their life's savings would disappear.[21]

Thus once a crisis breaks, the government must act decisively. But the policy options are few—and none are palatable. Even with best efforts, and unstinting support of the international community, the economic, social, and political costs are likely to be enormous.

Could financial crises be exploited by terrorists?

The past few years have been extraordinarily benign in terms of global growth, low interest rates, and

strong demand for the commodities and exports that emerging market countries produce. While many emerging market countries have used the breathing space of the past few years to improve their resilience—reducing their external debt, gradually accumulating foreign exchange reserves, enhancing regulation and supervision of their banks and financial sectors—others have not. The key question is whether emerging market economies will be resilient to crises when, inevitably, the good times come to an end.

Some commentators argue that the very efforts to reduce vulnerabilities is helping to sow the seeds for the next crisis.[22] In particular, many emerging market central banks—having learned the lessons of previous crises—are rapidly stockpiling reserves and trying to keep their exchange rates from appreciating or becoming overvalued. But in the process of doing so, they have been buying foreign reserves by selling domestic currency. This increases the money supply, and risks inflating stock prices and housing prices, leading to bubbles that, if they burst, could precipitate another crisis. Even if this does not happen, there is always the danger that policy makers will be fighting the last crisis, not the next. Just as the East Asian crisis taught the world that major financial crises could originate in the private sector, it is hard to tell when, and how the next crisis will occur. Indeed, as the recent sub-prime mortgage problem has shown, even advanced economies such as those of the United States and Great Britain are not immune from financial turmoil and even bank runs by panicked depositors who see losses running into the hundreds of billions of dollars.

Crisis prevention efforts can help guard against known risks, but how to inoculate against new threats is less clear. What is clear is that global financial markets are in constant development, and financial innovations—exotic instruments involving swaps, derivatives, structured finance products—are always one step ahead of the regulators. Many of these instruments are so sophisticated, with risk characteristics so complex, that no one really knows what would happen in a major financial crisis. As in East Asia, crises can spread rapidly from one country to another—and possibly from one region to another. A true global meltdown, whether starting in emerging markets and spreading to advanced economies or starting in the global financial markets and spreading to the developing world cannot be ruled out. As Paul Blustein, writing about the Asian crisis, notes, "Most chilling of all was how perilously close the U.S. economy came to joining the global meltdown in September and October 1998 … the convulsions on Wall Street might well have engendered a worldwide slump."[23] The consequences for the world economy would be catastrophic: not just billions of dollars lost, but millions of livelihoods destroyed.

How could such vulnerabilities be exploited by some group intent on making mischief? Because speculative attacks—if large enough—can be self-fulfilling, the trick would be to convince the market to jump on the same bandwagon and take positions against the currency being attacked. Markets are driven by the hope of making profits (or avoiding losses). Because successful speculation is profitable, what matters for getting other speculators to join an attack is convincing them that it will succeed. And if enough speculators can be convinced, the attack will indeed succeed—as George Soros showed when he successfully attacked the British pound, forcing its devaluation and ejection from the European Exchange Rate Mechanism in 1992.

To get other speculators to jump on the bandwagon requires two things: information and money. On the exchange market, profits can be made either by knowing in which direction the exchange rate is headed or—using derivatives—by knowing whether the *volatility* of the exchange rate is going to increase or decrease (see Appendix 2). Both of these depend very heavily on the reaction of the country's central bank: will it let the exchange rate be buffeted by market forces? Or will it intervene to stabilize the exchange rate?

Traditionally, central banks have been secretive about their operations, and while they are becoming more open and transparent in their dealings, their foreign exchange interventions remain shrouded in secrecy.[24] Nevertheless, some of this information is required to be provided to international financial institutions; for instance, the International Monetary Fund's Articles of Agreement mandate that all member countries

report their foreign exchange reserves, including forward transactions—although not necessarily on a real-time basis.[25]

Even with real-time data, however, predicting exchange rate movements is enormously difficult. Research shows that exchange rates follow a "random walk" (sometimes called a "drunk man's walk")—that is, successive movements are random, so that to predict the future exchange rate, one can do no better than simply assume that it will be same as the current exchange rate.[26]

Of course, speculators will occasionally bet the right way on an exchange rate movement—sometimes making spectacular profits. But at least standard models of exchange rate dynamics are incapable of systematically forecasting short-term movements with the accuracy that would be necessary to persuade the rest of the market that the attack is a winning proposition—and thus create self-fulfilling pressures on the currency.

One relatively new and unexplored class of models is so-called "neural networks". A neural network is a non-traditional form of computing that is loosely based on, or at least inspired by, the functioning of the human brain. Unlike a traditional computer program, which processes information sequentially, a neural net solves problems non-algorithmically—that is, without following a pre-set sequence of rules. To see the power of non-algorithmic methods, consider the following pieces of text:[27]

_ st_tch _n t_m_ s_v_s n_n_.	_ p_nny s_v_d _s _ p_nny __rn_d.	D_n't thr_w _w_y th_ _ld b_ck_t _nt_l y__ kn_w wh_th_r the_ n_ w _n_ h_lds w_t_r.

Trying to decipher these pieces of text sequentially—i.e. one letter at a time—is virtually impossible. (Try it: using a piece of card to cover up the other letters as you read each one.) Yet looking at the text as a whole, the pattern soon emerges—proverbs with the vowels missing. Even the third proverb, less familiar than the others, is easily grasped. In fact, a particular strength of neural networks is their ability to recognize patterns, and they are often used in such applications.

In the financial field, for instance, neural networks have been used for assessing credit risk, identifying forgeries, interpreting handwritten forms, rating investments and analyzing portfolios. Using neural networks for exchange rate forecasting is still relatively new, but preliminary work is promising. In one review of studies, neural networks outperformed traditional forecasting methods 86 percent of the time.[28]

The other key ingredient that terrorists would need to launch speculative attacks is money—and plenty of it. Without sufficiently large amounts of money, no one is even going to notice a speculative attack, let alone join it. How would terrorists finance such a speculative attack? Probably through a hedge fund (see Appendix 3).[29]

Given their often high profitability and general secretiveness, hedge funds have always had a certain mystique. Hedge fund managers have a reputation for astuteness, so that a rumour that hedge funds are taking a position may encourage other investors to follow. It is all the more likely that hedge funds may act as "lead steers" for investor herding behaviour, since they can themselves undertake a volume of sales that drive interest rates to levels that the central bank regards as unacceptably high until it abandons the defence of the exchange rate. To the extent that other large investors follow, the hedge fund would not even have to undertake all the transactions—it would merely need to signal its intention to do so.

In addition to the highly successful speculative attack against the British pound in the 1992, hedge funds have also been implicated in the East Asian currency crisis. As fears of an impending devaluation of the Thai baht intensified during early 1997, investors—not only hedge funds, but also mutual funds, banks, and others—began to sell the baht forward.[30] Estimates suggest that of the Bank of Thailand's US$ 28 billion forward sales of foreign exchange at the end of July 1997, around US$ 7 billion represented transactions with hedge funds (though total amounts are likely to have been larger, since hedge funds may have acted through offshore intermediaries). In a celebrated article in the *Wall Street Journal*, Malaysian Prime Minister Mohamad Mahathir accused hedge funds of being "highwaymen of the global economy," noting that "with these self-serving systems [short-selling and leverage] the big players can wreak havoc in the markets."[31] Over the past few years, hedge funds have grown enormously in importance. Whereas in the early 1990s, there were a few dozen hedge funds with perhaps a couple of hundred billion dollars, by 2006, there were more than one thousand hedge funds, with some one and a half *trillion* dollars under their management.

Hedge funds' other attractive feature—from the perspective of a potential terrorist—is that they are subject to very little regulation and supervision.[32] Because participation in hedge funds is restricted to "high net worth individuals"—meaning people rich enough that they are expected to be able to look after themselves—there is virtually no regulatory limit on how risky their investments can be. From time to time, usually after a crisis, there is interest in greater supervision and regulation of hedge funds. To date, however, there has not been sufficient consensus among the governments of the major industrialized countries to clamp down on hedge fund activities. At best, there is talk of a voluntary code of conduct to which hedge funds could adhere.[33] Thus, while these governments are spending a fortune on combating money laundering and the financing of terrorism, it apparently has not occurred to them that hedge funds could provide the perfect financing instrument for terrorists.

So, could it really happen? We can only hope not.

Appendix 1. Purchasing Power Parity and FEER

As discussed in the text, a key question for speculators intending to attack a currency, and for central banks trying to ward off such an attack, is whether the exchange rate is at its "correct" level. This appendix describes two simple models that are often used to help answer that question.

Purchasing Power Parity

Purchasing power parity (PPP) states that, converted into a common currency, national price levels should be equal. To understand why, consider first the price of a single good. Suppose that the price of a personal computer in the United States is $1,500, and that the exchange rate is 30 baht per U.S. dollar, then the price of the same computer in Thailand should be 4,500 baht. If it were higher, then it would be worth shipping computers from the US to Thailand; if it were lower, then it would be worth shipping them from Thailand to the US. Of course this "law of one price" does not hold exactly because of trade barriers and transportation costs. But if these costs are fairly constant, then the law of one price should hold in terms of changes—that is, if the exchange rate depreciates by 10 percent, then the price of computers in baht should go up by a corresponding amount.

Purchasing power parity extends this "law of one price" to the entire price level of the country. Why is this useful? Because in terms of rates of change, this translates into the rate of depreciation of the exchange rate equalling the inflation differential between the "home" and "foreign" country. For instance, if inflation in the U.S. is 5 percent per year, and if inflation in Thailand is 30 percent per year, then the baht should depreciate by 25 percent. Therefore, PPP can be used to help decide whether an exchange rate has depreciated "enough"—and whether the parity is now worth defending.

One of the first applications of PPP was in the interwar period. At the outbreak of World War I, most countries had left the gold standard, and at its conclusion, the question arose of what were the appropriate exchange rates at which to re-establish the parities, especially since the various belligerents had suffered very different degrees of economic dislocation. In a series of influential articles, the Swedish economist Gustav Cassel suggested that purchasing power parity theory could be used to establish appropriate exchange rates between countries—in particular, according to how much inflation they had suffered since the beginning of the war.

Classic texts on PPP are Cassel (1921, 1922); Officer (1976) provides the historical background, while Rogoff (1996) is a good survey.

Fundamental Equilibrium Exchange Rates

A more sophisticated variant of the PPP methodology is the fundamental equilibrium exchange rate (FEER) approach. This approach assumes that countries' exports are not identical and are imperfect substitutes for each other (a Ford is not the same as a Mercedes). As a country's exchange rate appreciates, its exports become less competitive while foreign imports increase (since they are cheaper). Both these effects tend to widen the country's trade deficit, which, in turn, must be financed by a capital inflow—that is, by borrowing from foreigners.

The FEER methodology turns this relationship between exchange rates and capital inflows on its head by asking how large a deficit a country might expect to be able to finance through capital inflows in "normal" times, and what is the corresponding level of the exchange rate. This is known as the fundamental equilibrium exchange rate. A variant of this approach is to determine what the current account "should be"—based on such factors as the country's demographics, external debt, and its growth prospects.

If the actual exchange rate is higher than the FEER, then it is overvalued and should be allowed to depreciate, thereby gaining competitiveness and reducing the deficit to a level that can be financed. But if the actual exchange rate is already below the FEER, it is worth defending against excessive depreciation. While FEER is more sophisticated than using simple PPP calculations, it also requires fine judgments about how much capital is likely to flow to the country, which may be particularly difficult to gauge in the midst of a currency crisis. See Isard and Faruquee (1998) and IMF (1998, 2001) on the FEER methodology; IEO (2007) presents a useful survey.

Appendix 2. Trading Volatility—Puts, Calls, and Derivatives

A derivative instrument is a contract whose value depends on—or derives from—the value of an underlying asset. For instance, the value of an option on IBM stock depends on the price of IBM shares. While derivative instruments can be highly complex, their fundamental building block—the option—is relatively straightforward and is key to understanding how derivatives can be used to place bets, not only on which direction a currency is headed, but also on whether the volatility of the exchange rate (which depends heavily on whether the central bank intervenes and whether there is a speculative attack) will change.

A call option gives the buyer of the option the right, but not the obligation, to buy a financial asset at a specific price on or before a particular date in the future; the specific price is called the "exercise" or "strike" price. A put option gives the buyer of the option the right, but not the obligation, to sell a financial asset at a specific price on or before a particular date.

An example from everyday life makes it easier to understand how options work.[1] Suppose a house-buyer finds one she likes whose asking price is US$ 1 million. The potential buyer can: (i) buy the house immediately; (ii) wait for one month in the hope that the price will go down, while recognizing that the price may increase in the meantime; (iii) ask the seller to provide her with an option such that the seller would hold the property for her at the same asking price for one month. If the seller agrees, he is selling a call option (on the house)—for which he will charge a fee (what determines that fee is discussed below).

What happens after one month? If the market price increases, the buyer will exercise her option to purchase the house at US$ 1 million (even if she does not want the house, she can sell it at a profit because the market price is above her purchase price).

To understand why trading options allows taking positions on the volatility of the underling asset's price, consider what determines the option fee. In the house example, suppose that house prices are very stable—so the likelihood that the price of the house will go up (or down) significantly in a one month period is small.

Therefore, the likelihood that the seller is going to lose (or the option buyer is going to gain) from the option is also small, so the option fee he will charge (or that she would be willing to pay) will be low. On the other hand, suppose that house prices are very volatile. Then there is a high risk that the price of the house will have increased above US$ 1 million. (There is also a high probability that the price will have decreased, but this is irrelevant since the option seller only loses, and the option buyer only gains, when the price rises.) But if there is a high risk that the option seller will lose money because the house price rose, he will charge a large option fee. Likewise, since there is a good chance that the option buyer will gain, she will be willing to pay a large option fee.

Hence, the value of an option (i.e., the fee) is intrinsically linked to the volatility of the price of the underlying asset, and trading options (i.e., buying and selling them) means taking bets on whether that volatility will change. (So much so, options are usually quoted in terms of the implied volatility of the underlying asset). This also explains why it is so important for speculators to know the central bank's intervention strategy, since such interventions can fundamentally alter the volatility of the exchange rate.

[1] The house-buyer example is taken from a superb booklet *Derivatives in Plain Words* by Frederic Lau; see also Luca (2000), Hull (2002) and Neftci (2004).

Appendix 3. Hedge Funds

Hedge funds often figure prominently in the press, especially when there are crises. But what is a hedge fund? And how does it work?

The term was coined by Carol Loomis in a 1966 *Fortune* magazine article to describe investment partnerships that combine two investment tools: short selling and leveraging. Short selling means borrowing a security (a stock or a currency) and selling it in anticipation that its price will fall before the time that it must be repaid to the lender. Leveraging means using borrowed funds, so the hedge fund's total market exposure may be several or many times its own capital base. While each of these investment tools is considered highly risky in isolation, the sociologist and financial journalist Alfred Winslow Jones showed how they could be combined to reduced market risk while earning high returns.

To understand Jones's insight, consider a single stock, say, IBM. The price of IBM's stock reflects two factors: the performance of IBM relative to other computer manufacturers, and the fortunes of the computer industry generally. To eliminate the latter risk, a hedged portfolio would consist of a long position in IBM stock and a short position in the stocks of other computer manufacturers. In other words, the hedge fund would buy IBM stock, and would borrow and sell stocks of the other computer manufacturers. If there is a boom in the computer industry, the portfolio gains from holding the IBM stock, but loses on its short sales since it must repurchase, at the new, higher market price, the borrowed securities that it has sold. Similarly, if there is a slump in the computer industry, the portfolio loses on its holding of IBM stock, but gains because it has sold at a high price the stocks of IBM's competitors, and their market price has fallen at the time that the hedge fund must repurchase them in order to repay the lender from whom it had borrowed the securities.

The vicissitudes of the computer industry are thus cancelled out by the combination of the long and the short positions, and the portfolio is perfectly "hedged" against them, leaving only the risk associated with IBM's performance relative to its competitors.

By leveraging, this difference in performance is magnified. Jones also made the manager's incentive fee a function of the hedge fund's profits (in his case, 20 percent of realized profits).

Hedge funds proliferated in the late 1960s, but because they had come to rely more on leveraging than on short sales, they lost heavily during the extended market downturn that started at the end of 1968. By 1970, the 28 largest hedge funds had lost 70 percent of their assets. Hedge funds became popular again in the mid-1980s, especially with the success of the Tiger Fund (and its offshore counterpart, the Jaguar Fund) which had purchased a large number of foreign currency call options in the expectation that the U.S. dollar, having risen sharply since 1982, was going to decline against the Japanese yen and the European currencies. (The call option gave the hedge fund the right, but not the obligation, to buy these non-dollar currencies at a predetermined price. As these currencies appreciated, the fund was able to exercise its options to buy these currencies at their previous, low price and immediately resell them for a handsome profit.)

Currently, there are more than one thousand hedge funds in existence, with more than one and a half trillion dollars under management. With leveraging, their total market power could be three or four times that amount. While some funds go bankrupt, others return spectacular returns—in one case, earning a return of 1,000 percent in one year. Finally, hedge funds are usually structured so that they are subject to minimal regulatory and disclosure requirements.

For a general description of hedge funds, see Eichengreen et al. (1998), on which this note draws heavily, and Lavinio (2000); for a history of Jones's fund, see Caldwell (1995).

(Endnotes)
Notes

[1] The term "emerging market" was coined by Antoine Van Agtmael, a former World Bank official, who wanted a sexier name for a "Third World" equity fund that he was trying to start. Today, the term refers to countries that are neither advanced economies (such as the United States or Germany) nor very poor, developing countries (such as Chad or Malawi)—but somewhere in between, such as Argentina, Brazil, China, India, Russia and Turkey.
[2] Two books by Paul Blustein (2001, 2006) are excellent journalistic accounts that provide fascinating backdrop to the drama of these crises. More academic treatments may be found in Lane et al. (1999), Corsetti, Pesenti and Roubini (1999), Ghosh et al. (2002), Collyns and Kincaid (2003), Daseking et al. (2005), Roubini and Setser (2004), Ghosh et al. (2007) and Ito (2007). Useful websites where materials on emerging market financial crises may be found include the International Monetary Fund (www.imf.org); the National Bureau of Economic Research (www.nber.org); and Roubini Global Economics (www.rgemonitor.com). An online tour of the Palais des Nations is available at: http://www.unog.ch/virtual_tour/palais_des_nations.html.
[3] The Great Depression lasted longer, and the cumulative decline over a four-year period was around 25 percent; data are from Temin (1994).
[4] See Booth (1998) and Lee (1998).
[5] Johnson (1998).
[6] Johnson (1998), quoting the *Jakarta Post*, May 18, 1998.
[7] The previous occasion had been during the hyperinflation in 1989-90. Blustein (2006) describes a woman on Argentine national television screaming at the presidential spokesman: "How can I get my money? It's my savings. I'm furious." The crisis left nearly a quarter of the workforce unemployed and a majority of the population below the poverty line. Average annual income per capita sank from US$8,500 in the late-1990s to US$2,800 in 2002.
[8] Blustein (2006), p.2.
[9] In fact, strict parity is unlikely to be enough: investors will demand an additional "risk premium" to compensate for the greater risk of investing in an emerging market country.
[10] On the merits of fixed versus floating exchange rates, see Ghosh et al. (2003); on currency crises, see

Kaminsky et al. (1998), Kaminsky and Reinhart (1999), Dornbusch (2001) and Ghosh and Ghosh (2003).
[11] Indeed, even when investors start getting nervous that the country is borrowing too much—like Argentina in the 1990s—managers of big mutual (and other investment) funds have the incentive to keep pouring in money because their performance is judged against an index of emerging market bonds, where the index has greatest weight on the country that is borrowing the most. As Blustein (2006) explains "the habit of cleaving to the index virtually forced these investors to lend vast sums to Argentina even if they feared the country was likely to default ... Money managers who shunned Argentine bonds completely, or held only small amounts, were taking a huge risk, because in the event that Argentine bonds rallied for some unforeseen reason, their portfolios would almost certainly underperform the index for a period of time, a potential disastrous blow to their careers."
[12] For the analytics of how a speculative attack happens, see Krugman (1979) and Flood and Garber (1984).
[13] This is known as a "multiple equilibria" problem because, equally, if there is no fear of devaluation, then no devaluation occurs. On multiple equilibria and speculative attacks, see Obstfeld (1986, 1994) and Masson (1999).
[14] The International Monetary Fund (together with the World Bank) was established at the Bretton Woods Conference in July 1944, and opened its doors in December 1947. At the time, most balance of payments problems were "current account" rather than "capital account" crises—that is, caused by countries running out of foreign exchange reserves due to trade deficits rather than because of large and sudden capital outflows. Indeed, John Maynard Keynes, one of the key architects of the IMF at Bretton Woods, favored imposing capital controls to prevent such crises.
[15] This is known as IMF "conditionality"—which serves two purposes: first, it provides safeguards to the IMF that the borrowing government will be in a position to repay the loan when it matures; second, it provides assurances to the borrowing government that IMF financing will be available—and cannot be withheld for political reasons—as long as it fulfils the conditions. Nevertheless, IMF conditionality remains controversial. In terms of the economics, conditionality can also play a crucial role of providing the government with a pre-commitment device, giving credibility to its reform programs, and allowing it easier and cheaper access to international loans.
[16] There is a vast literature on IMF-supported programs. For an overview of such programs, their design, and their success and failures, see Ghosh et al. (2005).
[17] The most famous example is Sweden during the speculative attacks against the European Monetary System in September 1992, when interest rates were raised to an unprecedented 500 percent per year. Although the defense was successful in staving off the crisis, Sweden eventually devalued and exited the European Exchange Rate Mechanism. For a detailed description of the events surrounding the ERM crises, see IMF (1993).
[18] Furman and Stiglitz (1998) claim that this is may have happened during the East Asian crisis, particularly in Korea. Empirical studies of the East Asian crisis countries, however, have found little evidence to support this contention, perhaps because interest rates did not rise sufficiently high; see Goldfajn and Gupta (1999) and Basurto and Ghosh (2001); for a theoretical model of balance sheet effects, see Aghion et al. (2001).
[19] As Ghosh et al. (2002) note, "But reliance on bilateral support was not without its risks. In Indonesia and Korea, funds pledged by bilateral creditors formed a second line of defense but were not subject to well defined terms and conditions and were never disbursed, contributing to market anxieties that may have influenced the decisions of private creditors to continue to exit."
[20] Forward transactions are used either for hedging or for speculation. Suppose a Japanese company is exporting to the U.S. and expects to be paid in U.S. dollar three months from now. The Japanese company is interested in locking-in the value in terms of yen. Therefore, it can sell forward (at an agreed exchange rate) the dollars it expects to receive in three months' time, and not face the exchange rate risk that dollar might depreciate in the meantime. But forward sales can also be used for speculation. For instance, if a bank does not have the dollars, it can still sell them in the forward market—which commits the bank to providing the dollars in three months' time. When the contract matures, if the dollar has depreciated, the bank simply buys the (now cheap) dollars in the market and sells them at the agreed (higher) exchange rate, making a profit. But if the dollar has depreciated in the meantime, the bank suffers the corresponding loss.

[21] Some commentators such as Radelet and Sachs (1998a,b) have argued that the middle of a crisis is not the time to start closing banks, but others (Ghosh et. al. (2002)) contend that problems in the financial sector were at the root of the crisis and restoring confidence would have been impossible without decisive action on bank closures. Lindgren et al. (1999), Enoch et al. (2001), Pangestu and Habir (2002) provide thorough discussions of the restructuring of the Indonesian banking system; for a description of the events surrounding the closure of the 16 banks, see Soesastro and Basri (1998), and Blustein (2001). Ultimately, the mistakes made in the closure of the Indonesian banks reflected a complex confluence of unfortunate decisions and events. In the text, for purposes of fiction, these are brought together in the actions of a single character, Xavier Adanpur; in reality, they cannot be blamed on any one person or institution, and no similarity to any individual, living or dead, or to any actual institution is intended or implied.

[22] Nouriel Roubini, a professor at New York University, and well-known authority on emerging market crises argues that Asia (and other emerging market countries) is vulnerable to a new, and different kind of financial crisis, caused in part by efforts to build up huge foreign exchange reserves. (Roubini's website is an excellent resource for understanding current economic news.) Terry Checki, an official of the New York Federal Reserve, likewise claims that "the recent long period of stability may contain the seeds of its own undoing." On crisis prevention efforts, see Ghosh et al. 2007.

[23] Blustein (2001, p13).

[24] Since foreign exchange intervention results in a change in the central bank's holdings of foreign exchange reserves, researchers often use data on reserves to infer central bank intervention. In practice, however, the relationship between changes in reserves and intervention is weak (Neely (2000)), because the central bank can reverse the intervention before it shows up in the monthly reserves figures (other strategies include selling reserves in the forward market—as the Bank of Thailand did on the eve of its 1997 devaluation—in which case the intervention does not show up in the reserves figures until the time the contract matures and the central bank actually has to deliver the foreign exchange). On reasons why the central bank may prefer secret intervention, see Ghosh (2001); on intervention practices, see Ishii et al. (2006). Information on central banks' foreign exchange reserves is available at the IMF's Dissemination Standards Bulletin Board: http://dsbb.imf.org/Applications/web/sddshome/

[25] Specifically, under a decision known as "Strengthening the Effectiveness of Article VIII, Section 5", member countries are required to inform the IMF of "the international reserve assets and reserve liabilities of the monetary authorities, specifying separately any reserve assets which are pledged or otherwise encumbered as well as any net derivative positions."

[26] See Meese and Rogoff (1983), Frankel and Rose (1995), Macdonald and Taylor (1992); Dornbusch (1976) gives a theoretical explanation for why exchange rates often "overshoot" in response to news about the economy or policies.

[27] The example is taken from Nelson and Illingworth (1991).

[28] Adya and Collopy (1998); see also Refnes (1995), McNeils (2004), and Medeiros (2000) on neural networks and genetic algorithms.

[29] Another possibility would be a "sovereign wealth fund". These are funds that are established by governments to invest foreign assets—typically oil revenues of oil-rich countries. While these are perfectly respectable, government-run investment funds, their secrecy and sheer size—often running into the hundreds of billions of dollars—has attracted attention and some concern. Moreover, in the hands of a rogue government intent on state-sponsored terrorism, a sovereign wealth fund could be used to wreak havoc on the international financial markets.

[30] *Wall Street Journal*, September 23, 1997. Forward selling the baht meant that these investors promised to deliver Thai baht at an agreed exchange rate in a few months' time. If the Thai baht was devalued in the meantime, they would make a profit. In order to stabilize the exchange rate, the Bank of Thailand had to take the counter position—buying baht in the forward market and promising to deliver U.S. dollars, incurring a loss if the baht was devalued in the mean time (as happened).

[31] In fact, available evidence does not suggest that hedge funds were especially active against the Malaysian ringit. Correlations between currency movements and returns to hedge funds suggest that hedge funds speculated actively against only the Thai baht and, to a lesser degree, the Indonesian rupiah and the Pound sterling during the European ERM crisis; see Chadha and Jansen (1998) and Brown et al. (2000).

[32] There are some disclosure requirements, but in practice hedge funds have considerable latitude not to disclose their operations. See Cullen (2001) for a detailed discussion of the legal and regulatory requirements on hedge funds, including those established "off-shore", e.g., in the Cayman Islands.
[33] In the wake of the collapse of Long Term Capital Management, a number of bodies have issued reports and studies, including the Basle Committee on Banking Supervision (*Sound Practices for Banks' Interactions with Highly Leveraged Institutions*, January 1999), the International Organization of Securities Commissions (*Hedge Funds and Other Highly Leveraged Institutions*), The President's Working Group on Financial Markets (*Hedge Funds, Leverage, and the Lessons of LTCM*, April 1999), The General Accounting Office (*Long Term Capital Management: Regulators Need to Focus Greater Attention on Systemic Risk*, October 1999) and Financial Stability Forum (*Working Group on Highly Leveraged Institutions*, April 2000). Enhanced regulation could, in principle, affect a number of aspects of hedge funds' activities, such as their ability to raise capital from investors or their putative ability to manipulate market prices. But direct regulation would run into a number of practical difficulties, not least because hedge funds are often established offshore, and without the cooperation of the authorities in these offshore centers it is not clear there could be effective jurisdiction of hedge funds located there. More importantly, despite efforts by the German government to press for greater regulation of hedge funds, to date there has been little political will in other advanced economies for doing so.

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