Lecture 4—Currency crises

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1 Introduction

Some definitions:

- A “devaluation” is the move taken by the government to change the target value of the fixed exchange rate regime to a weaker (higher) exchange rate. A “revaluation” is the move taken by the government to change the target value of the fixed exchange rate regime to a stronger (lower) exchange rate.

- A speculative attack is a situation where a large number of market participants go “one way” in the market—all participants either sell or buy the asset. In a speculative attack on a fixed exchange rate the central bank is obliged to stand as counter party to all transactions within the target zone, unless someone else takes the deal. The central bank will either do so by intervening in the markets directly, or by changing interest rates. Changing interest rate might induce private investors return to the currency to profit on the interest differential. At the same time higher interest rates increase the cost of speculation. When (if) the central banks pulls out the price of the asset will fall (or rise). Often a period of turbulence occurs before a new equilibrium is established.

- A “currency crisis” is a situation where a speculative attack forces the central bank to make a change in the fixed exchange rate not actually intended by the central bank.

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What is the difference between a “controlled” change in the exchange rate and a currency crisis? If the markets believe that the central bank will change the target rate, rational investors would only trade on one side of the markets—i.e. behave like in a speculative attack. The central bank has incentive to present this as if it was forced to abandon the fixed exchange rate, although its own behavior actually caused the markets to behave as they did.

Note that a currency crisis might occur even if the exchange rate is not fixed. If the markets bring forth a large change in a floating exchange rate over a short period of time, the central bank will be expected to intervene, as large changes in an exchange rate might destabilise financial markets. The inability of the central bank to keep the exchange rate at the wanted target can be considered a “currency crisis”, even if it does not induce a formal devaluation.

There are three sides to all currency crisis: the government, investors with liquid assets and investors with illiquid assets. For the government a currency crisis is a question of credibility, of flexibility in political decision making and about a possible fallout because of negative implications of a sudden change in the exchange rate. For a liquid, well informed investor a currency crisis is a question of potential financial gains.

The illiquid investors are the most vulnerable to currency volatility. They might not have the financial strength to diversify investments, or they might be contained to long term contracts. Further, these investors also tend to be smaller and perhaps less informed than the liquid investors. The presence of illiquid investors is especially a problem in countries with underdeveloped financial markets.

In this lecture we will discuss the interaction between government incentives and the behavior of the markets, by which we mean the liquid investors. We will return to issue of the illiquid investors in the last part of the course.

2 Speculative attacks

In the last lecture we discussed three reasons for why a fixed exchange rate might break down. They were all based on the fact that in a fixed exchange rate system monetary policy is outside the full control of the central bank. Changes in the money supply must be symmetric between the countries involved in the system. If optimal policy makes for asymmetric monetary policy, a fixed exchange rate is not sustainable.

1. The n-1 problem: the countries involved can not agree on a proper rate of growth in the money supply.
2. The adjustment problem: if we have asymmetric shocks and sticky prices, it might be optimal with leave the fixed rate regime.

3. The credibility problem: a fix is not sustainable if the governments involved have different loss functions, i.e. they care about different things.

If these were all the reasons why fixed exchange rate systems broke down, one should expect that governments chose to leave such systems by purpose. However, countries often first leave a fixed exchange rate system after a “speculative attack”, an event where the whole market has sold the currency to the central bank because everyone believes that the central bank soon will break its promise of a fixed rate.

An example of this is the EMS-crisis in 1992-93. After 1990 the countries in the European Monetary System had attempted to limit fluctuations in their exchange rates more actively—they had agreed on a less lenient use of the escape clause. Some countries outside the EMS, as Norway, Sweden and Finland also attempted to fix their currencies closer to the ECU. In the August of 1992 the currencies came under great stress. First, investors sold ITL and FIM. Both countries choose to devalue (or more exact—they let the value of the currency float). In early September Great Britain left the EMS. This attack is famous for the role of George Soros. His Quantum Funds is said to have increased its value with 25 per cent due to exchange rate movements in the fall of 1992. The speculators then turned to Scandinavia. Sweden came under pressure. However, the Swedish government, eager to build credibility in a new monetary policy, attempted to defend the exchange rate by rising over night interest rates to 500 per cent. This policy was not sustainable, and when the rates came down the attack continued. In November Sweden devalued. Norway devalued in December after heavy interventions.

In a fixed exchange rate regime the central bank has promised to buy and sell the currency at specified levels. The distance between the sell and buy price will be the “target zone”, the room for fluctuations in the exchange rate. The target zone is usually about +/- 2.5 per cent around the stated “fixed rate”. However, a central bank can only buy the local currency in exchange for foreign currency as long as it has foreign reserves available. In theory it can borrow reserves for interventions. However, one rarely sees this in practice. If the level of reserves become too low, the cost of standing by the promise of a fixed exchange rate might become to expensive—and the currency is devalued.

There has been much effort to understand the nature of speculative attacks. Some of what we know about speculative attacks can be summarised in these points:
Figure 1: Sweden's exit from the EMS—1992
• From the “first-generation model” (the Krugman model), we have that
  – A currency crisis will occur if the “shadow exchange rate”—the exchange rate that would have been if the rate was floating—is sufficiently different from the fixed rate ⇒ there must be some relationship between the fixed rate and a “fundamentally sound” rate.
  – If there are any kind of “trend” that will affect the shadow exchange rate the timing of an attack can be calculated. The time will be independent of “news”—it will only be a function of the rate of growth in the trend and how this affects the shadow exchange rate.

• If there is no trend affecting the shadow rate, the shadow rate might still fluctuate due to shocks.
  – If fundamentals are very strong (the shock is weak) the government will probably defend the currency no matter what.
  – If fundamentals are very weak (the shock is strong) the government will probably choose to devalue anyway.
  – Between these levels there will be a “window of uncertainty”. For a speculative attack to occur in this window, a sufficient number of speculators must believe in a crisis at the same time. If only a few investors speculate against the currency, they might lose money. For a speculative attack to succeed many investors must act simultaneously.

This is the so-called “second generation model, or the “Obstfeld model”. In this case speculation can cause a devaluation even if the government did not intend to devalue if there had been no speculation.

In the last couple of years (after the Asian crisis) new questions have been raised.

• Originally a trend that affected the shadow rate, as described in the Krugman model, was understood as growth in the money supply or depletion of foreign reserves. However, new models have emphasized the role of implicit obligations of the government: if the government has growing obligations to e.g. the banking sector, this might have the same implications for the shadow exchange rate as a fall in the actual level of foreign reserves.
• There has been much discussion on the question of contagion: why do currency crises tend to occur in “batches”—why do several countries experience currency crises at the same time?

• One has investigated whether e.g. hedge funds play a special role under speculative attacks. One can show that this might be the case if different investors have different information. If hedge fund have more information than others, and this is known to everyone, the presence of hedge funds might increase the volatility of capital flows.

• Last, much has been done on the role of regulating the exchange rate market. This is an issue we return to at the end of the course.

3 The Krugman model

We consider a small open economy where both the PPP and the UIP holds, and all investors have perfect foresight. Further, we assume for simplification that $y = 0$, $i^* = 0$ and $p^* = 0$. If we use a continuous time setting, and we let $\dot{e}$ be the rate of change in $e$, we can write the Cagan equation from the lecture 2 on the form

$$m_t - e_t = -\eta \dot{e}. \quad (1)$$

It follows from equation (1) that if the exchange rate is fixed at $\bar{e}$, the money stock is fixed at

$$\bar{m} = \bar{e}. \quad (2)$$

We now assume that the money stock is composed by two parts, domestic credit, $D$, and foreign reserves, $R$, such that

$$M_t = D_t + \epsilon R_t, \quad (3)$$

when $R$ is denominated in foreign currency terms. Let us further assume that the government follows a policy that expand domestic credit at a fixed rate $\mu$, such that

$$\frac{\dot{D}}{D} = \frac{\dot{d}}{d} = \mu. \quad (4)$$

This can be thought of as a fiscal deficit monetisation by the central bank, i.e. that the central bank issues money to pay for government expenditure. However, if the central bank at the same time follows a fixed exchange rate policy, if can not let the expansion of domestic credit affect the exchange rate. So by definition we must have that

$$\dot{D} = -\dot{R}, \quad (5)$$
expansion of domestic credit must be followed by a fall in the level of reserves.

Such a policy cannot last. Domestic credit can increase forever. Foreign reserves have only a limited supply. At some point of time the foreign reserves must be zero. At this time the central bank will no longer be able to stand by its obligations in the fixed exchange rate regime—with no foreign reserves the central bank can not fulfill the promise to exchange the domestic currency into foreign currency at a given rate. So a policy of domestic credit expansion must necessarily lead to the fall of the fixed exchange rate system.

When will such a collapse happen? Will it be when the inconsistent policy is introduced? Or will the exchange rate first collapse when the reserves are zero? In fact we observe that “currency crises” often seem to occur independent of new information. How can we explain that in this framework?

Let us define a “shadow exchange rate”, $\tilde{e}$, as the exchange rate that would have been if the speculative attack had already occurred. After a speculative attack, foreign reserves must be zero. In this case the money stock will only contain domestic credit, so we must have that $m_t = d_t$. However, we assume that domestic credit continues to grow at the rate $\mu$. If the money supply grows at a fixed rate, the exchange rate must depreciate at the rate $\eta \mu$, as we found Lecture 1. This implies that the shadow rate of the exchange rate will be

$$\tilde{e}_t = m_t + \eta \mu = d_t + \eta \mu = d_0 + \mu t + \eta \mu. \quad (6)$$

The Krugman model argues that by arbitrage the fixed exchange rate must collapse at the moment when the shadow rate equals the fixed rate, $\tilde{e} = \bar{e}$. Why? Assume that the fixed exchange rate equals the shadow rate at time $T$. Let the fixed exchange rate collapses at a $T + 2$. In this case the shadow rate will exceed the fixed rate. The fixed rate is terminated at this point, the exchange rate must make a jump from $\bar{e}$ to $\tilde{e}$. A discrete jump in the exchange rate will imply infinite profit opportunities for rational speculators. As everyone have perfect foresight, everyone will try to sell the domestic currency at time $T + 1$. Hence, the speculative attack will take place at $T + 1$. However, at $T + 1$ the jump will still be discrete. So everyone will sell at $T$.

Why not sell at $T - 1$? Simply because one would lose money by doing so. If everyone sell at $T - 1$ the exchange rate actually will appreciate, as the shadow rate at this time is lower than the fixed rate.

If we know when a speculative attack will occur, we can calculate the exact timing of an attack. We know that the attack will occur when

$$\bar{e}_t = d_0 + \mu t + \eta \mu. \quad (7)$$
Further, we know that

$$\bar{e} = m_o = \ln(D_0 + R_0)$$  \hspace{1cm} (8)

so that

$$\ln(D_0 + R_0) = d_0 + \mu T + \eta \mu.$$  \hspace{1cm} (9)

$T$ will then be given by

$$T = \frac{\ln(D_0 + R_0) - d_0 - \eta \mu}{\mu}.$$  \hspace{1cm} (10)

We see that the larger the initial holdings of reserves, the higher must $T$ be. Further, $T$ will decrease in the rate of growth in domestic credit.

$T$ must occur at a time when $R > 0$. The speculative attack will occur when the central bank still has some foreign reserves left. The result will be a fall in the money supply at time $T$ as the central bank must sell its foreign reserves during the attack. The reason why the money stock must fall is because the investors expect the growth in domestic credit to continue after the attack. Before the attack we had $\bar{e} = \bar{m}$. After the attack we have $e = m + \mu \eta$. The money stock must fall so that

$$\bar{m} = m_T + \mu \eta \Rightarrow \bar{m} - m_T = \mu \eta.$$  \hspace{1cm} (11)

There are a number of weaknesses in the Krugman model. These include that we assume perfect foresight, that we assume the UIP to hold at every point of time and that we assume that the government follow a totally inconsistent policy over time. One relevant question is why, when everybody has perfect foresight, should the government care to follow an inconsistent policy of this kind? However, the model tells us that if we want to understand why a seemingly “irrational” event occurs—remember, here a speculative attack occurs even if the central bank still controls foreign reserves—it is important to understand long term underlying trends, and how these affect the expectations of market participants.

4 Crises with no trend?

In the August 1993 the French franc, the Belgian franc and the Danish krone all experienced severe speculative attacks. As a result of this the countries agreed to widen their target zones within the EMS system from +/-2.5 per cent to +/-15 per cent. However, within two years of the attack all three currencies were not far from the edge of the original band. Figure 3 illustrate the movements of the BEF over the period from 1990 to 1999.
Figure 2: Anatomy of a speculative attack

log exchange rate

Fixed rate

Shadow floating rate

log foreign reserves

log money supply

9
Over this time period little changed in the Belgian economic policy. Belgium had with success followed a low inflation policy in the late 1980’s. Inflation remained low. The Belgian state debt was high—it was (and is) well above 100 of GDP—however it remained stable over the whole period.¹ There was strong support in Belgium for the long term goal of joining a common European currency. There was no obvious “trend” in Belgian policy that could be considered as incompatible with the commitment to a fixed exchange rate.

The Krugman model is clearly not able to explain events such as those we observed in Denmark, France and Belgium in 1993. In fact, a number of more recent currency crises have aspects that are similar to what we observe in these three countries. The Norwegian devaluation in 1992 happened in a country that at the time of attack had lower inflation than Germany and a very sound fiscal position.

A new line of currency crises models therefore emerged to suggest that even sustainable currency pegs could be attacked and even broken. These models focus on the choice of governments: they assume that the government will make a continuous comparison of the net benefits from changing the exchange rate versus the net benefits of defending it. When costs become to

¹One should note that the Belgian debt is mainly debt issued in domestic currency to domestic residents. This makes the high debt levels less of a problem with regard to the exchange rate.
high the fixed rate is abandoned. An important aspect is that speculation itself will affect to the cost of holding an exchange rate fixed.

4.1 The strategy of speculators

The following game theoretic approach\textsuperscript{2} illustrates the case of how speculative attacks might occur even in situations when the exchange rate peg is sustainable. The basis of the argument is that there is a correlation between the “discomfort” a government will feel about a devaluation and the level of reserves the government chooses to hold.

Assume that if fundamentals are very strong, the government is not under any circumstances willing to give up the fixed rate. In this case the level of reserves the government is willing to commit to defending the exchange rate is high. If fundamentals are very weak—think e.g. about a period when the real exchange rate is overvalued—the government might be willing to, or even interested in devaluing the exchange rate. So the level of reserves committed to defending the rate will be low.

The problematic case is the “grey zone”. Where do “good” fundamentals end and “bad” fundamentals start? Assume that the currency is slightly overvalued in real terms. However, there are reasons to believe that one can adjust this through lower inflation and tight fiscal policy. So the exchange rate peg is sustainable. However, given the economic difficulties, the government is not willing to put its full force behind the exchange rate peg. In the model we assume that at such “intermediate” levels of fundamentals the government is only willing to commit an intermediate level of reserves to defend the exchange rate.

More specific, we assume three possible states of the economy. In the good state the governments commits reserves equal to 20 “domestic money units”, e.g. 20 billion NOK. For simplicity we assume that this equals the total monetary base. In fact, such a commitment will make it impossible for speculators to topple the exchange rate.

In the intermediate stage the government commits reserves equal to 10. In this situation it is possible for speculators to topple the regime, but only if the whole markets reacts at the same time. In the bad state the government commits reserves equal to 6. In this case one large trader can topple the regime alone.

We assume the existence of two traders. Each trader control resources of 6 domestic money units. The traders incur a cost of $-1$ by attacking the exchange rate. Figure 4 presents the result of alternative strategies in

\textsuperscript{2}From Obstfeld, 1995.
Figure 4: Attack when fundamentals are strong. Committed reserves=20.

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<td>Trader 2</td>
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the “good state”. In this case the traders will not be able to topple the regime under any circumstances. They will gain 0 by doing nothing, and lose $-1$ by speculating against the currency. The case of “hold, hold” can be characterised as a “Nash equilibrium”.3

Assume that we are in the low state, and that one trader attack the exchange rate. Then the central bank will offer this trader its whole portfolio of reserves, equal to 6. Assume the currency depreciates with 50 per cent. The trader makes a profit of 2—the income from the speculation is $3$ and the cost of speculation is $-1$. However, if both traders sell at the same time, the traders will share the central bank reserves between each other. Both will make an income of $3/2$, and a profit of $1/2$. This case is illustrated in figure 5. In this case the “sell, sell” strategy will be a Nash equilibrium.

3A Nash equilibrium is a state where nobody, when the behaviour of everyone else is taken as given, can improve on their outcome by changing their own strategy.

4Assume that the peg was on the level 1:1. The trader exchanges 6 domestic currency units in 6 foreign currency units at the rate 1:1. After the devaluation she can exchange back at the rate 1.5:1—for her 6 units of foreign currency she will get 9 units of domestic currency. She will make a profit of $9 - 6 = 3$ units of domestic currency.
Figure 5: Attack when fundamentals are weak. Committed reserves=6.

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<tr>
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<td>Trader 2</td>
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<td>Sell</td>
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Trader 1

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The most interesting case is made up by the intermediate fundamentals. In this case no trader can topple the regime alone. So if a trader acts alone, she will gain nothing, and lose the cost of speculation. However, if both traders attack at the same time, both will gain $5/2 - 1 = 3/2$, as they will share the committed reserves of the central bank between them. This case is illustrated in figure 5. Here we have two Nash equilibria—it will be an equilibrium to “hold, hold”, but it will also be an equilibrium to “sell, sell”. In this situation we have possible instability—the peg might survive or it might not, depending on whether the traders are able to co-ordinate their attack or not.

4.2 The role of large speculators

Of course, the investor will never know exactly what commitment the central bank is ready to offer. So the investor must first observe some signal that gives her an opinion about the economy. Then she makes up her mind about
a speculation strategy. If she finds that she have positive expected returns, she will attack. If expected returns are negative, she will not attack.

One question that has been asked is what role large speculators play in determining the faid of fixed exchange rate regimes. Above, I referred to the story of George Soros and the devaluation of the GBP in 1992. Soros is said to have made billions of USD during this attack.

What is a large speculator? There exist funds that control enormous amounts of money. Several American pension funds have resources in excess of the Norwegian GDP. However, when we talk about a “large player” in the FX-market, it is not necessarily market capitalisation that is interesting. Rather it is the ability to take high risk positions. Most banks and pensions funds have strong restrictions on the level of risk they can take.

However, there exists a type of institutions that have no juridical restrictions on their risk positions. These are the so-called hedge funds. Hedge funds are financial institutions that specialise on making money on potential mis-pricing in financial markets. The hedge fund will form an opinion of what it perceives to be the “shadow exchange rate”. If the fixed rate and the “shadow rate” diverges, there are potential profits to be gained by speculating in this market.

The main difference between a hedge fund and a e.g. mutual fund is that while public regulators will take some responsibility for checking up on the practices of a mutual fund, the investors in a hedge fund is perceived to be able to take care of themselves. There is no restrictions on how a hedge fund can invest.

The fast way to make money in financial markets is by gearing risk. That is to gamble with loaned money. Assume that you expect the stock of firm A to increase with 50 per cent over a year. You have NOK 100. If you invest all you have in the firm, you expect to make NOK 50. However, assume that you gear your investment 10 times. That is, you offer a bank 100 as a security, and borrow 1000 for investment in the stock. The cost of the loan is 10 per cent, i.e. 100 for a year. If your expectations go in you gain 500 on your investment, and earn 400 after loan cost are paid. So you increase your profits by 800 per cent. However, the risk is of course considerable. Say that the firm actually goes bust. Then you lose 500 plus the cost of the loan, a total of 600. That is 500 more than you have...

An institution that basis its investment strategy on gearing is called a highly leveraged insinuation. Most hedge funds fall in this category. This implies that even a relatively small fund can take very large positions during e.g. a speculative attack.

How can an American hedge fund with no NOK assets attack a currency peg involving the NOK? It can do so by going short—i.e. sell currency in
the forward market. When the hedge funds sells a forward contract on the
delivery of NOK, the opposing party will be a bank. The contract implies that
the bank must take a delivery of NOK sometime into the future. However,
the bank does not want to expose itself to currency risk. So it will cover the
contract by selling NOK today. If there is no market for this NOK today,
the central bank must intervene, and foreign reserves will be depleted. The
hedge fund can force a spot sale of NOK today by intervening in the forward
market. However, one should note that this strategy is not risk free. The
cost of the forward contract is the same as the interest differential between
the two currencies of the contract. To short sell NOK is equivalent to taking
a loan in NOK. If Norges Bank increases its interest rates to stop the attack,
the cost of such a contract can be high.

Hedge funds have been accused of trying to destabilise financial markets.
The accusers are both politicians and economists, and they include, in a ran-
dom order of importance, the former French president Francois Mitterand,
the Malaysian prime minister Dr. Mathahir and the head of Norges Bank
Svein Gjedrem. The central banks of Hong Kong and Australia have both
issued reports where they accuse hedge funds of manipulating the local ex-
change rates. In the case of Norway, it has been reported that the fund
Tiger Management has been actively involved in speculation against NOK.
The same is the case of Chase Manhattan, although Chase is not a hedge
fund.

The idea is that a “large player” could generate profits by secretly selling
the currency forward and then deliberately trigger a crisis by making a large
spot sale combined with some public statements of how weak the currency is.
One example of manipulation might have taken place in Hong Kong in 1998.
It is said that funds short sold both the HKD and the Hang Seng index at
the same time. The idea was that by selling HKD they would force the Hong
Kong Monetary authority to leave the currency peg. Then they would make
money in on the currency contracts. Short selling the stock market would
increase the pressure for a devaluation. However, if the authorities raised
interest rates to defend the pegged rate one should expect the stock market
would fall. Then the investors would make money on the stock contracts
instead.

Was this a case of manipulation? “Fundamental analysis” probably could
justify both going short in the currency, and short in the stock market. Of
course by taking such positions, investors might contribute to making such
events inevitable. But whether this is “manipulation” or not is hard to say.

In fact the Hong Kong authorities pulled of a “double defence”. They
increased interest rates to defend the peg. However, at the same time they
intervened in the stock market to boost prices. This way investors lost money
Figure 7: Attack when fundamentals are weak. Committed reserves=6. Trader 1 controls 9 units, trader 2 3 units.

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on both their contracts. Hong Kong authorities might have fooled potential speculators. The question is how this willingness to intervene in the markets affected the perception of other potential investors in Hong Kong.

How should we analyse the role of large investors? Take the example of speculation given above. Assume that the two traders have unequal size. E.g. let one investor control resources equal to 9 domestic currency units, and the small investor controls resources equal to 3 units. What would change? The “good state” remains as before. No devaluation would occur. In the bad state the small investor could no longer attack the currency alone. In fact, the “large player” gets a proportional share of the central bank reserves—i.e. 75 per cent of the reserves, as she has 75 per cent of the market, then the small investor would not care about the currency markets at all. The small investor would lose money by selling anyway, given the high costs of speculation. This is illustrated in figure 7.

In the intermediate case however, there would be no real change. The large trader needs the support of the small trader to succeed. Only the
Figure 8: Attack when fundamentals are intermediate. Committed reserves=10. Trader 1 controls 9 units, trader 2 3 units.

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Payoffs would be different from the case where the traders were of equal size.

If size is the only difference between two traders, this might affect who takes part in an attack when the central bank has only a low commitment to a fixed exchange rate. However in these cases an attack is probably due to happen anyway. In the cases when fundamentals are stronger, the whole market still needs to take part for an attack to succeed.

If the large trader is different from the small trader on other counts than just size, this argument will of course change. If the large player is perceived to have superior information, that might increase her ability to influence the behavior of the market. If the large player has less cost of speculating than the small investor, this might also affect the results. An extreme version of this case is reflected in figure 9. Here we assume the large trader has no cost of speculating. In this case it would be optimal for the large trader to always speculate—and therefore for the small trader to speculate as well. If the costs of speculation is very small, the volatility of the exchange rate might increase.
Figure 9: Attack when fundamentals are intermediate and the large trader has no cost of speculation. Committed reserves=10. Trader 1 controls 9 units, trader 2 3 units.

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4.3 A short note on the Tobin tax

A Tobin tax is a proposed tax on all transactions in the foreign exchange market.

Intention: to reduce excess volatility caused by low costs of transaction. Will it work? Yes—and no.

- Hinder currency crises? If the cost is high relative to expected gains a tax will reduce the probability of crises. However, the tax necessary must probably be high. And there are possible problems, see example below.

- A tax would make the markets less liquid. It is not perfectly clear how that will effect the price process. However, short term volatility might fall.

- It has been argued that for a Tobin tax to be effective it must be implemented in all territories—if only a tiny bit of land is excluded one could move all FX transactions there to avoid the tax. However, a tax that covers the OECD countries will probably still have a substantial effect.

- The real problem is financial derivatives. It is possible to speculate in the FX-market without being in the FX-market—one can create financial derivatives that reflect the risk in the FX market.

5 Contagion

Figure 11 depicts the development of Asian currencies over the period from 1996 to 1998. As we see, during 1997 there occurred a period of severe volatility that lead to a shift from fixed exchange rate regimes to floating exchange rate regimes.

In figure 12 we take a closer look at the period from May 15 to December 31 1997. We observe that the crises did not occur simultaneously. Rather they occurred one after another. There is signs of some sort of regional “spread”. This phenomena is often referred to in the literature as “contagion”.

Why do contagion occur? Four reasons have been presented:

1. Several countries can be similarly affected by a common shock.

2. Trade linkages can imply that a crisis in one country weakens fundamentals in other countries.
Figure 10: Example of how a Tobin tax can be destabilising (note that this is an extreme case). Trader 1 controls 6 units, trader 2 6 units. Cost increases from 1 to 2.

<table>
<thead>
<tr>
<th></th>
<th>Hold</th>
<th>Sell</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Hold</strong></td>
<td>0,0</td>
<td>0,2</td>
</tr>
<tr>
<td><strong>Trader 2</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sell</strong></td>
<td>2,0</td>
<td>1/2,1/2</td>
</tr>
</tbody>
</table>

Attack when fundamentals are weak. Committed reserves=6. In first case cost of speculation is set to -1. In second case cost of speculation is set to -2. In the first case we have one Nash equilibrium, in the lower, right corner. In the second case we have two Nash equilibria, in the upper right and lower left corner. This creates the possibility of a more unstable situation.
Figure 11: Asian currencies against USD, 1996-98

Figure 12: Asian currencies against USD, May 15, 1997-December 31, 1997
3. Financial interdependence.

4. A currency crisis in one country can change market participants’ perceptions of other countries, resulting in the withdrawal of capital.

Argument one is providing a “fundamental” explanation of the spread of crises. Argument number four favour the perception of crisis as “self-fulfilling”. This argument does however depend on assumptions of limited rationality among market participants. It is no reason why a crisis in one country should affect rational expectations of other countries unless there are real links between the two economies. Arguments two and three are therefore perhaps the more interesting, as they provide explanations of why a crisis can be transmitted between countries even if there are no common shock.

5.1 Transmission of currency crisis via trade channels

It is important to point out that transmission via trade channels do not depend on the existence of trade channels between the countries affected. In fact, in the case of Asia one common feature is the relatively small trade flows between the countries affected by the speculative attacks.

The important feature is to which degree the exports of two countries are competing in foreign markets. In table 3 we illustrate the case with countries A and B exporting to countries C and D. Country A sends most of her exports to country C, while country B sends most of her exports to country D.

Assume that country A devalues with 10 per cent. What is the effect on the exports of country B? To say something about this we must make some assumptions about how close substitutes the goods of A and B are in C and D. We assume that there is a one-to-one relationship between a devaluation and an change in demand in the importing country. If the price of goods from country A falls with 10 per cent, the demand for goods from country B falls with 10 per cent. The relative price elasticity $\rho$, is set equal to 1.

The total effect of a devaluation in country A on the exports of country B will be given by

$$\Delta \text{exshare}_B = \sum_{k=C,D} [\rho(k) \cdot \text{exshare}_B(k) \cdot \text{marketshare}_A(k)] \cdot \text{dev}, \quad (12)$$

where $\text{exshare}_B(k)$ is the export share of country B in market $k$, $k \in \{C, D\}$, and dev is the devaluation in per cent. If we substitute in from table 3 we obtain

$$\Delta \text{exshare}_B = [1 \cdot 0.1 \cdot 0.9] \cdot 0.1 + [1 \cdot 0.9 \cdot 0.1] \cdot 0.1 = 1.8\%. \quad (13)$$
### Table 1: Non-competing trade flows

<table>
<thead>
<tr>
<th>Initial trade flows value</th>
<th>Export share percent</th>
<th>Market share percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>90 10</td>
<td>90 10</td>
</tr>
<tr>
<td>B</td>
<td>10 90</td>
<td>10 90</td>
</tr>
</tbody>
</table>

### Table 2: Competing trade flows

<table>
<thead>
<tr>
<th>Initial trade flows value</th>
<th>Export share percent</th>
<th>Market share percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>From</td>
<td></td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>10 90</td>
<td>50 50</td>
</tr>
<tr>
<td>B</td>
<td>10 90</td>
<td>50 50</td>
</tr>
</tbody>
</table>
The exports of country B will fall by 1.8 per cent. However, assume that country A and B are competing in the same markets. An example is given in table 2.

In this case the effect of a 10 per cent devaluation in country A will be

$$\Delta exshare_B = [1 \cdot 0.1 \cdot 0.5] \cdot 0.1 + [1 \cdot 0.9 \cdot 0.5] \cdot 0.1 = 5\%,$$

a 5 per cent fall in the exports of country B.

In the case of South East Asia, these countries were all competing in foreign markets. They all specialised on electronics and computer components, sending their goods to Japan, the USA and Europe. The actual trade between these countries was of lesser importance. However, in this case the actual devaluations were not 10 per cent. Thailand, Malaysia and South Korea experienced devaluations of close to 50 per cent. If we assume a 50 per cent devaluation in country A, we get a 9 per cent fall in exports in country B in the “little competition case”, and as much as 25 per cent fall in the exports of country B in the “strong competition case”. Effects of that magnitude would certainly create a “fundamental” basis for a devaluation in country B as well.

5.2 Transmission via a credit crunch

We consider a case where two banks, bank 1 and 2, lend to three different countries, A, B and C. However, the dependence on the two banks differ between the three countries. This is not an unrealistic assumption. Often banks will specialise on lending to specific geographical regions.

No assume that there is a speculative attack in country A, and that country A defaults on its foreign debt. Both bank 1 and 2 will lose all they have lent to country A. As a result both banks need to recall loans to satisfy the demands of their creditors. Bank 1 have total loans of 40 (20+20) after the default of A. It must recall a total of 20, which makes up 20/(20+20)=50 per cent of its loan portfolio. Bank 2 had an exposure of 10. It must no recall 10, which makes up 10/(10+80)=11.1 per cent of its portfolio.

For country B this means that total loans are reduced from 30 to

$$20 \cdot 0.5 + 10 \cdot 0.899 = 18.9.$$

That implies a reduction in total loans of (30-18.9)/30=37 per cent. For country C we find that total loans are reduced from 100 to

$$20 \cdot 0.5 + 80 \cdot 0.899 = 81.1.$$

That implies a reduction in total loans of (100-81.1)/100=18.9 per cent.
Table 3: Bank dependence

<table>
<thead>
<tr>
<th>From:</th>
<th>Initial portfolio</th>
<th>Exposure</th>
<th>Dependence</th>
<th>Total:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bank 1</td>
<td>Bank 2</td>
<td>Bank 1</td>
<td>Bank 2</td>
</tr>
<tr>
<td>To:</td>
<td>A</td>
<td>20</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>B</td>
<td>20</td>
<td>10</td>
<td>33</td>
</tr>
<tr>
<td></td>
<td>C</td>
<td>20</td>
<td>80</td>
<td>33</td>
</tr>
<tr>
<td>Total:</td>
<td></td>
<td></td>
<td></td>
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</table>
The point here is that a default in one country might have large effects on the financing of other countries if there are some kinds of concentration in lending. If credit channels and trade channels are both regional specific the transmission effects can be substantial. In other words, a shock to one country might have substantial implications for other countries, even though these countries before the crisis had “strong fundamentals”, and even if we assume investors to be fully rational. Through trade and credit channels economies can be interdependent despite no direct links between them.