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A Minskian Approach to Financial Crises with a Behavioural Twist: A Reappraisal of the 2000-2001 Financial Crisis in Turkey

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A MINSKIAN APPROACH TO FINANCIAL CRISES
WITH A BEHAVIOURAL TWIST:
A REAPPRAISAL OF THE 2000-2001 FINANCIAL CRISIS IN TURKEY

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DEDICATION

À Karine,

qui a eu la patience de m'accompagner tout au long du parcours

et dont l'amour m'aura donné la force de persévérer.

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ABSTRACT

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FEBRUARY 2012

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The phenomenal financial expansion of the last decades has been characterised by an exacerbation of systemic instability and an increase in the frequency of financial crises, culminating in the recent meltdown in the US financial sector. The literature on financial crises has developed concomitantly, but despite a large number of papers written on this subject, economists are still struggling to understand the underlying determinants of these phenomena. In this dissertation, I argue that one of the reasons for this apparent failure is the way agents, as well as the environment in which they evolve, are modelled in this literature. After reviewing the existing literature on international financial crises, I outline an alternative framework, drawing from Post-Keynesian and Behavioural insights. In this framework, international financial crises are seen as being a direct consequence of the way agents formulate expectations in an environment of fundamental uncertainty and the investment and financial decisions they subsequently take. I argue that the psychological heuristics agents use in formulating expectations under fundamental uncertainty can lead to decisions which fragilise the economy and can thus be conducive to financial crises.

I then apply this framework to the study of the 2000-2001 financial crisis in Turkey, which is notorious for not lending itself easily to explanations based on the existing theoretical literature on international financial crises. After outlining the crisis and reviewing the main existing accounts, I identify two moments prior to the crisis: A phase of increasing financial fragility, lasting from a previous crisis in 1994 to 1999, and a financial bubble in 2000 during the implementation of an IMF stabilisation program, partly predicated on the previous increase in financial fragility. My framework can account for both periods; it fits particularly well the first one and enhances the explanatory content of existing stories about the events that took place in 2000.

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INTRODUCTION

There has been a distinct increase in turbulence in world financial markets after the demise of the Bretton Woods system (Eichengreen 2002). Research on the topic extended concomitantly, for the most part in a delayed fashion. Each wave of crises tended to invalidate explanations elaborated previously and give rise to a new set of models, which were themselves put in question with the arrival of the next set of crises. Three generations of models were born in this way, each one broadening the scope of factors that could conspire to generate a crisis while circumscribing the specific characteristics of the wave of crises they were built to explain, without there arising a canonical form encompassing different variations of the phenomenon. Meanwhile, the instability of international capital markets continues unabated.

Financial instability is not only costly; it is dramatic for many people. The recent meltdown in US financial markets and its ripples across the globe has brought many corporations to their heels and put countless people out of work, despite the trillions of dollars thrown at the crisis. Existing models of financial crisis failed to herald the coming troubles, a theoretical blindness that had devastating consequences. This calls for a revamping of the way economists conceptualise crisis episodes and a better understanding of the processes which may lead to them.

One of the important failings of most existing accounts is their treatment of human beings through their use of «Rational Agents», with the assumption of the existence of perfect information equally or asymmetrically disseminated amongst them. This is not only unrealistic, a fact which most economist would probably recognise, but it also a poor heuristic device, as it fails to adequately represent important features of the behaviour of the

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participants in international financial markets, even though this behaviour is at the centre of most modern analyses. Some heterodox accounts, based on Minsky's (1982) financial fragility hypothesis, offer a solution through the explicit acknowledgement of fundamental uncertainty as a defining characteristic of international financial markets (Arestis and Glickman 2002, Depaula and Alves 2000, and Schroeder 2002). The adaptation of Minsky's hypothesis, originally located within the realm of a closed economy, to an international context thus seems to be a promising avenue to explore in an effort to devise a better framework to analyse international financial crises.

The adoption of the postulate of fundamental uncertainty is not a panacea, however, and the behaviour of agents under those conditions remains somewhat vague and ungrounded in Minsky's theory. A third theoretical strand, aptly labelled behavioural economics, provides some guidance on this question through the exploration of the psyche of human beings and their reactions when they are placed in situations akin to those they face in the economy. Applications of behavioural economics in finance have been growing in popularity in recent years and some of the results of both these theoretical approaches and these applications could be used for the study of financial crises. However, behavioural economics lacks a solid structure which would allow a systematic study of the processes surrounding and preceding financial crises. To address the deficiencies of both approaches while exploiting their strengths at the same time, I devise an original joint framework for the study of financial crises.

I then use this new analytical framework to study a financial crisis which occurred in Turkey in 2000-2001. This crisis was the original motivation for the project, since none of the existing generations of models can explain the 2000-2001 Turkish crisis particularly well, nor even, I would endeavour to say, can the more idiosyncratic accounts that have been put

forward to date. While my framework is general in nature, this crisis will be studied in all its specificity, with direct references to the particularities of the Turkish economy. To do so, I employ data I spent a summer collecting at the Central Bank of the Republic of Turkey, taking some cues from conversations I had with individuals who were important actors during the crisis.

The use of this data for the study of the financial crisis is novel, both in terms of the empirical tools I specifically designed to this end and the actual data, which had heretofore never served to analyse dynamics in the financial markets. In this way, I provide a new account of the Turkish financial crisis and an illustration of my framework at the same time. The results I obtain suggest that my framework can contribute in explaining the occurrence of the crisis. More specifically, there seem to be two distinct moments preceding it: An increase in the fragility of the domestic economy in the years after a previous crisis in 1994, and a financial bubble in 2000 whose development also fits my joint framework.

The remainder of the dissertation is divided in six chapters. In chapter 2, I critically review the current state of the literature on international financial crises. This is followed in chapter 4 by a redefinition of the actors present in financial markets, using notably insights from behavioural economics and research in psychology, as well as an outline of some relevant strands of Post-Keynesian analysis useful in delineating a structure to the analysis of financial crises in the first part of chapter 4. I combine the two in the second part of chapter 4 and outline an original joint theoretical framework.

The next two chapters contain the empirical investigation of the 2000-2001 financial crisis in Turkey. In chapter 5, I outline some important events in the Turkish economy that occurred in the decade preceding the crisis, before recounting some salient moments of the crisis itself. I then analyse the main existing accounts of the crisis, largely based on the

modern currency crisis literature reviewed in chapter 2, enriching in so doing the general

picture of the Turskish economy during this period, but also identifying some dimensions in

which these explanations are lacking. I apply my framework to the analysis of the Turkish

crisis in chapter 6, supplementing existing accounts and also testing my framework in this

context. Finally, I lay out a few concluding remarks in chapter 7.

CHAPTER 2

MODERN CURRENCY CRISIS LITERATURE

One of the most interesting characteristics of crises is the element of surprise, the fact that many actors are seemingly oblivious to rising risk during a boom or an expansion phase, a fragility that then becomes manifest once the crisis erupts. But economic models have come to be populated by "rational" agents[1] endowed with a propensity and ability to properly forecast future economic outcomes over long horizons, not the type of people liable to exhibit unwarranted exuberance. This creates a difficulty in accounting for the crises themselves: If actors are rational and able to forecast over the long haul, how could they not see the crisis coming and readjust their expectations accordingly? While a few savvy financiers often get on the ball at the very end and try to make money off the shifting situation, why did many people stand by in the period preceding those last moments, as the system was increasingly getting ripe for a crisis? Three generations of financial crisis models have been elaborated over the last three decades, as the system was becoming increasingly unstable (Eichengreen 2002), and now occupy most of the literature on the topic, but none of them provides a satisfactory answer to these questions. As I consider each of these generations of models in turn, I will be focused on financial crises involving a fixed exchange rate (often dubbed currency crises), as this is central to the Turkish case.

Currency crisis models are steeped in the specific historical period in which they are elaborated. The theory of financial crises was brought back to the fore at the end of the 1970s, in the wake of the abandonment of the Bretton Woods system and major turbulence

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[1] By "rational agent" I mean the depiction of humans as utility-maximising beings engaging in constant calculation of potential outcomes in order to select the proper actions to this end. As I argue later, this is not the only definition of rationality possible, but it is the one most commonly used in economics.

in world capital markets. A first group of models was formulated around that time, informed in large part by the balance of payment strains many countries were experiencing, strains that culminated in the debt crisis of 1982. The explanatory power of these models was found lacking when the European Monetary System was attacked at the beginning of the nineties, giving rise to a new set of models, which came to be known as "second-generation models". Along with their predecessors, now labelled "first-generation models", these models seemed incapable of explaining the events that unfolded in Asia a few years later. The Asian crisis gave rise to yet other models, a third generation, more disparate this time, as no single explanation of the crisis gained general assent.

Both the second and third generation of models built upon existing formulations, but they also emancipated themselves from them in important ways. It is therefore worthwhile to look at each of them separately and distil their essence. While categorising these models in generations does not say much about their nature (Jeanne 2000), it has the advantage of keeping them in their historical context. This is therefore the approach I adopt as well.[2] In addition, some characterisations of crisis elaborated during this period do not easily fit within this categorisation. I discuss some of them after drawing the generational family portrait and in the next chapter.

2.1   Mechanistic Elders (First Generation)

The first generation was elaborated by economists working at the Federal Reserve at the end of the 1970's (Flood and Marion 1998), and the first application of this model to speculative attacks on fixed exchange rates is attributed to Paul Krugman (1979). While the

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[2] The boundaries between generations are sometimes hard to discern. Mine will follow in large part the classification implicit in Jeanne (2000) for the first two generations and Fourçans and Franck (2003) for the third one.

model was later extended, simplified and modified later in many ways, the basic gist remains the same[3]: A government is running policies that are inconsistent with the exchange rate peg it is trying to maintain (like an expansionary policy draining its reserves), which eventually depletes its resources enough to force the exchange rate off the peg. Not much is said about the reasons why the government is running these conflicting policies, as the authorities are modelled as essentially mechanically following a rule until they have no choice but to abandon the fixed exchange rate arrangement. In some sense, as Jeanne (2000) argues, this vision of currency crises can be viewed as a product of the failure of Latin American stabilisation programs during that period, where governments were indeed following conflicting policies and pegs where attacked when they became unsustainable.

First-generation models come in many guises. Nevertheless, the main insights can still be captured through a description of the functioning of the first two to be devised, i.e. Krugman's (1979) model or the simplification offered by Flood and Garber (1984, as expounded in Obstfeld and Rogoff 1996) (the perfect foresight version). I will thus begin with such a description[4] and then discuss some extensions that have been brought forth since the two models were devised.

2.1.1 Basic Specification

The model centers on a small open economy where the government is pursuing an expansionary fiscal policy. Money supply is thought of consisting of domestic credit and foreign reserves, and as purchasing power parity and uncovered interest rate parity hold, it must stay the same as long as the exchange rate remains fixed. Moreover, it is assumed that

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[3] A good characterisation of first-generation models can be found, amongst other places, in Obstfeld and Rogoff (1996), Flood and Marion (1998), or Jeanne (2000).
[4] I inspire myself from Obstfeld and Rogoff (1996), pp. 558-565, Krugman (1979), Flood and Marion (1998), and Jeanne (2000).

there is a floor to the amount of foreign reserves that the government wishes to hold (or is able to command through foreign borrowing), so that reserves never fall below a certain level.

Now, the expansionary fiscal policy implies an increase of domestic credit every period. Since the overall money supply has to remain constant if the peg is to be preserved, this increase must be matched by an equal decrease in foreign reserves. This is clearly unsustainable, as reserves will sooner or later dwindle away, at which point the government would have to abandon the peg. The attack will occur before that point, however. To see this, let's define the shadow exchange rate as the rate that would prevail if an attack occurred, private investors bought the remainder of the reserves committed to the defence of the peg, and the government let the currency float. Suppose there is no attack, then the money supply would have to expand by the amount of domestic credit expansion the minute the government runs out of reserves. This would imply a discrete jump in the exchange rate of exactly that amount, which in turn implies that the shadow exchange rate, at that point, it higher than the peg. Anticipating this, investors will want to get rid of their currency before this happens. More generally, this will occur at any point where the shadow rate lies above the fixed rate. By backward induction, then, investors will end up bidding every gain away by running on the currency at the exact point where the shadow rate intersects the peg (which could be in period one, if the peg is wholly unsustainable), which is before the reserves are entirely spent.

In short, the basic model predicates that a currency crisis occurs as a result of bad fundamentals[5], in this case an unsustainable fiscal policy. Investors, being endowed with perfect foresight, see an occasion and run on the bank at the exact moment when the

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[5] There is not really any consensual definition of fundamental. I personally take them to mean "any macroeconomic variable that has an important influence on economic outcomes".

floating exchange rate resulting from the attack is equal to the fixed exchange rate, so there is no discrete jump in the exchange rate. At that moment, there is a discrete downward jump in the money supply, as reserves are all bought up. Uncovered interest rate parity will insure that the interest rate also increases, so money demand will decrease and the money market will balance out.

2.1.2   Alterations and Extensions

Many extensions can, and have, been made to this simple model, both to make it more realistic and to try to make it fit the data better. Firstly, if investors do not know exactly where the floor on reserves lies, then they may not have a clear idea of when to attack (as this minimum reserve amount enters in the determination of the shadow exchange rate). If there are no transactions costs, then the only equilibrium strategy is to attack as soon as there is some degree of likelihood that the peg will be abandoned, and then to revert back to domestic currency holding if the government commits more resources than previously thought. As Krugman (1979) mentions, this could lead to a string of small attacks eventually culminating in a crisis. Adding a cost to the attack mitigates this result, and can even make attacking into a dominated strategy if there is not enough cooperation between the speculators (so not enough resources are employed in the process) (Jeanne 2000).

Another possible extension is to modify government policies and their economic effects. For example, if some degree of policy uncertainty is introduced and the expansion of domestic credit is made stochastic, so that investors never know in advance the future path of credit expansion, the crisis will be preceded by an increase in the interest rate to account for an impending devaluation (a kind of peso effect)[6]. This change in interest rate is usually

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[6] Such an increase is actually often observed in the data (Flood and Marion 1998).

captured via the introduction of a risk premium (for an example of such a model, see Flood and Marion 2000). Since the risk premium depends on the expected future variability of the exchange rate, the model can have multiple equilibria. More precisely, if expectations of exchange rate variability increase, interest rates will increase and money demand will drop, which will affect the shadow exchange rate and make it more profitable to attack the currency[7]. Currency crises can therefore be partly self-engineered by speculators, although they are not very likely unless the exchange rate arrangement is made vulnerable by the current state of fundamentals. Given that it can be shown that, under certain conditions, the shock required to move from a no-attack to an attack equilibrium can be quite small, the presence of uncertainties imply that crises can be quite sudden and unexpected (Flood and Marion 1998). Under this kind of uncertainty, there may also be a discrete unanticipated jump of the exchange rate at the moment of the attack. If this occurs, there could be an important transfer of wealth from the government to speculators as the latter buy domestic reserves at a lower exchange rate while they attack and resell it after at a higher rate.

Furthermore, if the policies followed by the government are altered such that the expansion of domestic credit increases in the case of a successful speculative attack, multiple equilibria are again possible[8]. This is more easily seen in a two period framework. Suppose that current government policy is such that the peg would actually be sustainable in both periods. In that case, there is a first equilibrium where no speculative attack occurs, but if

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[7] Note that these results are derived assuming that monetary authorities sterilise financial flows, another possible modification which I will not analyse here.

[8] Here is an instance where the definition of categories could matter. According to my division, this policy reversal on the part of the government lies in the first generation because the government is still forced to devalue as a result of the behaviour of investors, that is, it does not really do so of its own volition. An example of such policy reversal could be an increased monetisation of the debt necessary if the government is cut-off from external borrowing after the crisis, which may have nothing to do with a cost-benefit calculation. For other authors, however, such policy reversal should be labelled as a second generation model because government policies *pull* the country into crises rather than *pushing* it through a gradual depletion of resources (e.g. Flood and Marion 1998).

investors attack and the peg is abandoned, then the government will step up its credit expansion and the subsequent floating exchange rate could be high enough to justify the attack *ex post*. In this case, crises could have a self-fulfilling component to them, although they are still based on weak fundamentals[9]. The conditions determining whether a crisis occurs or not, that is, which equilibrium is concretised, can vary from the degree of coordination amongst investors to the level of costs they face in mounting an attack.

2.1.3   Evaluation

In a nutshell, first-generation models depict a situation whereby a government is running policies that are inconsistent with a peg it is trying to maintain, which eventually depletes its resources enough to force the exchange rate off the peg. This may happen before resources are completely exhausted, but essentially, the outcome is made inevitable by the government's policy choices. The introduction of uncertainty makes the existence of multiple equilibria possible, adding a self-fulfilling component to the story. Similarly, when future government policy is influenced by the maintenance or abandonment of the peg there can once again be multiple equilibria.

While this class of models provides an interesting illustration of what may happen when a government pursues inconsistent policies, it possesses grave weaknesses. Both the notion of fundamental used in these models and the behaviour of the authorities are problematic. First-generation models imply a very narrow definition of fundamental,

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[9] This last result, which is central to second-generation models, could be said to be of little interest in the present case because of the *ad hoc* nature of the assumptions on government policies. As I argue below, however, one may wonder if the way in which government decisions are endogenised in second-generation models is much of an amelioration: why would the minimisation of a loss function that is just as *ad hoc* as a given mechanical policy rule be preferable to the latter?

basically limiting it to expansionary fiscal or monetary policies[10]. This seems at odds with the experience of many countries that suffered a crisis, especially in the 1990's, which did not follow fiscal or monetary policies that were contradictory with the maintenance of the peg. In addition, a lot of these countries had more than enough resources to defend the peg, yet chose not to do so. These two differences were major reasons justifying the elaboration of the second generation of models, which I review next.

This first criticism seems limited, however. It is certainly potent against Krugman's model, or any other occurring under perfect certainty, but it does not apply to the versions which explicitly incorporate uncertainty. In fact, although these models traditionally employ the same fundamentals as the other first-generation, they implicitly admit as fundamentals any macroeconomic variable that could shift the beliefs of investors about future changes in the exchange rates or in the money supply. Arguably, they still retain the feature that an attack will only occur if an economy is vulnerable to it, so that its resources to defend the peg are limited, but they cannot be accused of limiting their focus to expansionary fiscal and monetary policies.

A second aspect of the critique that led to the construction of second-generation models focuses on the mechanical government behaviour exhibited in first-generation models. Jeanne (2000) shows how, if the government was to be willing to thwart speculative attack attempts, it could do so by slightly altering the expansion of its domestic credit so that the shadow exchange rate remains above the peg[11]. Similarly, Pastine (2000) demonstrates

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[10] As Jeanne (2000) notes, this reliance is very strange, be it only because the assumptions usually taken in these models (such as price flexibility) essentially preclude expansionary policy from having an effect other than inflationary, was the exchange rate (along with purchasing power parity) not artificially maintained.
[11] Jeanne's claim appears a little strong. He supports it by deriving a rule under which a government is always able to adjust domestic credit so as to insure that the shadow exchange rate stays above the peg, but to implement it, the government would have to have perfect knowledge of private expectations regarding future values of domestic credit. That governments are able to monitor the private sector closely enough for this to be possible is rather questionable.

that if the government is endowed with the same level of rationality than the investors, it can eliminate the possibility of any predictable crisis. Consequently, mechanical behaviour is not an artefact of the models, but a requirement if they are to work. That is to say, the crisis only occurs because "rationality" is the hallmark of only a subset of actors. This is not really a satisfying solution to the quandary enunciated at the outset regarding the difficulty of generating a crisis with "rational actors", especially in a world where governments and central banks constantly work with and within financial markets.

Proponents of second-generation models tried to address the issue by elevating governments to the same level as speculators and granting them status of "rational actors". They argue that speculative attacks should instead be seen as episodes when governments elect to abandon the peg not because they blindly cornered themselves, but simply because the costs of maintenance are higher than the benefits. This seems like a promising avenue to explore, but as I argue below, it is problematic in its own right.

Interestingly, Pastine (2000) also points to the "irrationality" of governments as a potential rehabilitation of first-generation models taking place under complete certainty. Staying within the confines of traditional microeconomic theory, he justifies this possibility on the grounds that a group of policymakers is likely to exhibit non-transitive preferences if it is not led by a dictator, even if every one of them has transitive preferences. Consequently, any situation where different branches of government may be competing with one another, or where individuals within a ministry act non-cooperatively, could yield "irrational" behaviour on the part of the government and prevent it from averting predictable currency crises. In my opinion, this is an interesting first step in opening up the black box in which processes taking place within governments are usually put. It is hard to see why one would want to limit oneself to the mild statement made by Pastine, however, beyond the

opprobrium that is traditionally associated with any explanation challenging the rationality postulates made by mainstream economics.

Finally, it is also interesting to note that a lot of first-generation models mention that shifts in investors' expectations can have serious consequences, and even lead to crises which may not have occurred otherwise, but that for the most part they display the same shyness than Pastine regarding the factors that may lead to such a shift in expectations. In fact, to the extent that the causes underlying such a shift are discussed, the authors traditionally point to factors such as unexpected movements in fundamentals. Nevertheless, some recent accounts recognise that such a shift could be provoked by a wide array of variables, as is shown by the growing use of the term "sunspots" to designate such variables. If currency crises can be self-fulfilling, however, the fact that current models gloss over the factors which could trigger a change in investors' sentiment is a serious weakness. Indeed, to say that a shift in expectations can cause a crisis, only to leave unspecified the determinants of such a shift, scarce enhances the predictive power of a model.

Part of the problem stems from the "rational" actor formulation itself. If it is recognised that investors may take heed of all sorts of signals when they decide on the course of actions to follow, then researchers should grapple with people's ability to access and treat information, as well as the way they interpret it. A departure from the "rational" optimiser paradigm might contribute to a better understanding of the dynamics leading to a crisis, by analysing explicitly the way in which individuals influence economic conditions while being influenced by them. This is precluded in a "rational" optimiser setting, where the agent is constructed ahistorically, its makeup impervious to its surroundings, surroundings which merely supply him with a more or less complete and reliable set of information.

2.2   Rational Calculators (Second Generation)

The explanation of currency crises relying on inconsistent government policies advanced by first-generation models lost some of its attractiveness in the beginning of the nineties, when the European Monetary System was attacked. In the European case, it could scarce be argued that the countries which chose to devalue did not have the means to defend their currency, as most of the attacked countries had reserves equivalent to close to the totality of their monetary base at the time of the crisis (Obstfeld and Rogoff 1996, p. 566). In an effort to explain the crisis in this new context, mechanical governments were replaced by optimising policymakers who are no longer forced to devalue, but rather decide whether or not to do so by weighing relative costs and benefits. This induces a self-fulfilling component in the models, as the beliefs held by investors have an influence on the optimal course of action for the government. Once again, although the broadness of the framework has allowed for many different specifications, it is possible to illustrate the main insights via a very simple characterisation[12].

2.2.1   Elaboration[13]

The central point of this class of model is that the government should be considered on an equal footing with speculators, i.e. as a rational maximiser. The authorities are therefore lent some sort of objective function that they are trying to maximise. This can be captured by a loss function including a governmental objective, such as stable output or low unemployment, as well as a cost of depreciation, which can be equated to inflation under

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[12] Some of the simplifying assumptions underlying the following description, such as uncovered interest rate parity, will be left unmentioned, because it would not add much to the analysis to lay them down explicitly.
[13] This stark description is inspired mostly by Jeanne (2000).

purchasing power parity assumptions. For example, suppose that the government cares about unemployment, which is inversely related to unexpected inflation through an expectation-augmented Phillips curve. Let's further assume that there is a cost to reneging on the peg, maybe in the form of credibility loss. In this case, the government can abandon the peg in an effort to achieve its unemployment objectives, but only at a cost. In effect, the government will try to minimise the "loss" it incurs by choosing whether or not to devalue depending on the relative costs implied by each options.

The other side of the story, the behaviour of investors, is usually downplayed in second-generation models, since the decision to devalue now lies squarely with the government. In other words, the image of speculators changes from individuals conducting a decisive attack when conditions are ripe to actors whose role is confined to affecting the choices of the government via the expectations they form and the effects these expectations have on fundamentals. Theoretically, this does not appear to have to be the case, as investors could willingly affect these fundamentals and push the government to devalue. In any case, let us assume for present purposes, but without much loss of generality, that there are two options open to the government, namely conserving the peg or devaluing by a fixed amount. Such a devaluation would in turn have an incidence on inflation. The private sector forms expectations regarding the likelihood of devaluation, which has an effect on the realised rate of unemployment, because of its negative dependence on unexpected inflation.

The foregoing account gives rise to three possibilities. Firstly, if unemployment is close enough to the desired level, the cost of devaluation is always higher than the benefits, notwithstanding private expectations. In this case, the government will never devalue, which will be expected by the private sector. A second possibility is that unemployment could be so high (maybe because of an adverse shock to the economy) that private expectations are

again irrelevant to the government's choice. Under these conditions, the government will always devalue, which is once again correctly expected by the private sector. Finally, a situation could arise where there exists multiple equilibria depending on the expectations of the private sector. Unemployment levels could be such that it is preferable for the government to sustain the peg if the private sector expects it to do so, and to abandon it otherwise.

In brief, the model depicts the decision-making process of monetary authorities as a rational optimisation. The option of abandoning the peg can therefore be viewed as a sort of escape clause, which can be employed when economic conditions deteriorate below a certain acceptable level. Multiple equilibria can arise when the influence of private expectations on the economy is sufficient to tip government policy choices one way or the other, so that expectations of currency crises can be self-justifying. Finally, unlike first-generation models, a discrete jump in the exchange rate is usually embedded in second-generation accounts, which is somewhat closer to the experience of many countries that saw the value of their currency experience major drops in the aftermath of crises.

2.2.2 Variants

A common variant to the foregoing description uses a modified version of models of "time-inconsistent" policymaking (Flood and Marion 1998, Obstfeld 1994). Under this specification, the loss function of the government includes a consideration for inflation (once again equated with the exchange rate), a distortion that can be mitigated by unexpected inflation, as well as an unexpected shock. There are two different possible policy regimes: Either the government is committed to the fixed exchange rate rule and generates no inflation, or it acts in a discretionary way and sets the exchange rate *ex post* to minimise its

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loss function. Under discretion, the government is tempted to get out of the peg and try to compensate for the shock and the distortion. Knowing this, the private sector will expect inflation, expectations that will be validated at equilibrium. The usual welfare result then follows, namely that unless there is a very big shock, the government is better off following the rule than using discretionary policy.

At first glance, it would seem that, in a case such as this, following the rule seems preferable to using discretion. Large shocks do occur from time to time, however, so binding one's hands may not always be the best strategy. In fact, it turns out that it is optimal for the government to generally follow the rule, but to diverge once in a while and use an escape clause. Evidently, the escape clause must be costly to use, otherwise the government would always have recourse to it. Moreover, if uncertainty is built in this version of the model, then the decision rule of the government becomes non-linear and there can be different equilibrium value for the shock level that triggers the use of the escape clause, the selection of which depends on private expectations. In other words, there can be several values of the shock for which the loss under discretion is just equal the sum of the loss under the rule and the cost of abandonment, and it will be optimal for the government to validate private expectations in that regard[14].

The evident analogy in second-generation models between monetary policy and the conduct of exchange rate policy, as well as the posited feedbacks between policy stances and expectations, have led some economists to investigate the incidence of credibility in the formation of different equilibria and the determination of their characteristics. It turns out that unlike what could have been expected from a cursory glance at the variants of second-

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[14] Different implications can be derived for different functional forms of this decision rule. For example, it can sometimes be the case that a rise in the cost of abandonment may diminish the value of the lowest equilibrium shock level, making it therefore more likely for a crisis to occur. For more details, see Flood and Marion (1998).

generation models, it does not always pay to take a tough policy stance. For example, there is an inherent trade-off contained in any attempt to use contractionary policies to build a tough reputation. On the one hand, the government does indicate that it is committed to the maintenance of the peg, even at the expense of some other economic objective. However, it may fragilise the economy in the process and make it more vulnerable to a speculative attack. Delegating policymaking to a tough third party may also be sub-optimal, because if speculators do make a move, say to test the waters if they are uncertain of the level of commitment of this third party, then much more grief may be experienced before a devaluation takes place than would have been desired by the government. In short, credibility is important, but should not be sought after at all costs.

Furthermore, the explicit inclusion of an objective function for the government implicitly means that any factors that could enter in it should be included in the analysis. This has brought about various versions of second-generation models, each focusing on different possible objectives. As an example, Jeanne (2000) replaces the expectation-augmented Phillips curve used for the determination of future unemployment by a function that lends a negative impact to interest rate. Because of the hypotheses on the determination of interest rates, multiple equilibria can still arise. In fact, the only important divergence is that foreign monetary policy now participates in the determination of the likelihood of currency crises, through the different hypotheses linking interest rates internationally (e.g. uncovered interest rate parity). Other possible candidates for government objectives include, but are not restricted to, public debt, health of the financial system, and income distribution (Obstfeld 1995, Jeanne 2000). In any case, modifications in the governments' objective functions are likely to change the exact way in which the equilibria are arrived at, as well as the factors determining them, but are unlikely to yield ground breaking insights.

In contrast, recent research conducted on the availability and treatment of information on the part of private agents, prompted by the stress laid by second generation models on a perceived self-fulfilling nature of crises, appears promising. An instance of that literature is provided by Sbracia and Zaghini (2001), who contrast public and private information. They find that under certain conditions, such as perfect computational abilities and a degree of uncertainty in the signal received, purely private signals about the state of the economy could yield only one equilibrium (either attack or no-attack)[15]. This basically occurs because each agent tries to guess what signal the other received from their actions, given what they themselves learned and the fact that signal lie in a known range from one another, and end up all congregating away from middle grounds where multiple equilibria are possible (where the maintenance of the peg depends on private expectations)[16].

Other interesting examples of the research conducted on the effect of the nature and treatment of information by investors include informational cascades and information dispersal. Informational cascades refer to situations where investors act sequentially, and may decide to simply copy what has been done before them rather than heeding their private signals, which can give rise to herd phenomena. By contrast, in some models where information is dispersed amidst private agents, individuals don't reveal their private information until the state of fundamental becomes very bad, and then they rush all at once to exit the currency. This could potentially help account for the suddenness of many crises.

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[15] They derive this result from a paper by Morris and Shin (*AER*, 1998).
[16] Investors only act according to their private signals, however, so the process described is purely deductive and based on the information given by the signal and what is known about its characteristics (variance of the shock, etc.).

2.2.3 Assessment

Second-generation models depict the decision-making process of monetary authorities as a rational optimisation problem. The option of abandoning the peg is part of the policy arsenal at their disposal and may be employed when economic conditions deteriorate below a certain acceptable level. Multiple equilibria can arise when the influence of private expectations on the economy is sufficient to tip government policy choices one way or the other, and thus expectations of currency crises can be self-justifying. So here we have fully rational agents all around, but a crisis may arise nonetheless. Is the dilemma solved? Not quite.

Three things can conspire to precipitate a crisis in this context: Bad economic conditions ex ante, exogenous adverse shocks, and expectations of a crisis. Of these, the shocks are the least interesting in that the device is a deux ex machina. Of course, if the sky falls on people's heads, there will be a crisis... and the sky does fall once in a while – or rather, the ground shudders, as happened in 1999 in Turkey when there was a major earthquake and a short downturn ensued. But this does not explain the majority of cases which were not beset by momentous events or even why economies come to be fragile to such shocks. This sends us back to the nature of the underlying economic conditions... but these are simply taken as given in second-generations models. The model contains no dynamic mechanism which could generate a deterioration of economic conditions, a serious deficiency which I address below when I formulate my own account. What of expectations, then? They suffer from the exact same deficiency.

While it is a strong point of this class of models that it embeds an effect of expectations on underlying economic conditions, the formation of expectations itself is left somewhat indeterminate in the multiple equilibria case. When things are great or dire, agents

correctly forecast the outcome, but they have no bearing on it. When the outcome depends on expectations, however, so that investors get to determine whether there is a crisis or not, the processes underlying this "choice" are mostly absent from the model. Investors will be right once again, but why would they go one way or another, especially if they don't all have the same interests in the matter (depending on the nature of their investment position)? More to the point, if we leave the immediate moments preceding a crisis, did investors (and officials) correctly forecast the process all along, including the fact that their expectations would be determinant at a precise juncture down the road? But then, if this was foreseen, it should conceivably have been possible to avert it – unless the sky suddenly became unstable, which sends us back to exogenous shocks. And of course, as the length of many careers on Wall Street well shows, perfect forecast is not exactly a hallmark of many – the vast majority – of investors.

Research around information in the context of second-generation models stands as an exception and does offer some insight about expectations formations. By providing some plausible mechanisms whereby the treatment of information by private "rational" agents may precipitate a crisis, this strand of research could reconcile "rationality" and crisis. The solution is only apparent, however. Informational cascades are certainly possible, for example, and so is herd behaviour, but the resulting bubble makes little sense if this is the only thing going on. That is to say, asset price inflation will be largely visible pretty rapidly in the process, so either people have to genuinely believe that a new era has been ushered in or that they'll just beat the crowd on the way to the exit. More than informational cascades are needed for the new era hypothesis, while the optimism contained in the other is scarcely rational – most people will be burned in the end. Similarly, information dispersal is somewhat hard to swallow. While it could be envisaged for a subset of the economy, it

seems unlikely for a central bank and financial corporations monitoring markets at large, or even big non-financial corporations. Consequently, while this literature constitutes a good start, it hardly stands on its own as an explanation of crisis-generating expectations formation mechanisms.

The indeterminacy in what gets agents moving is also problematic in that it makes it very hard to pinpoint exactly what leads to crises and what does not. At a very general level, the most first- and second-generation models can really claim to do is to say that economic policies inconsistent with the peg can lead to crises, that the mere belief of an impending crisis can cause one, and that governments can chose to renege on a specific peg while they try to reach certain objectives. The current literature then lists several factors that should be considered while analysing those three features, a list that is still expanding. This in turn leads economists to an empiricist approach whereby they try to empirically discriminate between those factors. Unfortunately, empirical investigations have so far done little to relieve the theory of its indeterminacy.

Obstfeld (1995) cites a study by Eichengreen, Rose, and Wysplosz, which finds that attack episodes "vary widely among themselves in displaying significant pre-crisis changes in such variables as competitiveness, fiscal deficits and unemployment" (p.14)[17]. He interprets this as meaning that that there must be some self-fulfilling elements at work, but it could also be thought to mean that a lot of different variables can combine to make an economy ripe for a crisis. That said, Obstfeld also cite several other study that seem to find some measure of self-fulfilling components in crises preceding the mid-1990s, especially European ones. Flood and Marion (1998) cite several studies that support the view that traditional fundamentals (deficits, etc.) appear to have played a role in the pre-1990 crises. However,

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[17] These results appear common when industrial countries are taken as sample (Flood and Marion 1998).

when the coefficients estimated on these are used to fit equation and estimate the probability

of crisis over the whole period, it is found that although this probability rises around actual

crisis episodes, it never gets above 20-30 (Klein and Marion 1997). In other words,

traditional fundamentals play a role, but they cannot be said to be the whole story. Finally it

should be noted that all the foregoing models rely on very restrictive assumptions, such as

purchasing power parity or uncovered interest rate parity. Since exchange rate models using

those assumptions traditionally don't do very well in the data, the empirical results generated

when they are tested should probably be taken with a grain of salt. The inconclusive nature

of the available empirical evidence once again point to a need for a better understanding and

specification of the underlying processes at work.

2.3   Unruly Youngsters (Third Generation)

Despite the widening of the possible factors underlying a crisis, the Asian meltdown

still came as a total surprise. Just like the European crisis in the early 1990s, this new wave of

crisis did not seem to fit any of the existing frameworks. Fundamentals were quite healthy in

the affected countries at the time of the crises; reserves were not declining (if anything, they

were trending up) and monetary and fiscal policies were not overly expansionary (Frenkel

2000). First-generation models thus appeared useless in explaining the crisis. Moreover, if

one considers traditional government objectives, it is hard to find any trade-off that could

have incited the government to abandon the peg in favour of another policy objective,

which discounts the pertinence of second-generation models (Krugman 1999, Frenkel 2000,

Radelet and Sachs 2000). In short, as Krugman (1999) puts it, the affected Asian

governments had the resources to defend their currencies and it is unclear they faced much

of a trade-off in terms of economic well-being and defence of the peg, especially when one considers how the currency crises wreaked havoc in their economies when they gave in.

This novelty left the theory of currency crisis in a state of disarray. Some argued that existing accounts were sufficiently pliable to be applied to the Asian crisis (e.g. Jeanne 2000). At the same time, others called for a new class of model without giving much precision as to the form it should take (e.g. Krugman 1998, 2000). The end result was the bloom of an eclectic collection of models without a specific focus, save perhaps for the fact that they shifted the attention from the currency market to other parts of the economy whose [dis]functioning could lead to a financial crisis. The potential [in]adequacy of first- and second-generation models notwithstanding, many accounts in this new wave clearly have a different flavour than their predecessors, which warrants a separate exposition. However, given their disparate natures, I cannot organise this description around a canonical form. I will instead go through a few of the most interesting incarnations within this new class of models, coalesced around four different viewpoints on the causes underlying the crisis in Asia[18].

2.3.1 Distinguished Few

A first explanation of the Asian crisis contends that it was the result of moral-hazard problems created by the cronyism pervading the capitalist economies in Asia (Krugman 1998, 1999). In essence, the argument relies on the claim that the soundness of fundamentals were only apparent and that in effect there was a major over-borrowing problem originating from implicit governmental guarantees given to the banking sector. More precisely, the fact that governments appeared ready to bail out financial institutions

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[18] For an illustration of the diversity of existing (and potential) third-generation models, see Calvo (2000) and Fourçans and Franck (2003).

that went under could have led them to lend money to risky projects with a relatively low expected return. Given governmental guarantees, this implied the presence of a large hidden government deficit, which could have become unsustainable after a while[19]. The rest of the explanation can then be said to more or less follow the logic of a first-generation model. The main culprit, in this case, is therefore a faulty institutional setting, which incites market participants to adopt a behaviour that eventually renders the maintenance of the peg unsustainable.

A second bank-centred view is that the Asian crises could have been caused by a self-fulfilling loss of confidence, which would have constrained financial intermediaries to liquidate their investment prematurely (Krugman 1998, Chang and Velasco 1998a, b, 1999, 2000). The basic idea is that the financial system in Asia could have been vulnerable to bank runs because a large portion of the external debt had a short maturity while a lot of the funds were invested in long-run projects. This idea was formally explored extensively by Chang and Velasco, who base themselves analytically on a classic Diamond-Dybvig bank run model. Stated simply, investors in this model are faced with a choice between high-yield long-term investments and low-yield investments with a shorter maturity, while being uncertain as to when they want the investment to mature. It can then be optimal for financial intermediaries to pool the resources of investors and rely on the law of large numbers to mainly concentrate on long-term projects. The downside is that these

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[19] A variant of this argument is offered by Frenkel (2000), who argues that the guarantees implicitly offered by the Asian government included the liabilities incurred in foreign currency. Consequently, as capital inflows boomed, more and more reserves became implicitly committed to such a bail out, should one become necessary. The corollary is that this left the central bank with a decreasing amount of foreign exchange available to defend the peg. Frenkel then contends that investors eventually realised this depletion of available reserves and pulled their money out. Formally, a first-generation mechanism is at work again, as the crisis occurs when the reserves net of "bail-out" commitment fall to a low enough level for an attack to be interesting to conduct. This model is rather interesting, insofar as it points to the investment boom as a factor that could render an economy more vulnerable to crises, depending on the institutional setting.

intermediaries are then vulnerable to bank runs, which can be created from self-justifying panics.

Chang and Velasco (1998a, b, 1999, 2000) elaborate on this skeletal formulation and point out that a high level of short-run capital inflow can actually fragilise the financial system of an economy by exacerbating the maturity mismatch. Furthermore, they state that liberalisation policies, such as the decrease of required reserves and the increase in inter-bank competition, could also make runs more likely. A decrease in required reserves is likely to make bank assets less liquid, while an increase in inter-bank competition leaves banks less margin of manoeuvre. Finally, Chang and Velasco also explore different institutional settings and conclude that an economy is especially subject to the possibility of bank runs and currency crises under a fixed exchange rate system. The intuition is that under this system, the liabilities of the banking system are implicitly obligations in foreign currency, so that the amount of liquid international assets is lower than the level of international liabilities. By contrast, they claim that a currency board leaves open the possibility of bank runs, but not currency crises, while a flexible exchange rate system gets rid of both. They justify the latter by saying that under a flexible exchange rate regime, the central bank is not compelled to sell its reserves, which should ward off herd behaviour as long as the currency is effectively left to float.

Krugman (1999) offers a third alternative to these accounts by focusing on the interrelations between the balance sheets of investors and the effect of capital flows in affecting the real exchange rate. Suppose that the amount that can be borrowed by domestic entrepreneurs depends on their wealth, but that this wealth itself depends on the total amount of borrowing in the economy via the impact of capital flows on the terms of trade. This yields a situation where there exist multiple equilibria. If the confidence level of lenders

is relatively high, they will lend more readily, which will appreciate the real exchange rate, give local borrower a higher ability to borrow, and translate into a high investment equilibrium. Conversely, if the confidence level is low, they will refrain from providing funds, which will push domestic lenders towards bankruptcy and validate the opinion of the lenders. A country can therefore go suddenly from a booming situation to a crisis if there is a sudden shift in lender confidence. Two of the factors mentioned by Krugman as helping to put a country in such a position are a high leverage (low value of collateral), as well as a large amount of foreign borrowing, which is usually considered to have been the situation prevailing in South-East Asia at the time of the crisis.

A similar account is given by Aghion, Bacchetta, and Banerjee (2001), who also focus on firm balance sheets but add nominal price rigidities in the picture. In short, they describe a vicious circle whereby an exogenous shock induces an initial depreciation because of nominal rigidities, which then increase the foreign debt repayment burden on domestic firms and concomitantly reduce their profits. As the authors assume this is a credit-constrained economy, this reduces the borrowing capacity of domestic firms and thus investment and output, and finally the demand for domestic currency which leads to a further depreciation. The effects of such a vicious circle could be especially severe if there is a high degree of inter-enterprise credit in the economy (Calvo 2000). In that case, hardship experienced in a few sectors which are particularly exposed to foreign market risks could spread to the rest of the economy and engender a major output crunch. Of course, this could be further exacerbated by the inability of the banking sector to provide much-needed funds, a possibility underlined in the bank run models of Chang and Velasco.

Finally, Calvo (2000) observes that large transitory capital inflows may be inherently dangerous. Such inflows will have a strong and noticeable effect on relative prices, such as

the real exchange rate, as well as bank credit. Since these inflows are transitory or at least are usually viewed as such, investors will expect the economy to return to the conditions prevailing *ex ante*, the timing and manner remaining the only unknowns. Furthermore, if the participants are aware of the systemic fragilities magnified by the size of the inflow, they will attach some probability to a sudden fallout and will act accordingly. By focusing economic agents on the possibility of a crisis, large and sudden inflows of capital could therefore poise the economy for a financial crisis.

In sum, the first three alternatives, implicit government guarantees, maturity mismatch, and private balance sheets, share the feature that the focus is moved away from the currency market to other components of the economy. The first model can still be viewed as an extension of first-generation accounts, as it simply elaborates on the reasons explaining why a country might see the resources it can commit to the defence of the peg be depleted. The other two appear distinct from both preceding generations, however, as the government is all but absent from the story and the crises is brought about by the deterioration of economic conditions not directly related to the ability of the government to preserve the exchange rate regime. Along with Calvo's stress on the signal sent by a sudden important inflow of capital, they clearly pave the way for a broader understanding of the way in which the processes at work on international capital markets and their interplay with domestic economies can lead to a financial crisis.

2.3.2 Strengths and Weaknesses

One of the main analytical insights of third-generation models seems to be the fact that they explicitly consider institutions as being determinant for the vulnerability of a country to the occurrence of currency crises. The fact that the discussion has now been

broadened to include institutional arrangements, such as government guarantees or financial regulation, is certainly welcome, even if the depiction of these institutions still tends to remain quite stark. Moreover, the way they link the international financial markets to the rest of the economy appears especially useful in that it allows the theory of currency crises to move beyond mechanistic simpletons and rational calculators prone to time inconsistency. In particular, the way they highlight the role of private debt, be it through the banking system or directly via the balance sheet of the economy, is very potent. Such a process is in fact at the centre of my own formulation. Finally, the [mostly implicit] recognition that financial crises may simply result from international financial market processes themselves, may be contained in them, as it were, is very precious. It opens the way for endogenous characterisations of currency crises, which would no longer have to rely on exogenous shocks to act as *deus ex machina* in order to disrupt otherwise calm and predictable equilibria. Despite these real advances, however, third-generation models are far from ideal.

One criticism that is often levied against them is that while there might be some kernel of truth in each of them, none seems to entirely capture what happened in Asia. The moral hazard argument can be countered by pointing to the fact that many of the investment made during the boom could not be considered as having been protected by an implicit guarantee on the part of the government (Krugman 1999). Moreover, many of the non-performing loans that have been used as evidence that the banking system was not doing a proper job can be said to be a result of the crises, rather than a cause, as they might have done just fine if no meltdown had occurred. Furthermore, it seems hard to really find evidence of the premature liquidations predicted by the bank run models. Once again, it appears that many companies went bankrupt because of the general recessions that followed the crisis, not so much because of maturity mismatch (Krugman 1999). The third alternative

also contains some disquieting elements. For one thing, it once again begs the question of what caused the change in investor sentiment. Moreover, it does not lend any active role to monetary authorities, who, just like in the European case, could have committed much more resources to the defence of the peg then they actually did[20] (for statistics on reserves, see Frenkel 2000). In fact, Krugman's framework looks more like a model of an industrial crisis, where investment is based on borrowing from abroad, than a model of currency crisis.

At some level, however, these critiques are beside the point. The fact that none of them manages to properly encompass the entirety of the Asian experience, when this is precisely their objective, may be a shortfall, but this could be asking too much of any single model. Several of them do manage to bring interesting insights to the fore, which in turn allows for the formation of a better overall picture not only of the Asian crisis, but also of the processes surrounding currency crises in general. More to the point, however, these models encounter the same limitation than their forefathers regarding investor behaviour. Two generations of models had laid down a vast array of potential crises determinants, ranging from the narrow set of fundamentals at the center of the first generation to anything that influences investor beliefs or the desire of the authorities to have recourse to an escape clause. Third generation models then gave some indications regarding possible channels of transmission, but also contributed yet another group of factors, namely concomitant market processes and prevailing institutional environments. Mostly missing from these stories is the attempt to explicitly characterise economic agents beyond the rational agent fable; the way they treat information, form their beliefs, relate to each other and choose specific courses of action. In my view, such a characterisation would not only bring even more realism in the

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[20] Unless one uses Frenkel's argument that the reserves available for a defence of the peg were much lower than the gross reserves. But then, Frenkel's theory posits that the other reserves should have been used in the process to repay foreign creditors, also leading to a large outflow.

model, but it could also help in discriminating between the different scenarios that have been laid out so far.

Another shortcoming of these three generations of models is that they are often focused on «the crisis at hand». In other words, although their authors elaborate points that are quite general, the models are usually designed to explain a [recent] given subset of crises rather than the general phenomena. Consequently, they run the risk of describing the bark of a three very well while failing to give a proper overview of the forest. Moreover, by strictly restricting the analysis to economic processes for the most part, these models often miss critical components of the concomitant regulatory frameworks and political institutions. This is a serious deficiency, as it precludes those models from properly analysing phenomena such as capital flight and corruption, or simply the pressures government officials face when they design their policies. In order to gain some insights on those two questions, therefore, one must step outside the family house.

2.4   Beyond the Family Portrait - Broadening the Horizon

Financial markets do not operate in vacuum. They are shaped in important ways by regulatory frameworks, which are both constraining and facilitating in different ways, and are populated by agents whose objectives often transcends them, notably central banks and institutions such as the World Bank and the IMF. Despite their importance, which is certainly recognised by all economists working in the field of currency crises, these institutional realities are often downplayed in formal analyses through major simplifying assumptions, if not excluded from them outright[21]. This is a serious limitation of these models, the gains in terms of the effectiveness of the exposition of many pertinent

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[21] The analyses of Chang and Velasco (1998a, b, 1999, 2000) are notable exceptions.

arguments such simplifications can allow notwithstanding. Consequently, it appears important to complement the models described above by perspectives which give more weight to institutional arrangements.

In their account of the Asian Crisis, Wade and Veneroso (1998)[22] lay stress on the different institutional requirements of the development strategy followed by East Asian countries. Based on high levels of savings channelled to firms via the banking system in the form of loans, and thus highly leveraged firms, its functioning requires close coordination between domestic banks, firms and the government. Such a system being inherently fragile to adverse shocks, there is also a need for broad and stringent regulations on banking activities to insure prudential behaviour. In this context, the liberalisation of foreign exchange transactions[23], which occurred in the early 1990s, under the auspices and pressure of the IMF, OECD and the government of some industrialised countries, may have left Asian firms dangerously exposed to the vagaries of international capital markets. The further liberalisation reforms imposed by the IMF in exchange for bailout funds, once the crisis was in full bloom, may have exacerbated the problem[24].

At the same time this liberalisation process was taking place, large amounts of financial capital were prowling around in search for investment opportunities (Wade 1998). Wade attributes this high level of liquidity to the expansionary monetary policies of pursued by the European Union and Japan and the concomitant low interest rates in these areas as well as a depressed aggregate demand in Japan following the burst of the real estate bubble in 1990. As the Asian economies opened, capital poured in, attracted by their perceived soundness and their strong growth records. Furthermore, there was a general desire on the

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[22] See also Wade (1998).
[23] Also of importance is the fact that this liberalisation occurred at a pace which rendered difficult a replacement of the restrictions by supervisory institutions.
[24] See also Radelet and Sachs (2000) for an assessment of the IMF response to the crisis(es).

part of Japanese firms to have a base in a US dollar zone of influence following the Plaza accord of 1985, which had heralded a rise in the yen against the dollar. This «capital push» into Asia rapidly generated a deep structure of foreign debts which further fragilised these economies.

Arrighi (1994, 2003) and Arrighi and Silver (1999) go beyond this circumstantial explanation of the presence of large amounts of liquidity in international financial systems and argue that this is a sign that the accumulation of capital has outstripped profitable investment opportunities in the current capitalist system. As a result, a growing proportion of the incoming cash flow is kept in a liquid form, which can then be mobilised in speculation, borrowing and lending. As this financial expansion occurs and capital is delocalised, countries compete with one another to attract this capital. This implies a system-wide redistribution of resources towards the agencies that control mobile capital, which inflates and sustain the profitability of financial transactions. In the process, these transactions become largely divorced from commodity trade and production.

Kindleberger (2000) has a more linear historical interpretation. He states that money supply[25] has been constantly expanded throughout history, despite the efforts of monetary authorities to rein it in, and has also been used ever more efficiently in periods of boom to finance expansion and speculation. More specifically, he regards the recent international financial expansion as a result of factors such as a decrease in the ignorance of investors, which may have changed their opinion regarding foreign exchange investments, the downfall of the Bretton Woods system, which opened new speculation opportunities, and the advent of the petro-dollars. In brief, whether we adopt a more contingent viewpoint or a more

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[25] By money supply, Kindleberger means the sum of financial resources that can be commanded in an economy.

historical interpretation, there has been a widely documented financial expansion in the last decades.

Such a mass of financial capital could be fairly destabilising for prospective markets in developing countries not only by virtue of its sheer size, but also because there appears to be a moral hazard problem involved. In the case of sovereign debt, default has historically been very rare and even when it happened, settlements are usually very generous (Obstfeld and Rogoff 1996)[26]. Consequently, lenders are seldom very scrupulous regarding the ways in which the money is to be used. Henry (2003) eloquently documents how Third World debt accumulated through loans made for dubious, or even non-existent, projects, a large part of which left was simply stolen and laundered through the same entities that made the loans in the first place. However, there also appears to be implicit government guarantees for a portion of the private loans made in less-developed countries. This is made particularly evident in IMF bailout programs, which always specify [often complete] debt repayment as one of the main objectives, allegedly to restore creditworthiness and investor confidence. All in all, therefore, it is possible that original risk assessments are biased downward for loans made to less-developed countries. That said, the implicit presence of a lender of last resort makes it hard to understand why panics would occur at all, though they could be due to its incomplete coverage.

In sum, a major financial expansion appears to have taken place in the last decades, such that large quantities of liquid capital scour the world in search of investment opportunities, which may be related to actual production and trade patterns only remotely, as Arrighi (1994, 2003) and Arrighi and Silver (1996) argue. At the same time, there has been

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[26] This has changed somewhat in recent years, with partial default in countries such as Argentina and debt cancellations in some highly indebted poor countries. Nevertheless, this does not seem to have elicited much more careful scrutiny regarding the use of funds, as the hardship following the current financial crisis shows.

a general liberalisation of foreign exchange transactions in most countries, partly under the pressures of the governments of G-7 countries and international institutions such as the IMF (Wade and Veneroso 1998, Wade 1998), so the movement of this capital has been rendered more fluid. Those elements form a potentially explosive cocktail and give a broader context in which financial crises could occur, which well complements the family of models described above that were mainly concerned by proximate crisis determinants.

The presence of such large amounts of financial capital ready to be invested came to play in this latest crisis, which erupted at the end of the 2000s. Credit was pushed to borrowers that were already over-extended and, in hindsight, unlikely to be able to service their debt in the medium run. While the particular nature of some of the financial assets and instruments involved (CDOs, etc.) differed from previous crises, the general story followed a relatively familiar pattern of growing fragility during a boom, over-extension, and then debacle when things turn sour. This is perhaps why no new major theoretical formulation came out of the crisis. Some older accounts regained some prominence, such as the analysis of Hyman Minsky, about which more will be said in the next chapter, but no ground-breaking model has appeared. Rather, the economics profession has largely seemed a bit dazed by its failure to predict the outcome of the financial deregulation so many had advocated in previous years.

2.5   What to Make of This?

The modern currency crisis literature brings forth a few insights. From first-generation models, we see that a crisis can erupt if a government runs policies that are not consistent with the maintenance of the peg because of the drain on resources they may entail. To this important point, they add that the presence of uncertainty in the system

generates a scope for self-fulfilling crises. Second-generation models lay stress on this latter point, showing how the beliefs of investors can be determinant in a government's choice to maintain or abandon a fixed exchange rate system. In the process, they make the discarding of an exchange rate regime the outcome of a cost-benefit analysis on the part of the government rather than the outcome of a mechanical decrease in the resources available to defend it. In short, the first two generations demonstrate that government policies can render a given exchange rate arrangement unsustainable, although governments can also elect to modify a sustainable regime if it conflicts with other social objectives, and that investors can themselves bring the downfall of a system if they believe a crisis is brewing.

Third-generation models emphasise linkages between financial markets and the rest of the economy, especially in relation to the importance of private debts, as well as the idea that large and sudden inflows may be a mixed blessing. The dangers of maturity mismatch and the systemic fragility brought about by large amount of foreign borrowing and high leverage appear very present in a world of massive and rapid capital flows. Of course, the mention of the importance of institutions and the regulatory environments they imply is also an interesting general point, but I think there may be more to be gained on this topic from accounts located within the tradition of political economy, such as Wade (1998) and Wade and Veneroso (1998).

These important points aside, though, none of these models convincingly addresses the issue of investor rationality and the presence of crises. Playing with the nature of the information available, such as in information cascades, does open up some possibilities, but these models cannot account for many aspects of the phenomena, notably the length of the build-up before financial crises. Moreover, the restrictive hypotheses regarding information are not always plausible – once again especially within a longer time frame – and they miss

much of what seems to be happening: Investors don't have perfect information, sure, but they also don't seem to treat the information they have in a "rational" way. It is therefore important to move beyond the straightjacket of "rationality" and delve into what actually goes on in the head of economic agent, which is the subject of the next chapter. In the process, I also explore alternative models of financial crises in search of a structure that would be amenable to agents not endowed with the usual "rationality" postulates.

CHAPTER 3

ALTERNATIVE THEORETICAL TRADITIONS

The discussion in chapter 2 underlines the inadequacy of the treatment of individual behaviour and expectations formation in currently existing international financial crisis models. Even the second generation, which made great strides in the acknowledgement of the importance of investors' expectations, leaves them as rational optimisers, omniscient up to an informational asymmetry. This formulation is evidently completely unrealistic, but this could be tolerable if the exercise was a useful heuristic device. Once investor sentiment is put at the center of the analysis, however, it is important to abandon the aestheticism of the rationality postulates to study actual human behaviour, relegating the optimising figure to a benchmark role, at most. The virtual absence of any such exercise in modern currency crisis literature confines it to a position of agnosticism regarding crisis determinants as soon as a self-fulfilling component is involved: Situations in which a crisis can occur are delineated, but factors underlying switches in expectations are left unspecified. This is a serious limitation.

At the same time, moving away from the rational optimiser paradigm may seem like a daunting task. For all its downsides, this formulation has the advantage of being comfortable for economists; having been thoroughly explored in the last few decades, its functioning is well known to most of them. Moreover, it is so established that any departure from the canonical model is regarded with suspicion, leaving the proponent of any deviation with the burden of the proof. Such departures naturally beg the question of instrumentality and boundaries. In other words, are the changes only made to accommodate the theoretical viewpoint of its proponent? And perhaps more importantly, where should the reform stop?

To the former, it can be answered that since the rational optimiser is itself a theoretical construct, one would be hard-pressed to view it as more objective. In fact, the nature of the proper statistical model to assess given economic situations is itself often under dispute; for a theoretician to assume that the rationality of the agents populating his model implies that they should follow his hypotheses and views it as right is thus highly subjective. The second objection is more serious. Ideally, one would want to get a formulation of human agents which is as realistic as possible while remaining tractable, with the understanding that the complexity of human thought processes precludes any attempt to chart investment behaviour in its entirety.

With this in mind, it seems we need both a redefinition of the way actors think and behave, as well as an overall structure stressing the linkages between the financial and non-financial sector in which those actors would then evolve. Starting with the actors in this chapter, a first question to ask is that of the amount of information available to them and the way they process it as they strive to understand the current state of affairs and forecast the future.

3.1   A Closer Look at Homo Œconomicus

Homo Œconomicus, the incarnation of Social sciences' Rational Man in economic theory, is in truth quite a bizarre creature. Equipped with astounding computing abilities, it spends his time weighing different opportunities in an effort to maximise its utility, using its vast knowledge of its environment in the process. To this end, Homo œconomicus uses all available information to form beliefs regarding future states of affairs following different events or courses of actions, updating those beliefs in a Bayesian manner as new information comes its way. Falling short of omniscience, it relies on complete subjective probability

distributions to assess the likelihood of these different states of affairs[27]. It then follow a stable set of preferences, the formation of which is the only place where Homo œconomicus lets any emotion or feeling transpire, to determine which alternative courses of action gives it the most satisfaction.

Several features of Homo œconomicus set it apart from human beings. Its computing abilities far outstretch that of ordinary humans, and so does its self-control in decision-making situations. Beyond the tautological standpoint that whatever action taken by an individual maximises his utility at that point in time, it is hard to believe that people solve intricate optimisation problems when they take decisions. Rather, actions appear to be motivated by customs, habits, and rules of thumb, not to speak of impulses and emotional responses.

The way Homo œconomicus deals with uncertainty is also problematic (Davidson 1991). The fact that Homo œconomicus is able to form complete subjective probability distributions over future events implies that it essentially faces a gamble, a lottery with different levels of risk, rather than actual uncertainty about the future. That is to say, this representation implies that there exists an objective probability distribution that is in principle knowable. This seems to be quite a heroic assumption to make of the reality economic agents face, given the complexity of the economy and the fact that outcomes depend on each individual decisions taken following the formation of expectations.

Briefly put, three difficulties must be addressed: The amount of information available to economic agents, their ability to treat that information, and the actual way in which people make decisions.

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[27] See Davidson (1991) for a discussion of the use of probability distribution in Neo-Classical or Neo-Keynesian economic theory.

3.1.1 Information

Keynes (1937, 1964) provides an interesting alternative regarding the amount of

information available to economic actors. Speaking about possible events over the longer

term, he notes that «about these matters there is no scientific basis on which to form any

calculable probability whatever. We simply do not know» (Keynes 1937, p. 214).[28] As Crotty

(1994) puts it,

> The economic outcomes we observe over time, he [Keynes] argued, are generated
> by an ever-changing system of agents, agent preferences, expectations, and
> economic, political, and social institutions, a system of «originative» choice in
> which future states of the world are in part created by the current agent choice
> process itself. «What is imagined for a coming period must, in an ultimate sense,
> help to shape what will, ex *post*, emerge as the ultimate facts of that period»
> (Shackle 1972, p. 440). Thus, each observation is drawn from a unique generating
> mechanism whose structure depends on current and future agent choice as well as
> the future pattern of institutional change, both of which are inherently
> unpredictable. (p. 6)[29]

Agents are thus facing a future that is fundamentally uncertain which prevents them

from relying on objective or subjective probability orderings to assess the likelihood of

different future states of affairs. That is to say, the probabilities of future states don't add up

to one, so other rules to guide actions have to be adopted. Assuming that agents are aware

of their predicament, they would therefore not even attempt to forecast the future in the

same way as Homo œconomicus.

Following his description of fundamental uncertainty, Keynes reasoned that

economic agents rely disproportionately on such things as past experience, the current state

of affairs, and the average opinion of the matter (Keynes 1937, 1964). More generally, he

thought of a process whereby economic agents formulate a best guess of what the future

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[28] By «these matters», Keynes did not mean events that are actually probabilistic for all practical purposes, such
as the game of roulette, and he was mainly concerned about long-term expectations, such as that which are
pertinent to assess the prospective yield of investment projects.
[29] See also Davidson (1991) for an analysis of the different implications of fundamental uncertainty versus
subjective or objective probability systems.

might be and then assess the confidence with which they hold that view, so that the state of confidence is a central component of their evaluation of future conditions, notably the prospective yields of different investment projects.[30] Positive expectations could then still lead to inaction or prudence if these expectations are not held with much confidence, for example.

This description offers a useful basis from which to build a general understanding of decision-making behaviour. While I refine it below, I think that this element of confidence – and the way the formation beliefs about the future involve two distinct steps – should definitely be retained.

3.1.2 Cognitive Abilities

Reflecting on the computing abilities of Homo œconomicus, Herbert Simon (1955, 1956, 1972) observes that they are not only quite astounding, but also somewhat superfluous for ordinary humans. In other words, given the environment in which human beings have and do evolve, they can easily survive with much simpler behavioural rules. In fact, as Mullainathan and Thaler (2000) note, it is even unclear that evolutionary pressures would favour Homo œconomicus to the detriment of other types of individuals. They show how evolutionary arguments can actually be marshalled to explain just as well the weeding out of optimising behaviour or the disappearance of «irrational» behaviour. In the context of modern market economies, evolutionary pressures are also limited by the fact that

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[30] Keynes also mentions at some length that in the absence of any available valid scientific calculation, the long-term expectations of economic agents are heavily influenced by their state of mind, such as their level of optimism or their "animal spirit". This consideration can, however, be subsumed under the previous one, for what is an optimistic forecast if not a favourable evaluation of a prospect made with a high degree of confidence?

opportunities for arbitrage[31] are rare and very limited when they exist, and that although optimising behaviour can sometimes yield better results, simple behavioural rules can usually give sufficient and satisfactory ones. Finally, learning processes are both very slow and costly, so that the limited time and resources imparted to humans often prevents them from reaching optimal results.

In view of the superfluous character of optimising behaviour, Simon proceeds to propose a bounded rationality paradigm to replace it, whereby individuals try to attain given levels of satisfaction rather than maximise their utility. Instead of analysing all possible options and selecting the best one, individuals search amongst the options until they find one that allows them to attain a preset level of aspiration, a behaviour he calls 'satisficing'[32]. This, he deems, is not only more in line with human computational abilities, but it also concords with actual human behaviour to a greater extent. He thus strikes down a first characteristic of Homo œconomicus, but in so doing, he opens up another set of questions: If humans don't analyse options comprehensively to find the optimal one, how do they go about discriminating between alternatives and conducting their searches? This leads us to the third issue at hand: The way in which people actually formulate their beliefs and make decisions.

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[31] The arbitrage argument holds that if some economic agents diverge from «rational» behaviour, there will be money to be made by acting «rationally» and confirming to the «real» economic model for a given situation. For example, if irrational investors drive the price of an asset above its «real» or fundamental value, this creates an arbitrage opportunity for other investors who can therefore speculate against the price rise, since it is bound to come down to its actual value at some point. This point of view does not withstand scrutiny, even in financial markets which are most amenable to arbitrage behaviour, an issue which is analysed in more details below.

[32] Of course, the problem could be recast within an optimisation procedure, which would explicitly introduce a rule for the optimal amount of search. However, as Simon (1972) notes, this would not only require additional assumptions and information, which cast doubts about its practical usefulness for an individual, but would also imply a very different emphasis.

3.1.3 Decision-Making Behaviour

When human behaviour in situations of choice or risk[33] is studied, the picture that emerges is quite different from Homo œconomicus. Rather than making use of complex optimisation techniques, even implicitly, human beings appear to develop a whole set of habits and principles to process information in order to solve problems or formulate judgements, hereafter referred to as heuristics. Research on these heuristics is quite diverse, but a good idea of the results it has generated can be gathered from two volumes edited by Daniel Kahneman, Amos Tversky and Paul Slovic (1982) and Daniel Kahneman and Amos Tversky (2000)[34]. Of the numerous heuristics described throughout these volumes, those which seem relevant for the study of financial markets can be grouped in seven categories.

There seems to be a tendency for individuals to assess the probability that a given event is an instance of a general phenomenon by the degree to which this instance is representative of (or similar to) the general phenomenon. This subjective probability depends on whether the sample is similar to the parent and reflects the salient features of the process by which it is generated. For example, if a coin is tossed a few times, an outcome that is irregular and has close to half of each head and tail is more likely to be seen as having been generated by chance than a regular outcome with a disproportionate amount of heads or tails. The recourse to *representativeness* constitutes a first class of heuristics. Amongst other things, it leads to a neglect of prior probability and sample size in favour of proximity to a stereotype, as well as a disregard for phenomena of regression to the mean – a few good outcomes in a row tend to be extrapolated – unless the stereotype is that it should regress, like pure chance events which are conceived as such. In financial markets, *representativeness*

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[33] The psychological literature reviewed below relies mostly on a probabilistic vision of uncertainty for its studies. Fundamental uncertainty is considered later.

[34] See also Fromlet (2001) and Shefrin (2000) for practically-oriented reviews of some of these heuristics, and Barberis and Thaler (2002) and Shiller (1998) for reviews from a theoretical standpoint.

could lead to an extrapolation of upward or downward trends, thus lengthening upswings and downturns. It could also lead to a rapid switch in expectations if a few concentrated outcomes deemed representative turn out to differ from the trend. These behavioural traits are reinforced by a second class of heuristics, *availability.*

In addition to *representativeness,* subjective probability assessments also seem to depend on the ease with which different possibilities are brought to mind, their *availability.* The *availability* of past events that may be used to elaborate the subjective probability assessment is in turn influenced by the salience of these events, which depends on their proximity (spatially, chronologically, emotionally, or otherwise) and the strength of the stimuli they generated. Traumatic events, for instance, are more easily remembered and given undue considerations, and more weight is often given to first-hand experience. The *availability* heuristics also affect the way plausible future scenarios are constructed. The construction of different scenarios is itself a heuristics whose aim is to help determine the probability of a given event by an assessment of the propensity of a system to generate this event. In this way, the probability of an outcome may be assessed by the relative ease of constructing a plausible scenario starting from realistic values. This could induce an extrapolative tendency for agent expectations, as it may be hard to build negative scenarios in good times and vice versa in bad times, a tendency that could be reinforced if the economic trends continue for a while. At the same time, the fact that salient events are given a higher probabilistic weight implies that spectacular events, such as major bankruptcies or public scandals, could generate switches in expectations.

A third class of heuristics revolves around *overconfidence* (and underconfidence). Confidence intervals are usually too tight in probabilistic environments, which implies a discount on the probability of extreme outcomes. It could also imply a phenomenon of

anchoring, whereby agents start from a given probabilistic value and insufficiently adjust their guess. In addition, individuals tend not to be able to correctly evaluate their probability of guessing right, being overconfident when they are reasonably certain, i.e. when the subjective probability is high, and underconfident when there is a low probability of success, with a lack of accuracy in mid-range. Interestingly, the contrary seems true when individuals evaluate the difficulty of a task, being underconfident for easy ones and overconfident for hard ones. Another interesting trait is that the confidence exhibited in the assessment of a situation appears to increase with the volume of information available, as agents believe that they get a better grasp of a situation in this way. Finally, hindsight bias also seems to modulate people's confidence in their predictive capacities. *Overconfidence* appears especially important both in keeping individuals from properly evaluating the variance of potential outcomes and in insuring that they act according to their guess in a world of fundamental uncertainty. More precisely, *overconfidence* could be a factor which would reinforce given economic trends, pushing people forward when times are good and inducing more morosity when times are bad, except if their confidence is really low, in which case they might become overly cautious.

Furthermore, it seems that individuals have a hard time attributing *causality*, as they are not able to properly discern when the agent is responsible for an outcome and when other factors are. In particular, knowledge of the uniqueness of an actor's response to a given situation does not prompt an inference that the actor is the chief causal agent and vice versa when the response is widely shared. This sometimes translates, amongst other things, to an illusion of control whereby the chance component of an outcome can be attributed to skill. People will then modify their behaviour in chance situations according to the degree of control they think they have. In the context of financial markets, this attitude could render

success intoxicating, leading to euphoric expectations and increasingly risky behaviour during an upswing, while failure, even if it is moderate, could rapidly take confidence away.

Fifth, individuals appear to have major problems in properly *identifying covariations*, whether or not they hold priors to that effect. When presented with data on which they have no priors, people often can't discern a covariation when the objective correlation is less than 50% and they consistently underestimate it unless the actual correlation lies in the 0.9-1 range. At the same time, when individuals hold positive priors, they tend to overestimate the correlation. This could be viewed as a general conservative bias: Individuals don't easily give up their theories, nor do they readily embrace new ones.

This conservative view is reinforced by studies on *learning*, which show that individuals primarily look for confirming evidence when they assess the justness of a given theory. Beyond this detail, however, studies on *learning* processes tend to show that they are more adapted for behavioural rules than optimal procedures. Heuristics seem to be learned in a mostly inductive fashion, relying heavily on trial and error, as they are developed through the reinforcement of initial results leading to subsequent generalisation. Most heuristics appear to be quite specific, but there exists general rules – meta heuristics – that are used to devise specific ones. By contrast, optimal rules are deductive, abstract, and context dependent. Those rules often hold *ceteris paribus*, but since this condition does not apply in life, it is difficult to properly abstract from details and call on them. In addition, knowledge is organised by content rather than structure, which makes the problem structure hard to observe and consequently the choice of an optimal rule difficult. What is more, if individuals are unaware of the structure of a problem, then the outcome of heuristics can easily reinforce them as long as they are satisfactory. It might be noted in passing that to say

that we use poor rules and that they are reinforced through time does not contradict any Darwinian logic: The fittest survives by using better rules, not necessarily optimal ones.

Finally, in addition to all the troubles with the use of probabilities and statistics already mentioned, individuals generally have a faulty way of computing *multi-stage probabilities*. More precisely, they do not multiply properly the probabilities of each stage when they consider a scenario involving several steps, which has given rise to two different hypotheses concerning the heuristics they actually use. One contends that individuals more or less infer overall probabilities from their lowest single-stage estimate or the prevalence of low versus high probability events in the scenario. Another possibility is that people don't account properly for the probability that their best guess – the outcome with the highest probability – will not happen at each stage, which could be consistent with the observations on *overconfidence* mentioned above. This would be akin to a process whereby individuals take a best guess at each stage and without going as far as giving them an implicit probability of 1, they then insufficiently adjust downward the overall probability as they run through the scenario. In any case, the difficulties experienced in computing multistage probabilities shed some doubts on human abilities to make valid long-term risk assessments, all the more so when the elements involved are as complex as national economies.

Some of these heuristics have been combined by Kahneman and Tversky (2000) and moulded into a representation of individual behaviour under risk[35] they called «Prospect theory», a fully developed alternative to the expected utility theory derived from the same postulates as Homo œconomicus and commonly used in economics[36][37]. Prospect theory

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[35] As is usual in economics, they mainly conduct their analysis in a context of bets and lotteries with monetary values.

[36] For a layout and discussion of expected utility theory, see Frankfurter and McGoun (2001) and Varian (1992) and for an alternative description of prospect theory, see Barberis and Thaler (2002).

[37] Prospect theory also constitutes an alternative to subjective expected utility, a counterpart of expected utility theory developed by Savage for cases where probabilities are not objectively known (Barberis and Thaler 2002).

postulates two stages of decision-making: (1) an editing of the prospect and (2) the evaluation of the prospect. The editing of the prospect consists in an organisation and reformulation of the available options to simplify the evaluation and choice and can in turn be divided in five stages. The potential outcomes are first coded, usually in a way that depicts the outcomes of a gamble as gains and losses, rather than states of wealth as in expected utility theory. Consequently, the reference point moves along as given outcomes are integrated into the individual's wealth. Secondly, outcomes are combined to reduce the range of possible outcomes by categorising them. The segregation of prospects into the two categories of risky and riskless constitutes a third step in the editing process. Fourthly, common components between prospects are cancelled and lastly, there is a further simplification through the rounding and discarding of highly unlikely alternatives. Each of these stages is not always employed and the sequence may vary, especially depending on the framing of the question[38], which influences both the process and the result at different stages.

In the evaluation phase, a weight reflecting the impact of the probability of an outcome is ascribed to it – all weights need not equal one – and then a subjective value is devised for each outcome. The probability weights are function of the probabilities but are not equal to them, depending rather on how individuals process probabilities. In fact, it is hypothesised, following experimental evidence, that that low probabilities are overweighed, although very low probabilities are flatly ignored, while mid-range probabilities are underweighted. There is also a discrete jump at the ends of the probability distribution, as changes to and from certainty are weighed more than commensurate changes in mid-range.

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[38] For example, gambles that are presented as bundled together will be evaluated differently than gambles described as being different from each other, presumably because people adjust their reference point between each of them in the latter case.

For the value function, they deduce from experimental evidence that it is generally concave over gains and convex over losses, with a steeper slope in the loss domain. In other words, they posit that people are risk averse when they face possible gains and risk loving when they contemplate possible losses, an attitude they dub «loss aversion». That said, they add that some sections of the curves in each domains could exhibit the opposite shape, depending on particular circumstances around the relevant monetary values. For example, in the case of a lottery offering a small chance of a large gain, the overweighing of small probabilities may dominate, leading to risk seeking and vice versa for a prospect with a small chance of a large loss.

The perception of situations of risk in terms of gains or losses becomes even more important when we consider another heuristic: *mental accounting* (Barberis and Thaler 2002). An important feature of mental accounting is that individuals tend to consider each gamble as if it was the only gamble they faced in the world, rather than merging it with pre-existing ones and consider the new one as an addition. As such, individuals often don't make decisions based on the final probabilities of prospects but rather on the individual probabilities of each stage. The incidence of *mental accounting* is variable and heavily dependent on framing; gambles described together are likely to be edited differently than gambles mentioned separately.

Prospect theory stands at odds with traditional expected utility theory in many ways. To take but two examples, it is assumed in expected utility theory that if option A is at least as good as option B in everything and better in one respect, it should be preferred to B (dominance), and the preference ordering should be invariant to framing. However, the research behind prospect theory shows that framing a gamble in terms of wins or losses elicits different responses, which violates framing invariance. For instance, a 50% chance of

losing an amount of money that has just been given is viewed differently than a 50% chance of winning the same amount, although they are equivalent bets in the expected utility framework. Similarly, the bundling of a gamble happening over the domain of gains and another in the domain of losses can elicit a different response than when they are considered separately, even if one bundle clearly dominates the other.

While most of my analysis will follow these psychological heuristics, there is also an important emotional element to consider. Problems of self-control, such as procrastination, and courage immediately come to mind, as well as issues of regrets and cognitive dissonance (Shiller 1998). The actual goals of economic agents can also be questioned. A large portion of economic analysis assumes that the drive behind decisions taken in the realms of financial markets is revenue maximisation, but several studies suggest that other desires, such as emulation, could come into play (Kindleberger 2000). In addition, the stability of individual preferences and even attitude could be rejected and they could be made to change both through time and during the economic processes in which individuals take part.

Having discussed possible departures from Homo œconomicus, we can now turn towards the field of finance itself to see how the contest between Rational Man and alternatives devised along the lines of the foregoing analysis has played out.

3.2   Finance Theory Opens Itself to Humans

The specific form the rise in prominence of Homo œconomicus in the analysis of finance took has become known as the efficient markets hypothesis. In a nutshell, the efficient markets hypothesis holds that financial markets are efficient in the sense that the price of securities are always at their fundamental values. In other words, security prices are assumed to fully reflect the available information and the hypothesis «rules out the

possibility of trading systems based only on current information that have expected profits or returns in excess of equilibrium expected profit or return» (Fama, quoted in Shleifer 2000, p.1). In other words, no investor can hope to beat the market and future prices are not predictable based on current information. This view, elaborated in the 1960's, christened in 1967 by Harry Roberts (Dimson and Mussavian 1998) and laid out in all its glory by Fama in 1970, pervades the field of financial economics and is often depicted as the default hypothesis against which any contender must square. Behavioural finance, which has integrated many of the findings on the psychology of economic agents reviewed in sub-section 2.1 to the analysis of financial markets, and as such is closely related to my own endeavour, currently seems to be its most serious contender.

There are three distinct theoretical arguments in favour of the efficient markets hypothesis, each progressively weaker (Shleifer 2000). Firstly, if investors are «rational», and as such rationally value a security at its fundamental value, which is equal to the discounted sum of the expected net future cash flows adjusted for risk, securities will be priced at the said fundamental value and markets will be efficient. In that case, all the available information is computed in the price and new information is rapidly and correctly integrated into investor's expectations through Bayesian updating. Secondly, to the extent that some investors are not rational, their trades are random and cancel each other out without affecting prices. Finally, to the extent that investors are «irrational» in similar ways, their influence on prices is eliminated by rational arbitrageurs. In this context, 'arbitrage' is defined as the simultaneous purchase and sale of the same, or an essentially similar, security in two different markets at advantageous prices. In practice, the idea is that if a security is overpriced (underpriced) as a result of the actions of irrational investors, it should be possible for a rational arbitrageur to sell (buy) the security short (long) and hedge his

position by buying (selling) another similar security at the right price. This will pull the «badly» priced security back to its fundamental value and as time goes on, irrational investors should lose money and gradually disappear from the picture.

It is interesting to note that the efficient markets hypothesis does not rely on the exclusive presence of Homo œconomicus for its survival and can easily accommodate irrational investors, as long as there are sufficient representatives of the former category to weed them out. Of course, there are presumably irrational investors born every minute, but the effectiveness of the arbitrage process can nonetheless seem quite intuitive. What is more, there is also ample empirical support for the efficient markets hypothesis. In fact, Shleifer (2000) recounts that in the first two decades of its existence, empirical results were virtually all on the side of the efficient markets hypothesis. The two propositions, to the effect that any news should be correctly and quickly incorporated into the prices and that prices should not move without and news about the security, seemed to be generally borne out by the data. It seemed that there was no way to earn superior risk-adjusted returns using any publicly available information, which excludes opportunities that may arise from the possession of insider information, nor observable overreaction to news, underreaction, or price trends.

By the end of the 1970's, after two decades of success, the spirit of the proponents of the efficient markets hypothesis was buoyant. Shleifer (2000) even quotes Michael Jensen as saying in 1978 that «there is no other proposition in economics which has more solid empirical evidence supporting it than the Efficient Markets Hypothesis» (p.1). Ironically, this is about when it started to come under strains. A growing body empirical results emerged which were going against the efficient markets hypothesis, notably evidence that the market was more volatile than what the theory predicted. Past movements also seemed to be extrapolated in the short-run while there was an observable reversal to the mean at longer

horizons, which pointed to possibilities of short-run underreaction coupled with long-term overreaction. In short, it did look as if returns were predictable using past information, after all.

Foreign currency and international capital markets were not left aside in this general empirical critique. Kaminsky and Schmuckler (1999), for instance, show that during the Asian crisis, many of the largest 1-day swings cannot be attributed to any substantial news and that investors over-react to bad news, while reactions to good news have a more persistent effect. Furthermore, investors themselves do not seem to believe that foreign exchange prices are driven by fundamentals. In a survey of 142 US foreign exchange traders, Cheung and Chinn (1999) show that while traders believe that prices adjust very rapidly to unexpected announcement, mostly within thirty minutes or less, about 95% of them think that short-run price movements are mostly driven by speculation. In fact, less than 60% believe that movements over a six month period reflect fundamental value and less than a third think that it is the primary mover within that horizon. In addition, surveyed traders said that the importance of given fundamentals, say the trade deficit or unemployment, varies through time, making it even more difficult to see how individual news about fundamentals can be integrated in prices if their impact is only felt in the long-run. Furthermore, if the traders' opinions about the importance of different fundamentals vary, both amongst them and across time, the idea that the value of a currency should reflect the fundamentals only begs the question: Which ones? Finally, for the most part, traders believe that the concept of purchasing power parity is irrelevant for the measure of macroeconomic fundamentals, even in the long-run.

The efficient markets hypothesis has been challenged on theoretical grounds as well. This challenge came at two distinct but complementary levels. For one thing, research in

psychology giving a description of economic agents differing significantly from Homo œconomicus started to make its way into economic theory, a large portion of which is reviewed above. Quite apart from individual behavioural propensities, it was also shown that the microstructure of financial markets themselves and the agency problems it creates can be inconsistent with «rational» behaviour on the part of investment managers. For instance, it may pay a manager to follow the herd in order to minimise the chances of being the only one left out in the cold or to build a portfolio excessively close to the benchmark he is being evaluated on (Fromlet 2001, Shleifer 2000, Barberis and Thaler 2002). What is more, evidence from research in psychology tended to show that the «irrational» behaviour of investors was in fact not random, so the effects of the actions of many such investors on financial markets did not simply cancel out. Briefly put, investors did not seem «rational», the structures in which some of them operated did not incite such behaviour, and the deviations seemed to be correlated rather than random. However, to say that investors simply do not conform to the rationality postulates espoused by the proponents of the efficient markets hypothesis and that this behaviour could have real effects on prices is not sufficient; there remains the third line of defence of the efficient market hypothesis: Arbitrage.

The second theoretical challenge therefore pertains to arbitrage processes and their ability to guarantee that prices stay at fundamental values. Researchers have identified at least five important limits to arbitrage (Shleifer 2000, Barberis and Thaler 2002). Firstly, there seldom exist perfect substitutes with which to hedge a position taken in a mis-priced security, which exposes the arbitrageur to what has been termed *fundamental risk*. For example, for a class of assets as a whole, such as stocks or bonds, there is no substitute portfolio. More generally, arbitrageurs are usually forced to hedge his position in a mis-

priced security with an imperfect substitute and therefore bear the risk that one of the two positions will react idiosyncratically to new information, say to good news in the case of a security they are holding short. For instance, hedging the stock of a US car company with that of another US car company presumably shields the arbitrageurs from movements due to news concerning the industry or the economy as a whole, but not from news about individual companies, and yet it might well be the best substitute available.

The danger that the mis-pricing can worsen in the short-run is another type of risk to which arbitrageurs are confronted. The time-horizon of arbitrageurs might be short, perhaps because they don't manage their own money and are often monitored, because they have to pay interest on borrowed securities, or because face the risk of liquidation if the value of their collateral decreases too much. In particular, in a market that is not liquid enough, it might be very difficult and costly, or even impossible, to go short in the desired security. Under such conditions, if the mis-pricing persists too long or deteriorates, the arbitrageur might not be able to withstand the short-term loss and the arbitraging process could therefore become too costly to undertake. Shleifer (2000) even shows that in a case where arbitrageurs have sufficiently short horizons and in the absence of *fundamental risk*, it is plausible that «irrational» traders, which he calls *noise* traders, will earn higher expected profits and maybe even drive some arbitrageurs out of the market (see also De Long *et al.* 1990). In some sense, noise traders thrive because they are less risk averse and more willing and able to bear the risk they themselves create.

A third set of problem may arise if the arbitrageur is not using his money. If the owner of the money does not understand the arbitrageur's strategies or simply cannot properly observe his competence, he may allocate his money according to measures of short-term performance and therefore not be sufficiently patient. In particular, if the

arbitrageur is managing somebody else's investment, the conservation of a losing long position may be viewed as a sign of incompetence after a while – even more so if the price disparity widens – and the investor may elect to shift his money to a manager that has a better short-term record. Similarly, if the money is borrowed, the loan could be recalled if the value of the collateral decreases too much, say because the price of the long position decreases, which could result in the liquidation of the arbitrageur's assets. If the value of the collateral is still above that of the loan and the creditor is responsible for the liquidation, there could even be a fire sale by the lender who is only concerned about the recovery of the amount of the loan.

It could be argued that the impact of these agency problems could be mitigated by the fact that funds will decline with a lag and there should therefore be time to cover up. Lags of withdrawal are usually quite short, however. In fact, there could even voluntary withdrawal on the part of an arbitrageur who fears that his position might worsen even more and that he could face a massive capital outflow later on if this occurred, speeding the process further. Another way out for the arbitrageur could be to diversify, so that he does not only hold losing positions at the same time. This can work, as Shleifer (2000) admits, but only if the pricing trend is specific to one set of securities. If the movement is general, however, or simply if the downward pressure put on the price of the asset the arbitrageurs are liquidating to meet cash requirement in the first position is sufficient to force other liquidations and the downward trend spills over in other industries, diversification will not help and might even exacerbate the problem.

Fourthly, arbitrage is not always the best strategy to pursue, even on the part of a «rational» investor. Instead, it might pay more to try to ride on the trend and get out before it stops and reverts to fundamental prices, if it does at all. In other words, it is often unclear

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whether or not potential arbitrageurs have any incentive to pursue arbitraging strategies, especially if they have better knowledge of the value of the security and the investment process in general than noise traders do. In this way, the activities of potential arbitrageurs could actually be destabilising and the price of the security could move further from its fundamental value. A study of the inner functioning of a large portion of the speculative bubbles which happened throughout history suggests that this is not merely a theoretical possibility (Kindleberger 2000, Shleifer 2000).

Finally, transaction costs also constitute an impediment in and of themselves. They may render many arbitraging process uninteresting, especially if these persist over long periods of time and therefore give a relatively low overall return or simply if they are not large enough. Furthermore, if a correction necessitates the action of many people who must bear a cost in the process, there is an inherent risk facing every individual that he will not be followed and will bear the cost to no avail (Barberis and Thaler 2002).

To summarise, the efficient markets hypothesis is questioned both on empirical and theoretical grounds. The efficient markets hypothesis relies theoretically on the «rationality» of investors, or at least the ineffectuality of the behaviour of «irrational» investors, either because of its randomness or through the corrective influence of arbitrage. All three of these propositions have been shown to be problematic: Humans differ from the Homo œconomicus archetype and there are important limits to arbitrage processes. A large body of empirical evidence has also been amassed in opposition of the efficient markets hypothesis. In that domain, however, it is harder to adjudicate between the two sides, since there is also evidence in support of the efficient markets hypothesis.

Incidentally, Fama (1998) offers a strong, and sometimes strident, defence of the efficient markets hypothesis he helped to create. His main line of defence is that most of the

evidence marshalled by the proponents of behavioural finance comes from chance results, separated between two roughly equal categories of under- and overreaction, which implies that they cancel each other off. Moreover he claims that they tend to disappear when the proper adjustments is made to the way they are measured, such as the setting of different methods to account for risk. In fact, some proponents of behavioural finance admit that the empirical case in favour of their alternative is not air-tight (e.g. Shleifer 2000). At the same time, empirical tests of the efficient markets hypothesis should not be expected to be conclusive. As Crotty (2011) details, the theory has to be operationalised through specific models with their own sets of assumptions in order to be used empirically, so that in effect, both model and theory are jointly tested. In essence, "it is impossible to adequately test [that] theoretical proposition in isolation from assumptions not specified within the theory" (Crotty 2011, p. 9).

While the battle rages on, it is interesting to note how the burden of the proof basically lies entirely on the shoulder of behavioural finance. The mere fact that results which contradict the efficient markets hypothesis are dubbed anomalies is telling. Frankfurter and McGoun (2001) argue quite convincingly that the term is not meant in the Kuhnian sense of a novelty of fact that can lead to an important revision of the reigning paradigm or a paradigm shift, but rather in a pejorative way, perhaps even as part of an attempt to marginalise this strands of literature. More generally, Frankfurter and McGoun (2001) identify quite a few epistemological problems in that debate, notably the unwritten axiom that unrealistic assumptions which lead to rational conclusions can be useful building blocks, a view often associated with Milton Friedman. In essence, this could easily lead to the view that if more realistic assumptions lead to the elaboration of theories that are inconsistent with the logic of Homo œconomicus, they are worthless. All in all, they strongly

critique the bases on which the debate is conducted and generally lambaste the proponents of the status quo for what they deem to be a refusal to work constructively towards the elaboration of a better theory, accusing them instead of being more preoccupied by the preservation of their own view of the world. Crotty (2011) lays out a similar critique, demonstrating in the process how absurd assumptions about the way financial markets function, and in particular those underlying the efficient markets hypothesis, led to dubious policy recommendations, notably widespread deregulation, which contributed to the financial meltdown at the end of the 2000s. He counters that a theory based on more realistic assumption would not only provide a better basis from which to study and understand financial markets, but it would also likely lead to a better management of these markets.

The introduction of behavioural elements in the analysis of financial markets has undermined the position of the efficient markets hypothesis. This has led to a reassessment of the determinants of financial crises, a welcome development in view of the weaknesses identified in chapter 2. Let's see if a behavioural approach fares better than modern financial crisis literature.

3.3   Euphoria, Exuberance, and Panic: Behavioural Finance's Take on Crises

Behavioural explorations of bubble and crash phenomena have followed the usual theoretical and empirical dichotomy present in the rest of economic analysis, with blurry zones in between. On the theoretical side of things, some researchers have tried to see if using some cues from behavioural economics could help them design a financial market in which bubbles and crashes are present. In this case, the exercise was partly meant to see if behavioural finance could improve upon existing models of rational bubbles, i.e. bubble

phenomena occurring in environments where rational expectations are present. Empirical accounts are usually concerned either with identifying the presence of behavioural elements in market behaviour or in using such elements to make sense of observed patterns. Although they still tend to have important limitations, there are some good points to be gleaned from both theoretical and empirical analyses.

3.3.1   Theory

Starting from the theoretical end of the spectrum, it might be useful to see how bubbles could exist in a rational expectations framework. Rational expectations can be consistent with (infinitely) many equilibria for asset prices (De Grauwe and Grimaldi 2004, Diba and Grossman 1988). Essentially, since expectations can be self-fulfilling, investors could correctly anticipate a price path diverging from fundamental value. In a perfect foresight environment, this implies prices that increase forever since any future crash would be correctly anticipated, which by backward induction would preclude the bubble in the first place (downward spirals are also ruled out since asset prices can't be expected to be negative) (ibid.). This is not particularly illuminating, since bubbles, to the extent that they exist, do burst.

One way to resolve this issue, proposed by Blanchard and Watson, is to assume that the environment is in fact stochastic (ibid.). There is going to be a crash, which is anticipated by investors, but the timing of the crash is unknown. This allows for the occurrence of bubbles and crashes in succession. Interestingly, crashes occur in this model because they are expected to occur, but these expectations come from outside the structure of the model, from a common sense that bubbles cannot last forever (De Grauwe and Grimaldi 2004). This is not particularly satisfactory. The determination of agent expectations is once again

left squarely outside the analysis, a recurrent problem in models of international financial crises.[39]

Johanson and Sornette (2001) provide another example of a rational bubble model, this time relying on imitation between traders, possibly because there is noise (interestingly, noise does not influence the price of the asset in the actual model). They develop a model where traders get some of their information through networks. There is a "hazard rate", essentially a probability of a crash in the next period, based on agent interactions. The more agents agree with each other, the likelier the crash, but also the higher the price rise as long as there is no crash, to compensate for that higher probability (though one wonders if this makes sense, given the nature of the information networks justifying the model). The feature that order – agreement amongst traders – creates a crisis is interesting, going against the usual depiction as crashes being instances of chaos. Johanson and Sornette (2001) set up an exogenous critical time period representing the time when the crash is most likely (the crash may still happen before the critical time or even not at all, a feature that is necessary to prevent agents from anticipating the crash and leaving the market), and the probability of crash increases through time as the critical time is approached.

Johanson and Sornette (2001) manage to reproduce many empirical features of bubbles and crashes with their model, notably the general shape of the upward movement coming from a power law and price oscillations throughout. There again, though, the exogenous setting of a critical period is disconcerting. In fact, in their empirical

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[39] Blanchard and Watson's model also encounters various difficulties in a general equilibrium setting, such as the implausibility of ever recurring crises or the need for an ever expanding number of agents, but this is slightly besides the point (De Grauwe and Grimaldi 2004, Diba and Grossman 1988). More important is the criticism that the [exponential] distribution of bubbles implied by the model does not seem to be borne out empirically, as data suggest the presence of fat tails (De Grauwe and Grimaldi 2004). Still, the general idea of a bubble and a crash could occur is what matters.

investigations, the author set the critical time period as the actual peak in price for the different episodes they look at, thus somewhat assuming their own conclusion.

Bubbles can also be generated by introducing noise traders in the agent mix and accounting for limits to arbitrage in ways described above. There as well the crashing process is somewhat exogenous but in this case, the main issue is that these models send us back to an asymmetry in rationality between different agents that is not easily justified. It's one thing to show that it does not take much for the Efficient Markets Hypothesis to experience problems, quite another to argue that financial markets are actually populated by dummies and geniuses (with the modeller making the latter in his or her image).

Some see the entire rational bubbles exercise as being besides the point. Bubbles are not rational… and that's fine, because human beings don't abide by the rationality postulate dominating economics anyway. Prechter and Parker (2007), for example, delineate a socionomic alternative to the Efficient Markets Hypothesis. Backed up by neurological research, they assert that herding behaviour is perfectly natural. It is not a question of rationality – that people act purposefully is not disputed – but simply of the way the brain processes impulses. While people can always rationalise their decisions ex post, Prechter and Parker (2007) marshal evidence that undermines the idea that people can actually think coolly in the middle of bubbles or crashes, including some physiological indicators. Nofsinger (2005) develops a theory of social mood that reinforces Prechter and Parker's (2007) viewpoint. Nofsinger (2005) combines the fact that most human actions are influenced by the mood people are in and that emotional states are both influenced by general conditions affecting many people and tend to spread around networks. He then claims on the basis of these elements that we should expect a common component in people's decisions that should push them in a common direction, an element that could be

cyclical in nature. This in turn could also help explain herding behaviour. Focusing on herding as an evolutionary biological legacy is an interesting approach, which would certainly help explain reinforcing dynamics in that system.[40]

De Grauwe and Grimaldi (2004) offer another behavioural alternative to the theory of rational bubbles. They set up a system with homogenous traders, who have a limited ability to gather and analyse information and thus use simple heuristics as forecasting rules for the exchange rate. These agents are still "rational", in that they look at the relative profitability of their rule and are willing to switch if they deem it to be sub-par. De Grauwe and Grimaldi (2004) posit two forecasting rules: (1) Given an exogenous fundamental value of the exchange rate, "fundamentalist" agents will forecast that the exchange rate will converge to that value at a given rate, while (2) "technical traders" simply extrapolate past exchange rate movements (the rule is based on changes in the exchange rate). Traders switch between the rules at a given rate depending on which one would have been more profitable (adjusting for risk) given how the exchange rate turned out to move.

There are two types of equilibria in this model. One possibility is that the exchange rate is at its fundamental value and stays there. In this case half of the population follows each rule. There is also a bubble equilibrium, where the exchange rate permanently differs from its fundamental value and everybody uses technical trading (so there is no mean-reverting tendency). A bubble can arise if the exchange rate moves in one direction, changing profitability and leading enough people to switch to technical trading to create a bandwagon (once the price starts moving steadily in one direction, it will lead people to adopt technical trading). The number of people who adopt technical trading must be

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[40] See Haiss (2010) for an extensive review of ways in which micro-structures, agent psychology, and regulatory environments can combine to elicit herding behaviour in asset markets (with a focus on banking). Such factors reinforce the assertion made by Prechter and Parker (2007) and Nofsinger (2005).

sufficient to dampen the mean-reverting tendency of fundamentalists. The rate of change of the exchange rate slows down when almost everybody is a technical trader. At that point, a reversal can be triggered by an appropriate exogenous shock, which would make the fundamental (mean-reverting) strategy more profitable. The price goes back to the fundamental value faster than it trended away, given that both fundamentalists and technical traders are now pushing the system in the same direction.

Crashes are thus made endogenous in the system elaborated by De Grauwe and Grimaldi (2001), which is somewhat more satisfactory than the ad hoc set ups of rational bubbles, although there is still a reliance on exogenous shocks. They manage that with homogenous agents using simple forecasting rules while trying their best to make money, an improvement over the requirement that rationality not be uniformly available. However, in doing so, they do sacrifice much of the richness of behavioural finance. Sure, they found a way to generate a bubble from behavioural elements, but their system remains very specific, leading one to wonder how applicable it might be. Moreover, their analysis is confined to the market of the specific asset being analysed, without much regard to the rest of the economy. This is a general problem with behavioural finance, which tends to analyse financial markets in isolation. Given that an economy is made up of varied sectors which interact and co-determine each other, this is a serious limitation.

Feldman (2010) addresses this issue somewhat by developing a model where two financial markets are linked through global portfolio managers, who interact with local managers. His intent is to study the possibility of a global financial crisis including the two markets. A base-case model where managers simply use a mean variance framework yields no financial crises. Feldman (2010) then extends the model by having the risk aversion parameter depend on losses. What ensues is that global managers first stabilise the markets

through diversification, but then become more tolerant to risk through that very stabilisation and increase their leverage. More global managers also enter the market taking on more risk, a process that eventually de-stabilise the situation (in fact, when the number of global managers is small, the stabilising effect of diversification dominates). When losses do occur, the process of de-leveraging then leads to an unravelling on both markets and a global financial crisis.

This model is fairly interesting. It is consistent with a story of bubbles where part of the problem is that the upward trend in price is supported by the entry of new investors, a process that comes an end when there is nobody left to enter. This is not quite what happens in Feldman's (2010) model, but the entry of more bullish investors does destabilise markets and lead to deeper financial crises. Furthermore, the endogenisation of risk preference (or aversion) is a promising development, capturing one of the central insights of the psychology literature reviewed above – that the agent is not time-invariant, people respond to their environment in the way they process information and act on it. More specifically, this way to model the risk-aversion parameter is consistent with *availability*, as agents are made to forget and concentrate on recent outcomes, and *over-confidence*, in that recent success does lead managers (or at least their investors) to believe they can get away with more risk-taking. Implicitly, it could be argued that *causality* is also mis-perceived in this model, as risk-aversion is made to depend solely on results, rather than through a broader understanding of the processes that could have generated those results. While the actual parameter depicts risk aversion, this model could thus be an illustration of either an increasing tendency for risk to be less salient as good times endure or simply as people increasingly believing in their ability not to fall victim of that risk, both of which are consistent with the psychological heuristics identified above and not mutually exclusive.

Of all these models, I'd say Feldman's is the most interesting, as it displays agents and markets dialectically affecting each other. It is not only that people are limited and structures constraining, the two problems the other models concentrate on, but that markets determine agents just as much as they determine markets. Nonetheless, models of bubbles remain a bit limited in that they are so stylised that they both largely abstract from the presence of an economy and from much of the richness of agent behaviour. They need to be supplemented by a more general depiction of the economy and some literary account which don't face the same analytical constraints.

3.3.2 Empirics

There is a wide variety of empirical analyses in behavioural finance. Some people survey investors to try to understand their psyche, some try to identify behavioural elements at play in different events, others bolster their econometric analysis with a behavioural component or two... A complete review would take us much beyond the scope of this study, but a few examples of different types of empirical undertakings, with a special focus on crises, may be useful to get an idea of the current state of affairs.

Starting with econometrics, many people test the presence of bubbles in asset markets by trying to determine whether the price of given assets diverges from their fundamental values. One basic difficulty is that any determination of a fundamental value, on which the whole analysis depends, is intrinsically subjective. Trying to compare asset price movements with movements in the price of variables deemed "fundamental", say via cointegration tests, does not solve the issue, both because of the subjective designation of such variables and because their prices could theoretically be subject to non-fundamental dynamics of their own, not to speak of possible missing variables bias. Some researchers

have thus tried to look at the dynamics of the data itself to see if it exhibits some characteristics that could be associated with bubbles.

Jirasakuldech, Emekter, and Rao (2008) provide an example of this dual methodology in their study of Thai stock prices. They conduct a cointegration test within a variable autoregressive model, using earnings and dividends as fundamental variables. They find no cointegration between stock prices and dividends or earning, suggesting an absence of long-term relationship between these variables and thus the presence of bubbles in that market, though this is less true after the Asian crisis. To circumvent potential criticisms regarding fundamental variables, they then conduct a "duration dependence" test. The model of rational bubble they use implies that longer runs of positive price growth have to be associated with declining probability of a crash (essentially, the longer it goes, small positive gains have to weighed against larger possible drops). The idea is thus to see if the implicit crash probability does decrease the longer a price run-up goes. Once again, they find such evidence for the whole sample and, specifically, for the period preceding the Asian crisis.

Interestingly, Jirasakuldech, Emekter, and Rao (2008) claim that "duration dependence" tests allow them to steer clear of the common criticism with cointegration techniques that it is a joint test of the model and the hypothesis, but their methodology is heavily dependent on the implicit theoretical model. Different models would yield different predictions, such as that of Johanson and Sornette, itself a rational bubble model, where the probability of a crash actually increases through time. In any event, while the authors do find some evidence for bubbles, these types of tests are not particularly conclusive. Indeed, as Jirasakuldech, Emekter, and Rao (2008) themselves admit, evidence garnered using these methods is mixed.

Another way to look at a similar issue is to investigate whether investors overreact to new information. If the process is cumulative, say because there is a wave a optimism or pessimism, there could be bubbles. Evidence is mixed once again, though according to Otchere and Chan (2003), there is stronger support for immediate over-reaction rather than longer-term waves of pessimism or optimism. Just as for tests regarding the presence of bubbles, the methodology could be partly to blame, as it is once again hard to establish a benchmark, especially for longer-term enquiries. In any event, there is evidence of such waves in the Turkish case, the impact of which is discussed in later chapters.

A third strand of statistical analysis with behavioural elements simply seeks to see if their incorporation can improve econometric models. Some positive results have been attained in this way. For example, Zhu and Yang (2008) seek to improve the understanding of the determinants of contagion between different financial markets by adding a psychological proximity variable. The general idea is that if investors compartmentalise different markets in specific categories and then use *representativeness*, they may extend their perception of financial troubles in one market to other markets in the same category. They operationalize this concept by building a composite variable, using the physical distance between markets, the presence of a common language (to approximate cultural proximity), the difference in GDP per capita (to capture similarities in development levels), and a regional organisation membership variable (to adjust for coordinated response or policies at a regional level).

This is not particularly ground-breaking, constituting rather a re-packaging of some of the variables already present in cross-country analyses, but it is an interesting use of these variables nonetheless. Certainly, such endeavours – developing variables to represent psychological heuristics – have some value, both to test behavioural finance hypotheses and

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to bolster the empirical analysis of financial markets. In this case, Zhu and Yang (2008) do find a positive and highly significant role for psychic proximity in explaining contagion, providing support for their behavioural contention.

Some attention has also been directed towards analysts. There seems to be a general optimistic bias in the forecast of most analysts, except perhaps in times of crisis when the bias goes in the other direction (Qian 2009, Stotz and Von Nitzsch 2005). Three explanations are usually brought forward, namely misaligned incentives (Qian 2009), cognitive bias (Stotz and Von Nitzsch 2005), and earnings skewness (Gu and Wu 2003), this last one being more or less a statistical artefact. The first of these pertains largely to the micro-structure of the industry, wherein positive forecasts allow analysts to generate more fees and commissions and increase the chances of promotion. Of course, being wrong also affects their reputation... Qian (2009) surmises that these competing incentives may actually align forecast with investor sentiment. That is to say, she hypothesises that analysts may be able to get away with overly optimist forecasts when investors are also optimistic and she finds some supporting evidence for this view. Of course, the problem is that it is also possible that analysts are simply affected by the same general mood than investors or that they suffer from the same bias, but the co-movement is interesting nonetheless.

Stotz and Von Nitzsch (2005) investigate a possible *overconfidence* bias to explain unwarranted optimism, which they attribute largely to an illusion of control. The premise is interesting, but all they muster in the end are survey results to the effect that most analysts think they are above average. This is hardly new or surprising. Nonetheless, it is probable that analysts are subject to the same heuristics than investors, including *overconfidence*. Of course, it is not evident why the bias should be upwards as Stotz and Von Nitzsch (2005) imply, so the above elements of micro-structure could also have a role. In any event, the fact

that investor sentiment and analyst forecast move together could give rise to a reinforcing effect during bubble episodes.

Narratives of specific crises, linking events and decisions to particular cognitive biases, constitute a last category of empirical studies in Behavioural finance. Focusing on the most recent financial crisis, Grosse (2010), Szyszka (2010), and Shefrin (2010) wrote such narratives, which are relatively representative example of this strand of research. Each of these authors specifies a list of biases to be identified in the story, then goes on to recount parts of the crisis while pointing out to the possible influence of these biases. Virtually all the heuristics referred to in these articles are already described above, so I'll simply list the particular ones analysed by the authors as I review their studies.

Grosse (2010) looks at the entire crisis experience and essentially identifies behavioural issues along two complementary lines: Psychological factors and limits to arbitrage. On the psychological side, he says that people exhibited irrational exuberance which was followed a negative reaction that was similarly exaggerated. This pessimism led to a flight to quality, with people pouring in the government bonds market, putting a lot of pressure on firms which could otherwise have weathered the storm. Grosse (2010) believes that there is probably no way to prevent this kind of attitude, so he calls for government constraints on the type of positions people can take. The author also mentions how firms, regulators, and investors did not have a very clear idea of the assets they were dealing with given their complexity and the financial ramifications they imply, rendering government regulation, internal control in financial firms, and oversight by investors very difficult. Regarding arbitrage, Grosse (2010) points to the fact that many firms were operating on the basis of very short-term horizons, making it difficult to simply wait while prices went down instead of realising losses. The fact that many firms operated in a mark-to-market model put

great constraints on the level of fluctuation they could deal with and often implied injections of liquidity to recapitalise their position that they could not afford. In this case, Grosse (2010) recommends built-in government response mechanism that would trigger whenever the firm crossed given thresholds or ratios, instead of waiting and having to inject large sums after the fact.

Szyszka (2010) focuses on more precise heuristics in his description, which he conversely keeps at a very general level. He mentions how people are guided by two contradictory sentiments, greed and the fear of a drop in consumption, the former taking precedence in a boom and the latter in a downturn. People also suffer from narrow framing (from the mental accounting heuristics), so that they disregard the correlation between asset returns, which leads to faulty diversification strategies. Agents are generally overconfident, a bias which stems from different elements, such as an illusion of control, unwarranted optimism in good times, the feeling by individuals that their capacities are above average, and finally that people cannot calibrate probabilities properly, putting too much weight on relatively probable events and not enough on low-probability events. This latter problem is then in turn likely to lead to an underestimation of systematic risk. Szyszka (2010) also points to the existence of herding and the use of the representativeness heuristics, the latter leading to an unwarranted extension of growth forecasts in the future, a problem he associates in particular with rating agencies. Finally, he also mentions how obscure payoff structure made calculations very hard to make and led people to rely on their instinct, which then leads to the psychological heuristics mentioned.

The article by Shefrin (2010) is probably the most interesting. Going through five case studies – AIG, UBS, the investment fund of the town of Navik in Norway, the SEC, and Standard and Poor's – Shefrin identifies some of the biases that might have been at

work in corporate units or larger institutions. In this way, he departs from the usual analysis focused on individual investors or regulators, though Grosse (2010) had made a couple of forays in that direction as well. He devises a framework whereby he looks at four dimensions of functioning of these institutions: Planning, standards used, information sharing, and the incentive structure. He then proceeds to identify instances of heuristics, such as overconfidence or confirmation bias (linked to the learning heuristics above), in those different organisations, along these four dimensions. For example, he recounts how the SEC failed to uncover Madoff's ponzi scheme, despite numerous complaints as early as 1992, because its agents were essentially looking to comfort their ex ante vision that all was fine.

Shefrin's (2010) article is a nice read, both because of all the institutional evidence he brings to bear and because of the analytical framework he uses. One of the main problems of behavioural finance is that it is somewhat easy to get lost in the embarrassment of riches provided by the various psychological heuristics present and then simply retreat to making general statements about how this or that could have played a role overall. This issue does plague Szyszka's (2010) analysis, for example. By contrast, Shefrin (2010) brings forth specific example at precise moments in the functioning of the organisations he reviews, which allows the reader to have a better sense of how these heuristics play out exactly.

Just as the bubble models reviewed before, however, this type of enquiry is still limited in the end. What is lacking is a general vision of the way an economy functions and different sectors interact. Financial markets don't exist in a vacuum, crises are not anomalous events, being rather an integral part of the system, and agents are not atomistic beings from which the analysis must start. A good overall structure is needed, one that provides a space for

behavioural elements while giving a good picture of the inner workings of the economy.

This is taken up in the next chapter.

CHAPTER 4

A STRUCTURE AND A MODEL

The human agents described in the previous chapter appear to associate a situation with a particular class of events according to whether or not the situation is *representative* of that class of events; give more weight to information that is more readily *available* to their mind; hover between *underconfidence* and *overconfidence* in their own ability to assess a situation; have trouble identifying *causality* and *covariation*; have a way of *learning* which tends to reinforce priors; and can't *compute multi-stage probability* properly. The combination of these seven traits gives rise to a picture where the psychological make-up of the participants in international financial markets is in constant evolution, changing as events imprint more or less deep traces in people's mind, as memories fade or traumas are revived, as success intoxicates and failure frightens. In short, agent behaviour is dynamic, endogenously influenced by the way financial markets evolve through a synergic relationship between sentiment and market outcomes. In this way, agents are both limited in the information they have and treat and behave differently than the typical "rational actors" depicted in economics would. These considerations are all but absent from modern currency crisis models: First-generation models have automatons and an exogenous set of government policies; second-generation models leave aside both the processes underlying expectations formations and the historical path leading to the crisis; while third-generation models tend to focus on the processes themselves rather than the agents.

At the same time, behavioural finance lacks a structure to transform its varied insights into a coherent alternative representation of the economy. Dow (2011) even goes as far as to claim that all behavioural finance is to study punctual departures from the rational

agent models without actually challenging it as a benchmark. This is perhaps a bit harsh, as some of the approaches to behavioural finance reviewed in the previous chapter did propose radical departures, such as Prechter and Parker's (2007) socionomic approach and, in some ways, some of the models of bubbles. Nonetheless, Dow (2011) does have a point, in that behavioural finance largely seeks to depart from the rational agent model without fully articulating such a departure.

What seems to be needed is a dynamic framework wherein economic outcomes are determined endogenously through the interrelation of agents' actions and beliefs with the economic processes within which they take place. Minsky (1982) provides us with such a framework for a modern capitalist economy, which leads Dow (2011) to argue for its use as a basis for the analyses of economic crises instead of behavioural finance. The point is not, she says, to "incorporate psychology into economics, but rather to build economics on the basis of a rounded theory of human behaviour." (2011, p. 247) While I agree with this point of view, it not clear we should abandon the advances made in behavioural economics. Minsky's (1982) framework is not devoid of shortcomings either, however useful a starting point it might be. In what follows, I propose a joint theoretical framework with Post-Keynesian and behavioural elements, after a brief outline of Minsky's theory.

4.1   Minsky's Framework

Minsky borrows several elements from Keynes to elaborate his financial instability hypothesis.[41] In addition to the postulate of fundamental uncertainty, he adopts Keynes' general analytical view of time as being a unidirectional flow, one of the characteristics of the world from which arise fundamental uncertainty, but also one liable to make time-

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[41] What follows is largely based on Minsky (1982).

consuming economic processes, such as investment, irreversible or rendering assets illiquid. A third idea Minsky gets from Keynes is the characterisation of capitalist economies as being denominated in money. From these three building blocks, Minsky elaborates a theory which locates in financial markets a fundamental and inherent source of instability for a modern capitalist economy.

From the perspective of financial markets, he argues, the economy is a world of money claims distributed through time, whose viability rests on the cash flow generated by businesses, households, and governments. Of these claims, Minsky focuses his analysis on business debts because of the central role they occupy in the functioning of a modern capitalist economy. The validation of these debts require that output and price levels be such that enough firms earn enough surplus over costs to be able to fulfill gross payments or induce the refinancing of their debt. Refinancing of course necessitates the expectation that a similar validation will happen in the future.

The funds available to meet current liability structures depend on investment, which implies that the adequacy of a liability structure depends on current speculations on the course of future investment. In Minsky's terms, «the ability to debt-finance new investment depends upon expectations that future investment will be high enough so that future cash flows will be large enough for the debts that are issued today to be repaid or refinanced» (1982, p.65). Net profits also constitute the cash flow that accrues to equity holders, so equity prices are driven by the capitalisation of expected residual cash flows. Equity prices are in turn a determinant of the market valuation of capital assets, which itself affects the demand for investment goods and determines investment along with supply conditions. Given these linkages, the systemic instability comes from the subjective nature of expectations about future investment and subjective determination of the appropriate debt

structure for financing different capital assets, both formulated in an environment of fundamental uncertainty.

The behavioural component of his model is the hypothesis that expectations are pro-cyclical and also delayed in the upswing. More precisely, at the outset of an upswing, agents will be cautious, memories of the crash still being quite vivid, and safety margins will be set accordingly. As the upswing proceeds and business picks up, these memories will slowly fade away while optimistic guesses are being validated and indebted firms prosper.[42] After a while, the cautious safety margins will appear over-prudent and acceptable debt will increase as these margins decrease. This will itself bid up the price of capital assets and increase investment demand, which can then lead to a boom economy. This tendency is exacerbated by a propensity to make financial innovations during a boom, which further increases the market price of assets. In short, stability and tranquility on financial markets is itself destabilising, as it induces an increasing amount of risk-taking, which in turn undermines the functioning of the system. A tranquil steady state equilibrium may exist, but under these conditions, it cannot but be transitory and unstable. This description of human behaviour seems roughly accurate, but its foundation is lacking. Although it is at the centre of Minsky's model, and indeed necessary if the model is going to work, it is simply asserted as a fact without further justification. One of the objectives of the inclusion of behavioural elements in the analysis is to provide such a justification, along with a clarification of agent behaviour under fundamental uncertainty, and perhaps some qualifications to Minsky's position.

Minsky then completes the description by outlining an endogenous process whereby the boom could finally end. The increased investment demand following the improvement of long-term expectations will lead to an increase in the production of investment

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[42] Such views on the selective and fading nature of the memory of investors have a long history in the financial market literature. They figure prominently in Bagehot's 1873 classic, <u>Lombard Street</u>, for example.

commodities, which will itself raise the need for financing. If the financing curve is not perfectly elastic, then interest rates will rise and indebted firms will eventually come under strain. As some firms experience difficulties in making their payments, some financing units that had overly stretched themselves will also come under strain and pressure their other debtors for more money. At the same time, the brewing troubles will shift the expectations of some creditors and they might become reluctant to refinance some debts that were previously expected to be rolled-over. This combined effect will eventually lead to a crisis, the magnitude of which depends amongst other things on the extent of the systemic fragility, the intervention of the government, and the impact on long-term expectations.

A similar process could take place if the financing curve is perfectly elastic during the boom, perhaps as a result of an entirely endogenous money supply. In that case, interest rates would not move as a result of the increased demand for financing, but increased profits would bid up the price of capital assets, as was alluded to before. This would not only lead to further investment, but also to inflationary pressures. Mechanisms internal to the central bank could eventually kick in and it would try to moderate the expansion, which would result in the supply curve for financing becoming inelastic. Short and long-term interest rates would increase, which would both depress profit expectations and generate the strains mentioned in the previous paragraph.

Of course, this exact process need not take place. Once the economy is in a sufficiently fragile state, any important adverse shock will lead to a crisis. Indeed, different variants and interpretations of Minsky's hypothesis have posited different turning points. However, as long as the process of "fragilisation" is accepted, and it is admitted that interest rates will eventually increase a result of the boom, Minsky's reasoning shows that the processes of expansion, boom, and crisis are entirely endogenous to the capitalist system.

This is not to say that these tendencies could not be mitigated, possibly by proper government action, but simply that the system is inherently unstable.

The financial instability hypothesis is a very compelling account of capitalist financial processes. The mechanism it proposes to explain financial crises makes exogenous shocks superfluous, at least if we accept both the behavioural assumptions and the fact that an investment boom eventually lead to rising interest rates. Indeed, the financial instability hypothesis integrates all the causal elements within the model and thus the structure of the capitalist financial markets themselves, dispensing with the necessity of inventing unspecified exogenous shocks to account for movements away from a posited general equilibrium. That said, it relies on strong behavioural assumptions whose theoretical basis is somewhat flimsy and the description of the process leading to an increase in interest rates is vague. Although the statement of both conditions is plausible, the story would certainly gain from further research to support them further. Finally, the model would need adjustments if it was to be used to analyse international financial crises, but this is not a serious problem.

4.1.1   Variants, Extensions, and Adaptations

Minsky's financial instability hypothesis was originally devised to analyse the US economy and the method was mainly literary. Following the taste of the economics profession for mathematics, Minsky's model was also given formal analytical moorings in a few different ways, four representative examples of which are reviewed in this sub-section[43]. The extension of the coverage of the analysis to different countries, as well as international financial arrangements, constitutes a second natural line of exploration in this era of global

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[43] Formalisations, as Skott (1994b) notes, allow for a consideration of the influence of the specification of the system, notably the relevant parameter values and functional forms, on the interaction of its components. As such, it can be viewed as a worthwhile contribution to the analysis of complex economic phenomena.

financial markets. It was indeed rapidly adopted by Kindleberger, who used it as one of the main theoretical underpinnings his 1978 classic «Manias, Panics and Crashes: A History of Financial Crises», and more recently by Robert Wade (2000) in his attempt to make sense of the Asian meltdown. I inspire myself from both of these adaptations and review them after the formal models.

4.1.1.1   Formalisations

The most simplified analytical version of Minsky's instability hypothesis is offered by Lavoie (1986-87). In his view, the natural tendency of the economy to move towards a more fragile financial system and the eventual rise of interest rates are the two crucial phenomena on which Minsky's thesis relies. He therefore sets out to provide a simple model in which those two phenomena are illustrated.

The first step of his analysis is to show that the leverage ratio, taken as a proxy for fragility, has a tendency to go up during investment booms. The booms themselves are assumed to arise out of the behaviour of agents under fundamental uncertainty and their initiation is not explicitly modelled. In a few words, his analysis amounts to a statement that if the rate of capital growth is to increase, a situation which defines an investment boom, the resources have to come from somewhere and eventually from a higher leverage ratio. This result is arrived at by observing that the level of gross investment is a function of desired retained profits and leverage ratio. Noting that these variables are in turn realised independently of household savings decisions under certain conditions[44], he assumes this is

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[44] (1) Firms choose a proper profit margin; (2) external funds take the form of share issues or bond prices follow the fluctuation of share prices; (3) the aggregate valuation ratio is endogenously determined; and (4) the banking system must be willing to accommodate (Lavoie 1986-87).

the case and shows that the rate of growth of capital, i.e. the growth rate of the investment rate, is equal to the growth rate of five different variables: the profit retention ratio, the profit share, capacity utilisation, the technological capital-capacity ratio, and the leverage ratio. Consequently, the increase in the investment rate characteristic of a boom must eventually be financed through an increase in leverage, if we assume that the technological capital-capacity ratio is stable, since the profit share, profit retention and capacity utilisation are all bounded.

The second stage of Lavoie's analysis is to show how interest rates are made to increase. As he adopts the Post-Keynesian stance of money supply endogeneity, he cannot have recourse to a simple supply and demand argument, so he turns to inflation. He mentions two possible ways whereby an investment boom could generate inflation. He first remarks that inflation can be equated to the rates of growth of nominal wages, the profit share, and output per workers. If a rising investment rate is associated with a rising profit share it could thus induce inflation, but there is no necessity since the investment boom could be financed by different means. In any case, the change in profit share is bounded, so that inflation from this source is limited. Lavoie's second potential channel between investment boom and inflation could resolve this problem somewhat: If nominal wage growth depends positively on the growth of the profit share, its distance from a fair share, and inflation, even a declining profit share growth could generate accelerating inflation. Finally, Lavoie quickly deduces an increase in nominal interest rates from inflation and thus closes the model.

Given the simplicity of means employed to reach it, this is quite a neat exposition. Of course, it has the faults of its virtues and leaves a lot of loose ends. For instance, investment booms are simply assumed rather that derived, essentially taking Minksy's

behavioural assumptions for granted. Moreover, leaving the components of outside funding unspecified somewhat weakens the quality of the proxy. Interest-bearing debt and equity for which a firm may not even have the obligation to pay dividends have potentially very different implications for the fragility of the system, not to mention its dynamics. More importantly, the inflation-interest rate mechanism is somewhat weak. Minsky tended to be a little vague about the sources of inflation beyond the demand-side pressures on capital goods output generated by the boom or feedbacks from rising interest rates and to invoke an increase in the interest rate from the inner workings of the central bank as a *deus ex machina*. Lavoie's description is, by contrast, very precise, but his channels rely on a rising share of profits and an association between this rise and nominal wages, both of which are neither necessary nor evident. What is more, even if inflation is generated via this channel, all we get is an increase in *nominal* interest rates, which are not necessarily problematic for firms whose output price rises alongside the interest rates. Both explanations are less than satisfactory, to say the least.

Taylor and O'Connell (1985) also elaborate a formalisation of Minsky's financial instability hypothesis. They explicitly consider a situation where nominal wealth is macroeconomically determined, dependent on confidence and the state of the cycle, and assets choices by firms and households are not coordinated. Firms obtain finance from equity or loans from intermediaries, using it to build capital or their net worth. Meanwhile, households use intermediaries and equity markets to direct their savings to firms, but there is no effective arbitrage between the valuation of physical capital and the financial capital held by households. This results in a situation where the price of shares can differ substantially from the book value of capital. A second assumption that is central to their formulation is that there is a high substitutability between households' assets. In other words, there can be

a flight to money when panics occur, which in turn could lead to a rise in interest rates, investment cut-backs, and a decrease in profit rates.

To explore these ideas, Taylor and O'Connell posit a single economy-wide price level and define the shadow price leading investment decisions as being the capitalised value of expected earnings per unit of investments, the latter of which depending both on the current and anticipated profit rates as well as interest rates. Following Minsky, investment demand is then made to depend on the difference between this shadow price and the general price level. The growth rate of the capital stock thus depends negatively on the interest rate and positively on anticipated profits, like the rate of profits and capacity utilisation. The focus then shifts to the portfolio choices of individuals. Households allocate their wealth between money, equity, and bonds, depending on the interest rates and expected profits, but not on expected future equity prices for simplicity and because they deem that bubbles are not instrumental in Minsky's hypothesis. The upshot is that if we assume that markets clear, increases in the money supply, say exogenously via open market operations, will increase money holdings and decrease interest rates, and thus generate higher shadow and equity prices, while an increase in the anticipated profit rate will also lead to a decrease in interest rates as long as there is a high degree of substitutability between money and equity.

The assumed high asset substitutability generates a financial market equilibrium schedule with a negative slope in profit-interest rate space. Taylor and O'Connell's story is that higher expectations about prospective profits generate a shift away from bonds and money to equity, which should increase equity prices and thus wealth. Interest rates then adjust downward to make household content to hold the current stock of bonds at their new wealth levels. The equilibrium schedule in the commodity market also slopes down, more so than the financial market schedule, so that higher expected profits will yield lower interest

rates and a higher profit rate by stimulating a move to equity on the one hand and investment demand and output on the other. By contrast, if prospects are less optimistic, households will flee towards money, which will drive up the interest rate, decrease the profit rate and strangle growth. Contractionary monetary policy would have the same effect. To close the model, Taylor and O'Connell specify changes in expectations about prospective profits as being dependent on the level of the interest rate relative to a 'normal' average as well as government behaviour, which is assumed to be fairly autonomous - a fixed rule for money growth, expenditures as a function of the capital stock, and taxes as a proportion of expenditures.

This setting can exhibit instability and generate booms and financial meltdowns if the interest rate and the demand for liquidity respond sufficiently to changes in profit expectations, which is possible under high asset substitutability. Under these conditions, a downward change in anticipated profits will lead to an increase in interest rates and then a decrease in profits, all of which induce households to increase their money balances, which in turn lead to further interest rate increases and so on. Finally, they note that this basic model can be easily expanded to account for more complexity in financial intermediation, such that both booms and crisis situations can be exacerbated by the creation and destruction of financial structures - the system's fragility increase during a boom and the downfall is accelerated when the time of reckoning comes.

Taylor and O'Connell's article is much more elaborate than Lavoie's and as such is more detailed about the mechanisms underlying it. The formation of expectations about prospective profits is modelled explicitly, as are movements in the interest rate independently of its inflation component. In so doing, however, they end up departing markedly from Minsky's accounts. The responsibility for a downturn is now put exclusively

on a change in expectations, as the interest rate is relegated to the position of an exacerbating factor, forever decreasing during a boom or increasing during a downturn and thus not increasing at some point to signal the end of the boom. But as modelled, the process whereby expectations are generated is also completely inertial. In other words, not only is it bereft of much of its behavioural content, such as the state of confidence, but the way it is reduced to a mechanical backward-looking rule with respect to the interest (or profit) rate prevents it from exhibiting sudden (or even any) changes. It is true that a high substitutability between different assets, notably money and equity, which can be likened to 'irrational exuberance' or a marked desire for liquidity during a downturn, can be considered as an element of fragility stemming from fundamental uncertainty, but this is a little stark compared to the richness of Minsky's description. In short, while it contains many elements taken from Minsky's analysis, Taylor and O'Connell's model amounts to a representation of an economy that could spiral downward or upward, which stands in contrast with the cyclical account proposed by Minsky.[45]

Delli Gatti and Gallegati (1990) present a third model along the lines of Minsky's hypothesis. Their analysis is focused around the interaction of the demand and supply price of capital assets, or in other terms the current asset price and the price of investment commodities, the latter of which is distinct from the price of consumption output. The two output prices are assumed to be cost-determined, while the price of capital assets is left flexible. Just as Taylor and O'Connell, they treat commodity and financial markets separately, assuming that household investment decisions are divorced from firm investment decisions. The commodity sector is modelled as a Kaleckian system with two sectors, where

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[45] Skott (1994b) comments about the paper in a similar way. In particular, he notes that the rule they employ for the adjustment of profit expectations is somewhat ad hoc and that it is strange that these expectations are made to evolve without any feedback of realised outcomes. Furthermore, Skott argues that the choice of the interest rate as a key variable is questionable in that it is a poor indicator of the multi-dimensional financial practices and institutions described by Minsky.

investment and profits are assumed to be above zero[46]. Following Minsky, they make

investment demand depend on the difference between capital asset prices and the price of

investment goods, as well as retained profits. The price of capital assets is assumed to be

above the price of investment goods since there would be no investment otherwise, which is

ruled out by assumption. Delli Gatti and Gallegati project the resulting commodity market

equilibrium schedule in profit - asset price space, where its slope is ambiguous.

For the monetary sector, Delli Gatti and Gallegati start by distinguishing three

distinct demand motives for money: Transaction, speculation, and finance. The demand for

transaction purposes is assumed to be a linear function of nominal income. The speculative

demand for money is a function of the difference between prospective and current asset

prices following a simple rule: If prospective equity prices are above current prices, all

wealth will be held in the form of equity and vice versa if equity prices are expected to drop,

except for a small intermediary band with higher current prices, which is diversified linearly

until all wealth is expended. On aggregate, there is no money hoarding if the weighted

average of price expectations is above the current price, some if it lies within the aggregate

band, etc.[47] Finally, the demand for money for financing purposes arises out of the financing

gap of firms, i.e. the difference between investment and retained profits. Since investment is

independent from savings, the latter being even generated by the former through the

multiplier in Keynesian fashion, there is a need for external finance. The presence of

external finance in turn insures that investment not be a stable function of income and thus

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[46] Delli Gatti and Gallegati claim that it is necessary for the viability of the model to assume that investment is positive, otherwise virtually all the variables also fall to zero. This is only a result of the way the model is built, however. Although it would certainly lose a lot of its interest, the model could easily be devised with only a consumption sector. It is only by assuming the presence of interest in the first place that all the other variables can be made to depend on it.

[47] This is a strange feature of their model. It would seem that as soon as one agent's evaluation of prospective asset prices lies below current asset prices, there should be a positive level of hoarding in the aggregate. Of course, this issue does not arise if there is a representative agent or if all agents are assumed to be similar, but I could not trace such hypotheses in the paper.

ultimately determines it, along with employment. The money market equilibrium schedule resulting from the consideration of these three distinct demand functions, which Delli Gatti and Gallegati once again project in profit – asset price space, also has an ambiguous slope.

With their IS-LM model in hand, Delli Gatti and Gallegati turn to the analysis of instability proper. They adopt Minsky's view that instability comes from fragility, which they model using the leverage ratio – the financing gap over retained profits – like Lavoie. The price of capital assets has an unambiguous positive impact on the leverage ratio and the authors assume that greater profits will lead to more leveraged investments. Given these relations, the profit – asset price space allows for the projection of a map of negatively sloped iso-leverage curves. To this, they add dynamic adjustment mechanisms for profits and capital asset prices. Prices are assumed to evolve through time as a function of the difference between investment and saving, while the price of capital assets evolves as a function of the excess demand for money. Delli Gatti and Gallegati then note that if we assume, following Minsky, that the elasticity of real investment to profits increase during a business upswing, both IS and LM curve will move counter-clockwise in the profit - asset price space. Such a movement in turn gives rise to the possibility that the leverage ratio will also increase in the process.

The model by Delli Gatti and Gallegati differs from the above two depictions in that its driving force is the relationship between the price of capital assets and that of investment output, which the authors deem to be closer to Minsky's original thought. The profit rate, which was at the centre of the analysis of Taylor and O'Connell, is not even computed and the interest rate never appears in the story, being neither used as an exacerbating factor as in Taylor and O'Connell's model, nor as a hindering one as it is by Lavoie. This latter omission is in part due to the fact that just like Taylor and O'Connell, Delli Gatti and Gallegati outline

a model wherein a situation of fragility is generated during an expansion without actually

providing a mechanism whereby the expansion comes to an end, which remains a serious

limitation. Furthermore, the expectations process is left unspecified and relegated to the

status of a bystander, as only actual prices are made to adjust. Delli Gatti and Gallegati's

account is certainly interesting in that it puts Minsky's dual price analysis back to the fore,

but the absence of both a formal treatment of expectations as well as any effect on the

interest rates or even prices are two important and perhaps unfortunate departures from

Minsky's analysis[48].

Although they differ in their treatment and focus, the three models just reviewed

share the important limitation of being unidirectional – depicting boom or crisis situations,

but no transition – unlike Minsky's account. By contrast, Skott (1994a, b) frames his

exploration Minsky's financial instability hypothesis as a search for a possibility of economic

cycles generated by financial variables. Starting from a historical standpoint, he disregards

specific indicators or institutional arrangements and adopts the general categories of

tranquility and fragility (or financial trouble and laxity) as financial variables in order to retain

the richness and complexity of the financial processes they encompass. The change in

fragility is assumed to depend positively on the current state of tranquility, while tranquility

is a function of fragility (negative) and the realised profit rate (positive), the latter

operationalised through the output-capital ratio, following the assumption that this ratio and

the profit rate are functionally related. These two variables are then grafted on a simple

representation of investment, which in addition to the financial variables also depends on

the output-capital ratio, while saving is assumed to depend only on the output-capital ratio

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[48] Skott (1994a, b) notes that «the interest rate» may not be that interesting a variable to focus on, given the complexity of the financial market processes under study and their historically contingent nature. Its inclusion in formal model of Minsky's financial instability hypothesis might therefore not be that crucial.

for simplicity but without any qualitative impact. From this basis, Skott generates three different models by playing around with the functional forms and specifications of the equations, one timeless, another in discrete time, and the last one in continuous time, all of which can give rise to cyclicality under the right conditions.

The model without any time consideration has a completely linear specification, save for upper and lower bounds on the value of the investment-output ratio, and the analysis is conducted in fragility – output-capital ratio space. The model can exhibit cyclical behaviour if the financial variables exert an important influence on investment, in a way that makes the system unstable, and the impact of fragility on tranquility (or the lack thereof) is relatively pronounced, so that the combined influence of fragility on investment is negative.

In the discrete-time version, the model remains linear for the most part, but tranquility is now related to fragility through a concave function. Skott justifies this formulation with the observation that the magnitude of the impact of fragility is likely to be inversely related to existent safety margins, themselves inversely related to fragility. This setting can generate a range of dynamic outcomes, notably chaotic variations with perpetual fluctuations. However, the non-linearity in the financial variable is crucial for this result, as is the discrete-time specification, two hypotheses which are questionable, like the assumption held in the first two models that the model is at its short-run equilibrium.

To reinforce the argument, Skott therefore jettisons these assumptions and builds a continuous-time model based on Kaldor's model of the trade cycle, which is linear in its financial arguments, though the investment is now an S-shaped function of the output-capital ratio. This third model can exhibit cyclical behaviour when fragility has a negative impact on the rate of growth of capital, either directly or via its negative effect on tranquility. Even then, however, cyclicality is only one of the possible outcomes.

Skott's formalisations stand out amidst the others as they are the only ones within which cyclical systemic behaviour is generated. The process is entirely endogenous and even dispenses with movements in the interest rate as proximate causes of the downturn for which the justification is sometimes shaky. These results seem to be obtained at the cost of a more precise delineation of economic processes, however. In addition to the absence of a labour market and the concomitant analysis of consumption behaviour, a limitation Skott acknowledges, other important components are quite starkly defined. The motivations behind investment decisions are not really explored, for example, as they are made to depend squarely on the profit rate and the financial variables, wherein many other factors are admittedly subsumed. Moreover, investment is undifferentiated. Presumably, varied degrees of prudence or excitement are likely to lead to different types of investment, which could in turn influence the level of fragility in an economy.

Having such general and sweeping variables also raises some questions with respect to units and functional form, the latter questioning being central to the model as a whole given the preponderant role of non-linearities in the generation of cyclical behaviour. At the same time, this generality can also be viewed as an asset in that it does not confine the model to particular economic settings. In particular, Skott argues that the use of fragility and tranquility as financial variables allows for an analysis that is less time and institutionally constrained. Be that as it may, Skott's formalisations need to be complemented by more detailed accounts if they are to be used to describe particular situations.

Finally, there is still no explicit consideration of the formation of expectations or even of agent behaviour in financial markets in this case, as the question is eluded somewhat by appealing to the dynamic relationship between fragility and tranquility and otherwise subsuming agent behaviour under them. This is problematic, notably given the fact that

ultimately, tranquility and fragility and outcome variables. Fragility depends on tranquility, which itself depends on the realised profit rate. The specification of the model implies that a given level of realised profit is always perceived in the same way. But as I argue in chapter 2, people's vision of any given outcome is likely to evolve endogenously as well, generating different levels of tranquility (disturbances are likely to be more worrisome right after the crash, for example).

While all four of these models are interesting rendering of Minsky's hypothesis, especially Skott's wherein endogenous cycles are generated, they all have important lacunae. One of the most important ones is that their behavioural components are either absent (Lavoie), stark and rigid (Taylor and O'Connell, Delli Gatti and Gallegati), or subsumed in general financial variables (Skott). A more precise definition of some decision-processes, notably the formation of expectations, would be interesting. In this, I think, behavioural economics could have a useful role to play.

Another drawback of these four models is that they don't really apply to international financial markets. The setting in Lavoie's model is much too stark and would need a major revamping before it could be applied to international financial crises. Taylor and O'Connell's depiction of a forever expanding (or shrinking) economy centres on an asset substitution which does not seem that relevant in an international context, especially if the potential level of funds forthcoming to any small market far outweigh the actual amount at work there, and it is problematically unidirectional. Delli Gatti and Gallegati's formalisation is also problematic since it focuses on a price distinction that is not faced by international investors, because of the existence of the two levels of markets. That said, those last two formulations could perhaps be recuperated if the analysis centred on the inner working of the economies and international markets were depicted as exogenous potential

supply of resources. This seems like a dubious way to proceed, however, since most of the action in terms of confidence levels seems to happen within international markets. Skott's account is more pliable, given that it keep financial markets in the background and remains at a high degree of abstraction. To be useful, though, a model would have to specify particular outcomes for variables such as exchange rates or capital flows.

4.1.1.2   The International Scene

The four formalisations reviewed above remain within the confine of a generic closed economy. The characteristics of an advanced capitalist economy are easily discernible but actual institutional or historical details are shunned in favour of a more general coverage. Kindleberger (2000) takes the exact opposite approach and gives a detailed historical account of different financial crises across the world, taking as general framework a variation on Minsky's financial instability hypothesis. His method is to divide the economic process leading to a crisis in different stages and then illustrate them using historical evidence. Kindleberger's rich account serves as a good complement to the more formal analyses described in the previous sub-section and without going into the specifics of the historical analysis, his version of Minsky's instability hypothesis deserves some attention.

For Kindleberger, the typical build-up of a crisis situation starts with a displacement – an important macroeconomic shock – which opens new profit opportunities in some sectors and closes some in others. If the creation of the new opportunities more than compensates the disappearance of the old ones, the displacement results in increase in investment, production, and a boom situation. The boom is then fed by an expansion of credit that increases the money supply, either through the banking system, new credit instruments or personal credit. An urge to speculate takes hold of an important proportion

of investors, which leads to an increase in effective demand, which in turn gives rise to inflation when the economy gets near total capacity utilisation. This process itself opens up new profit opportunities, notably through speculation on price increases, feeding the boom further.

As the boom runs its course, it becomes increasingly hard to stand by and see the participants get rich and people are drawn in, sometimes without much understanding of the process. Eventually, some insiders start perceiving that potential profit opportunities may be exhausted or that the structure has become too fragile and they start selling off, while new recruits are still being drawn in. Prices settle and the upward trend in the market abates, which sends the signal to move into more liquid assets. The move itself might be set off by a dramatic event such as a bankruptcy or a scandal – speculative expansions are golden opportunities for swindlers and tight credit situations can not only lead to financial distress, especially when the market settles down and euphoric expectations cannot be validated, but also incite fraudulent behaviour – or simply be a response of different distress signal sent by various sectors of the economy. Whatever the proximate causes, which are immaterial for the general analysis, there is a major reversal of confidence and people rush out into liquid assets in a more or less disorderly fashion and panic sets in. Overstretched firms then experience trouble, bankruptcies accumulate, and the economy goes into a downward spiral. This downward cycle lasts until trading is cut-off or prices fall so low that investors start coming back. The crash can also be shortened or softened if there is a lender of last resort which manages to reassure investors and stem the outflow from the financial markets.

Kindleberger's variant of the financial instability hypothesis adjoins two new elements to Minsky's layout. Firstly, whereas the lull of good times were formerly deemed sufficient to provoke an increase in fragility in the system and start a build-up towards a

crisis-prone state, Kindleberger posits the existence of an initial displacement which leads to a boom situation. This change does not appear to be material, however. It does imply the introduction of some exogeneity in the model, unless it is also posited that such shocks are endogenously generated, but not in the financial processes themselves, which is arguably the portion that matters. Moreover, the presence of an initial displacement is coherent with Minsky's theory, though it is not deemed to be needed. In that sense, Kindleberger's account is simply a little more restrictive than Minsky's.

A second change, the introduction of a demarcation between insiders and outsiders, is more fundamental, although once again not inconsistent with Minsky's version. No differentiation is necessary for the financial instability hypothesis; it is not only immaterial whether the expectations of all agents change concurrently or not, but also unimportant whose opinions change first if they don't all evolve at the same speed. At the same time, a process whereby a herd is led by some insiders could also fit within the general pattern. This last scenario raises questions of market structure and intentionality, however. What is the place and power of insiders versus outsiders? If there are insiders with a better access to information and perhaps some market power, what incentives do they face when they take investment decisions and send signals?

Beyond these interrogations, the introduction of a differentiation between insiders and outsiders helps Kindleberger to describe a distinct mechanism whereby the boom can morph into crisis. In all the other accounts so far, such a mechanism is either absent or the role is played by the interest rates, except for Skott's models, where tipping is more or less posited at a certain level of financial fragility without there being much elaboration on the topic. Kindleberger's description of the settling down of markets, with the concomitant distress for indebted firms and the mixed signals it sends which herald a crisis, relies partly

on the role of insiders in operating a timely pull-out. While Kindleberger's alternative deserves to be studied, analysis in behavioural finance tends to suggest that everybody is subject to behavioural heuristics, which undermines this interpretation. At the very least, this calls for an extensive analysis of the microstructure of a market beset by a crisis and the way it may or may not have contributed to the crisis.

Kindleberger projects the financial instability hypothesis unto a historical and international context, using examples taken from many countries over a period spanning more than three centuries. However, he says relatively little on the workings of international financial markets themselves, except for considerations on the possibility of contagion across different national markets. In other words, he does speak of how national markets are linked and how trouble in one market may spill in another, but he does not analyse in the depth the functioning and inner logic of international markets. Wade (2000) fills this lacuna by providing an analysis of the underlying causes of the Asian crisis based on Minsky's financial instability hypothesis.

Wade starts his account from common grounds, focusing in particular on the importance of the increase in leverage during an investment boom as a fragilising factor for the system. He mentions how higher leverage is worst for instability since debt calls for capital and interest payments regardless of the financial results of the debtor, while equity commands a share in profits. Nonetheless, Wade acknowledges that equity finance may also be destabilising during a boom, since extrapolative [pro-cyclical] expectations can create a bubble and firms may borrow against rising equity prices or simply to buy back their stocks to increase its price. He also notes in passing that countercyclical fiscal policy exacerbates the problem since the government borrows less and more savings are intermediated through the banking system to firms. This statement seems to suggest that Wade does not adopt the

common Post-Keynesian position of endogenous money supply or even the direction of causality from investment to savings, implying rather that private and public investment are competing for scarce savings. Finally, he makes behavioural assumptions about investors that are similar to Minsky's and those underlying the formalisations of the previous sub-section. Having succinctly described his variant of the usual closed economy version of the financial instability hypothesis, Wade then introduces international elements in the model.

Wade first contends that in a small booming economy open to trade, imports will rise, increasing the current account deficit and pulling foreign savings to finance the deficit, which in turn will put upward pressure on the real exchange rate and decrease the competitiveness and profitability of the domestic tradeable sector. If the capital account is also open and domestic interest rates are higher than world average, the boom will suck in more capital than is needed by the trade process as foreign investors will rush in to partake in the boom. High capital inflows could translate into higher reserves if the exchange rate is not left to float, which in turn is likely to generate a money supply expansion, further feeding the credit boom, since sterilisation procedures are both costly and difficult[49]. The credit boom will then vent itself through either of four channels: (1) A rise in consumer imports, (2) an inflation in consumer goods prices; (3) a surge in investment in asset market, inflating their price; and (4) an increase in industrial investment, coming from the assumption that production increments can always be exported if not sold at home, and thus a rise in capital goods imports. In short, this small open economy faces inflationary pressures which lead to an appreciation of the real exchange rate and a further deterioration of the current account,

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[49] Wade mentions three reasons why inflows may be hard to sterilise: It is expensive, since the government pays a higher interest rate on domestic bonds than it gets from the instrument purchased with the reserves, such as treasury bonds; it may not be feasible at all if domestic financial markets are not deep enough; and it will tend to raise domestic interest rates, which will pull more money in, defeating the purpose.

either through consumer goods imports if consumption propensities are high or capital goods imports if saving propensities are high.

From this analysis, at least six potential sources of endogenously generated fragility are discernable: (a) A productive capacity bubble generated by sustained above-trend investment levels; (b) high and rising ratio of corporate debt to equity; (c) an asset price bubble; (d) smaller margin of safety held by economic agents with extrapolative expectations; (e) high and rising current account deficits; and (6) relatively high and rising external debt. Under these conditions, says Wade, any number of small shocks, such as a small devaluation, an increase in interest rates or a decrease in demand can push several firms into illiquidity. The usual scenario might then ensue, taking here the form of a repatriation of foreign investment abroad, forced devaluation, credit contraction and a round of defaults.

Wade's main intent in adapting the financial instability hypothesis to international financial markets is to provide an alternative explanation to the Asian crisis, which does not rely on factors idiosyncratic to the affected Asian economies. In this, he certainly seems very successful; his account of the Asian experience within this theoretical framework is very compelling. As a general model, however, it has a few loose ends. For instance, Wade's opening statement to the effect that a boom in a small economy open to trade exacerbates its current account deficit and generate an inflow of capital to finance it assumes both that there is a current account deficit and that foreigners are willing to oblige. Such assumptions are by no means farfetched, but they must be justified. Similarly, in a country which is only open to trade, Wade's assertion that a boom will lead to an appreciation in the real exchange rate is not evident, especially if the pressures to import are not matched by a willingness in foreign capital markets to oblige. Moreover, the source of extrapolative expectation is as usual not really discussed, nor are the factors underlying the domestic boom, though for this

latter issue Wade presumably relies on the original analysis coupled with the possibility of an exogenous capital push by international financial markets. None of these are crucial flaws, and most of the elements in his story are plausible, but the model could benefit from some tightening.

Finally, it is also worth noting that the idea of a capital push by international financial markets occupies a central place in Wade's account. For the process to unfold there must be a possibility and a willingness on the part of the international capital markets to flood the affected economies, that is the capital account must be open and free of control, and international investors must be [increasingly] eager to invest in the booming economy. At the other end, for a crisis to erupt, investors have to be liable to experience a rapid switch in expectations and be able to rush out. But this is the essence of the financial instability hypothesis simply reformulated in the context of international financial markets and thus has to constitute a central element of any such reformulation.

To summarize, the Minskian framework provides a good structure to analyse financial crisis, a structure that is extendable to an international setting and amenable to a definition of agents that moves us away from the rational actor paradigm. The way this latter issue has been treated so far is not entirely satisfactory. The original story has some richness and a plausible account of the way human expectations and actions will evolve at different moments of an expansion, but it tends to stay at a general level, painting an overall picture lacking in details. It is also somewhat ungrounded, more asserted than demonstrated. The lack of precision in Minsky's theory is problematic when trying to study specific crises, in that it makes it difficult to analyse expectations per se. This has typically led people using this theory to focus on actual indicators of fragility (e.g. indices of leverage) rather than the

evolution of expectations, resulting in difficulties in explaining how and why these indicators move the way they do.

Analytical frameworks don't improve this aspect much. Most either dispense with the behavioural component (Lavoie) or turn it into some stark mechanical rule having relatively little to do with the original narrative (Taylor and O'Connell, Delli Gatti and Gallegatti). These mechanical rules generate unidirectional movements (booms or busts), but they cannot account for reversal in expectations (or economic fortunes for that matter). The rules are also inconsistent with a large portion of the behavioural literature reviewed in chapter 2, such as tendencies for over-confidence in a boom, or how similar outcomes may be viewed differently at different moments. Skott does a better job, but he still sweeps consideration of expectations formation or even agent behaviour in financial markets in the dynamic relationship of two ultimately outcome-based general financial variables. This prevents an explicit analysis of the way expectations can be influenced by different outcomes or state of the environment and the way they determine agent behaviour. This is problematic in view of the assumptions that are taken with respect to the way outcomes feed in these general financial variables, some of which are also inconsistent with the behavioural literature reviewed earlier. The more precise behavioural rules adopted in analytical frameworks therefore don't resolve the problem inherent in Minsky's treatment of the behavioural component of his theory.

What I propose to do is to address these lacunae via the incorporation of elements from behavioural economics. In this way, I aim to give Minsky's general narrative precise behavioural foundations, detailing in the process how expectations formation influences the general level of fragility in the economy. Conversely, putting these behavioural elements in a Minskian structure allows for a dynamic analysis of financial crises encompassing various

sectors of the economy. This gets us away from models of bubbles with financial markets operating in vacuum.

4.2   The Model

To say that there exists fundamental uncertainty in a given situation is to make a statement about the information available to human beings [or the lack thereof] as they act when they are put in that situation. Likewise, the seven behavioural traits I bring forth to delineate further human behaviour in conditions of fundamental uncertainty are primarily about the selection and treatment of information.[50] My claim is thus that within the structure of a modern capitalist economy, the way economic agents integrate and treat information in financial market settings, in their effort to cope with fundamental uncertainty, gives rise to sets of practices that can be conducive to crises.

Consider an economy populated by non-financial firms and financial institutions. Firm managers make investment decisions based on their expectations of various variables pertaining to the functioning of their business, such as demand and future profitability, which also predicates their credit requirements. Conversely, financial institutions allocate credit according to different prudential standards as they assess the riskiness and potential payoffs of different investment projects. Outcomes are then realised and things are fine as long as profit flows are sufficient to justify the ex ante amount of borrowing and support its servicing costs, while trouble starts brewing if profits fall shorts of debt servicing requirements.

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[50] The only exception is *overconfidence*, whose purview is larger than simply the treatment of information and encompasses the decision process itself.

The two most common ways to represent the way these agents forecast the future is to endow them with rational forward-looking expectations (RE) or backward-looking expectations (BLE). RE imply that agents always correctly forecast the future within the model, up to an exogenous shock or a deficit of information, which means that they perfectly understand the economy, conceptualise it in the exact same way as the modeller, and can treat correctly all the relevant information at their disposal. Under fundamental uncertainty, RE is not a feasible alternative, since agents cannot form complete probability distributions over the future – whether or not they would have the computing capabilities to do so.

By contrast, BLE is less demanding in that they assume that agents simply project the past unto the future, thus themselves implicitly making the assumption that past realisations of any given variable can be used as a guide to its future value. While this is a possible strategy under fundamental uncertainty, its full-blown implementation would require vast resources. It is not only that agents are able to correctly observe past economic outcomes and project them forward, but they have to observe a multiplicity of these outcomes. For example, suppose a manager is trying to determine how much demand there will be for a given product. Presumably, that manager would have to identify all the variables that are relevant to that demand; figure out their actual influence; trace a recent path for these variables; project that path forward in one way or another; and then compute an overall estimate of demand. That manager would then have to do that for a whole array of variables that may be pertinent for the health of his business. In the process, that manager would have to be careful to determine exactly what expectations are over – levels or rate of change? – an issue I come back to below. A possible strategy, sure, but an exhausting one.

Instead of an extensive version of BLE, agents are at best reduced to a smaller and modified version, where some past outcomes are observed and deemed *representative* of the current state of affairs. In selecting this subset of events, agents will find some information more salient than others. Some spectacular success or failure is likely to be given more weight than "normal" outcomes and the *availability* of given events will fade through time. In fact, the same information is liable to be interpreted differently at different moments: Unless it is dire, bad news will tend to be discounted in good times and vice versa in bad times, a tendency reinforced by the fact that people mainly look for corroborative evidence. That is to say, not only are agents more receptive to different pieces of information at different time, but the way they treat this information is itself influenced by outside circumstances. Since people have difficulty ascribing *causality*, this means that they are likely to become progressively *overconfident* if they enjoy a streak of successes or unduly prudent after a string of mishaps; exuberant in an expansion, scared after a crisis.

This duality, whereby agents are selective in the information they use and their treatment of that information is dependent on the general state of things, is important. It is one of the major differences with a traditional BLE framework, however extensive it is to be. It is not only that agents formulate expectations by projecting a subset of realisations of given variables forward, but that they operationalise these realisations differently at different junctures. The longer an expansion will last, for instance, the more positively given outcomes will be perceived. This implies that as time passes, a greater discrepancy between realised outcomes and expectations is sustainable. In other words, the sustainable difference between realised outcomes and prior expectations, without reajustement, increases gradually during an expansion. Conversely, if there is a downturn, there will be a period of sustained

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"over-pessimism" where successive realisations above expectations do not bring a readjustment of expectations.

To further illustrate, consider Skott's (1994a, b) tranquility and fragility variables. To restate, tranquility represents the firms' ability to meet their financial commitments – depending on financial payments they have to make and realised cash-flows – and fragility the state of the financial system in terms of its resilience to different shocks. Within Skott's model, there is a negative feedback between the two variables, since fragility depends positively on tranquility while tranquility depends negatively on fragility. Instability is thus generated through the interaction of real and financial variables.

Now suppose that this framework is amended such that firm managers are forming expectations on future solvency, i.e. on the levels of future profit flows with which they could service their financial obligations. To keep things simple, suppose they are only looking at past profit realisations. According to the behavioural expectations formation process outlined above, a given ability to meet their commitment – a given level of tranquility – would lead, over the time of an expansion, to more optimistic predictions of future profit flows. This could, in turn, lead to a greater willingness on their part to take risks and, if the financial sector obliges, perhaps because they share similar expectations, a greater level of fragility for any given level of tranquility. In this way, the negative feedback between the two variables is dampened through time, as lower level of tranquility breed similar increases in fragility, despite the negative impact of the latter on tranquility. This is not to say that the interactions between real and financial variables are not important, but that this behavioural expectations formation process can actually contribute in an important way to the increase of fragility during an expansion.

In practice, to the extent that agents don't form expectations over every possible variable, the actual contribution of the expectations formation process to instability dynamics will depend on the variables over which expectations are formed. Different variables will be salient at different moments, with different impacts on agent behaviour. I will consider this explicitly when I detail a case study in the coming chapters.

This vision of varying treatment of information also addresses one criticism of behavioural finance, which is the claim that some agents, say people managing the investment positions of big firms like Citibank, should have most of the relevant information when they make decisions. The presence of fundamental uncertainty renders this impossible and, at any rate, the information to be had is sometimes of debatable quality.[51] Moreover, this brings back issues of limits to arbitrage, but beyond that, even so-called sophisticated investors will not interpret the same information the same way at different moment. That is to say, even information that is in principle available and sound, say quarterly results for firm managers, will be assessed differently in good or bad times.

Coming back to the population of firms and financiers, in the face of fundamental uncertainty, they would form expectations quite different in shape and nature than BLE or RE. Both these types of expectations imply a rapid adaptation to any change in situation, either through its projection forward (BLE) or simply an immediate and perfect integration in the expectations formation process. Agents under RE would never be durably wrong, even if random shocks may temporarily throw them off, and agents holding BLE would generally tend towards the correct prediction by integrating any change in their new forecast, even though again, they might never be entirely right. Actually, under certain circumstances, expectations generated with BLE may fall ever further. For example, if the rate of inflation is

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[51] See, for example, Kregel (2008) on how a large part of the information on the borrowers getting sub-prime loans in the United States between 2003 and 2006 was either missing or fabricated.

ever increasing. Expectations generated about the price level using BLE will fall short and increasingly so. Nevertheless, agents would adjust their predictions in the right direction, even though the adjustment would be increasingly insufficient. Eventually, they might be led to change the variable over which they are forming expectations (e.g. go for inflation instead of the price level), which would contribute to the accuracy of BLE. Finally, BLE might also lead to adjustments in the wrong direction is there are sharp oscillations in the data (then again, this could be built in the expectations formation mechanism). Still, to the extent that agents select appropriate variables and that trends form, including a stabilisation of the variable in question, BLE would generally allow agents to form expectations tending towards realisations.

By contrast, the use of behavioural heuristics may lead agents to elaborate predictions that will tend to diverge systematically from reality, and even increasingly so, if particular trends hold up. During an economic expansion, for example, agents will become more and more disconnected from reality, exhibiting increasingly unwarranted optimism. This would occur through phenomena such as a string of successes that would make positive news more *salient* and *representative* of the overall state of things, and breed *over-confidence*.[52] Similarly, if there is a downturn, they are liable to panic rather than calmly revise their expectations downward. In this case, since the crisis is much more *available* than other information, agents expectations are likely to overshoot downward.

Under certain circumstances, behavioural heuristics could also help, rather than hinder, predictive accuracy. For example, imagine a case of oscillating outcomes (say growth alternating between 5% and -5%). BLE formed by taking only past realisations of this variable into account, say through a moving average with decreasing weights, would tend to

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[52] See appendix A below for an example of such a process.

predict an increase for each decrease and vice versa. By contrast, agents might not see each increase or decrease as *representative* of a trend starting and thus be more conservative in their assessment. The impact of different expectations formations mechanism therefore remains context-specific.

Coming back to the expansion scenario, one interesting aspect of this is that profit flows could actually be going up during an expansion, but if profit expectations keep outstripping them in an ever greater way, the actual position of the firm could be deteriorating. As I detail later in the study of a crisis that happened in Turkey in 2000-2001, demand in the Turkish case was a key variable over which non-financial corporations were forming expectations. During an expansion that happened in the second part of the 1990s, expectations of new orders, for example, gradually came to outstrip the number of actual new orders, with the disconnect increasing over time. Assuming investment decisions are made on the basis of expectation of future demand, this would imply that firms invested more than they would have if their expectations had been on the mark. To the extent that this investment is partly financed through loans, this also means that firms contract more debt than they would have with lower expectations, debt they have an increasing difficulty to service given that there is a relative lack of outlet for their products. I explore such hypotheses in the next chapters.

Such an expansion can proceed for a while, but in the absence of any outside check like government-set prudential standards, the likelihood of crisis will gradually increase as agents become less prudent.[53] In theory, there are a few possible scenarios that can arise. Less prudent investors may start going for projects that are inherently more risky, either

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[53] Government policy can work the other way as well. In Turkey, for example, the government offered foreign creditors a complete guarantee on the loans they provided to domestic firms and financial institutions, a policy unlikely to instil prudence or restraint on the part of foreign investors.

because more secure ones become too scarce to respond to the demand or simply because they promise a higher possible return. The economy might overheat, leading to processes such as the ones recounted by Minsky (1982) whereby there are inflationary pressures or interest rates increases. Another possibility is simply that margins of safety having been decreased, with an increase in indebtedness relative to the flows of profits supposed to be justifying this debt, many firms are more vulnerable to any given problem that can threaten cash-flow in the short-run, and such events always happen. Finally, a well-publicised scandal may lead to a revision in expectations and lead to an overcompensation downward in one market, which could then have a domino effect in others.

In an international context, managers of domestic firms are liable to take on an ever greater volume of loans, foreign and domestic, for given profit levels, lowering the resilience of domestic firms to adverse outcomes. Eventually, the situation will become untenable and start unravelling. The more extended firms are at that point, the further individual expectations are from realised outcomes, the steeper the fall, as agents suddenly and drastically modify their view of the economy. Expectations go back down towards what economic outcomes would warrant, likely overshooting in the process, as now bad news become more *available* and failures *representative*, leading to rash moves rather than an orderly shakeout.

Time is central to this story and so is the irreversibility of investment, two elements also important in the Keynesian tradition. The build-up towards a crisis is gradual, rather than falling from the sky as in second-generation models; it happens because agents become increasingly oblivious to the risk of a downturn, unlike in first-generation models where investors see it coming all along and third-generation models where the problem is solely structural. The over-extension of firms is problematic because their investment projects

cannot be liquidated easily in case of a sudden need for cash-flow. Moreover, there is no equilibrium towards which the economy is tending, but rather a constantly evolving situation, though at any moment markets may actually clear. In fact, as Minsky (1982) states, there can be no such thing as a stable equilibrium, since stability would breed comfort and optimism, and thus its undoing through an expansion likely to overshoot: Stability breeds instability.

This framework shares similarities with a bubble process, in that in an expansion, expectations will gradually diverge from realised outcomes, which would be considered to be a basis of reference. At the same time, the process at work is larger than a simple bubble in financial market, being more cyclical in nature. There is nothing exceptional about the increase in fragility, but rather a systematic tendency for it to gradually increase in an economy in every expansion, for recessions to subside and give way to such expansions, even though they have a tendency to last longer than they could have otherwise. In this way, it resembles Minsky's framework, with more precise behavioural underpinnings. In fact, having the agents described in behavioural economics evolve in a Keynesian world creates such a cyclical process.

Having a more precise description of agent behaviour allows me to improve on Minsky's framework by delineating precisely some of the channels whereby expectations formation can contribute to changes in the levels of fragility. This points to the importance of looking at expectations survey when assessing the health of an economy, to see if and how in line expectations are with realisations. Such an analysis can complement objective risk measures, such as leverage or debt-reserve ratios. I use both types of indices in what follows.

Is my framework a good representation of the instances of crisis we have witnessed in recent years? In the next chapters, I look at one such crisis, which occurred in Turkey in

2000-2001, to see how this theoretical account fares in the real world. Turkey had another crisis in 1994, so by looking at the period in between, it is possible to study a whole cycle.

CHAPTER 5

THE TURKISH CRISIS

Up to now, I have discussed financial crises in general terms, delineating different theoretical frameworks that have been devised to make sense of them and elaborating my own based on different theoretical traditions. While theoretical debates are fundamental, ultimately the test is to see if any of these theories are useful to explain actual occurrences. In this chapter, I thus turn to a financial crisis that happened in Turkey in 2000-2001 and study it through the lens of the modern currency crisis tradition to see if its different generations provide a good theoretical underpinning to explain the crisis. While existing explanations based on this tradition make good points and bring out some important elements I ultimately find them lacking. The next chapter is then devoted to applying my framework to that crisis to see if it fares better and improves on the existing accounts.

The Turkish crisis is interesting for a few reasons. It happened during an IMF stabilisation plan, which denotes a careful governmental monitoring of the economy – far from the implicit neglect depicted in first-generation models. Moreover, it happened while the capital account was fully liberalised, so that foreign and domestic markets could in principle interact freely. While in practice there is evidence that foreign investment was curtailed in some ways (Dufour and Orhangazi 2009), this set up does allow for the study of market behaviour with low constraints. Finally, the 2000-2001 crisis followed another important one that happened in 1994, with an expansion in between. This gives me access to a full economic cycle, allowing me to look at the evolution of fragility over time.

5.1   A Backgrounder on the Crisis

In order to put the 2000-2001 financial crisis in its proper context, it might be useful to look at some events and macroeconomic developments in the decade that preceded it. [54]

The capital account was completely liberalised in 1989 and remained so throughout the decade, all the way up to the financial crisis and beyond. In fact, the IMF forced the Turkish government to keep the capital account open even during the worst of the crisis, in exchange for its help (Dufour and Orhangazi 2009). The move was supposed to lead to financial deepening for the country, with a portfolio shift towards the financing of productive assets (Boratav and Yeldan 2002). Instead, as Akyüz and Boratav (2003) relate, the government ended up having to offer higher premia on its securities which pushed real interest rates up and provided private banks with arbitrage opportunities on the high rates on government securities compared to foreign borrowing and domestic deposits.

Boratav and Yeldan (2002) claim that this situation led the banking system to leave its traditional lending role and become mostly involved in dealing government securities. The extent of the phenomenon can be seen in Table 4. It is indeed true that the amount of government bonds increased a lot throughout the period, dwarfing the volume of shares on the stock market. Meanwhile, the volume of repo operations had reached 221 billion dollars (110%) of the GDP by 2000. This illustrates a broader increasing trend in government borrowing. By the end of the decade, interest payments absorbed 75% of tax revenues and the government was forced to borrow increasing amounts to meet the escalating debt charges (Akyüz and Boratav 2003).

However involved the banking system became in the securities market, Boratav and Yeldan overstate their point when they claim that banks abandoned their traditional role.

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[54] Boratav and Yeldan (2002) offer a good overview of the macroeconomic developments in Turkey following financial liberalisation.

From Figure 7, it can be seen that loans to non-financial corporations (NFCs) almost tripled during the 1990s, with a large portion of the increase happening at the end of the decade. Figures 6 and 8 also suggest that a lot of funds were being channelled to NFC loans as a proportion of GNP: While the proportion of domestic credit going to NFCs stayed relatively stable around 70 percent, domestic credit a proportion of GDP increased from 20 to 29 percent between 1990 and 1998, levelling off after that, with most of the action again happening in the second half of the decade.

At the same time, inflation was above 60% for the whole decade, sometimes going to 100%, but never spiralling in hyper-inflation (Akyüz and Boratav 2003). The combination of high interest and inflation rates, heightened activity on loans markets, and an open capital account generated a high degree of volatility in Turkish financial markets, including a particularly important crisis in 1994. Under these circumstances, Turkey's average growth was generally low and volatile (hovering between 9.3 percent and -5.5 percent of GDP), although there was an economic expansion between the crisis of 1994 and an earthquake of August 17, 1999 (see Table 5 for GDP growth statistics and Table 6 for unemployment statistics). Levels of private investment also experienced ups and down during the decade, with a peak before the 1994 crisis and an especially large increase for a few years starting in 1995 (Figures 12, 13, and 14).

In 1998, the Turkish government began working with the IMF to stabilise the economy in response to this decade of instability. The implementation of the stabilization program began in December 1999, following a slowdown after the Russian crisis in 1998 and the important earthquake of 1999 that reinforced the perceived need for the stabilisation package.

The plan that the Turkish government and the IMF designed to address this problem stressed the need to reduce inflation. One way in which this objective was to be reached was through the reduction of government debt, viewed as an important factor driving inflation, notably through widespread privatisation. Another important component of the program was the pledge by the Turkish government to maintain free capital flows and forgo any intensification of trade restrictions (IMF 1999a, b). Finally, the government abandoned its role as lender of last resort to the banking system. Instead, any insolvent banking institution was to be recovered by the Savings Deposits Insurance Fund (SDIF)[55] and subsequently restructured or liquidated, and the SDIF was only allowed to provide funds to institutions under its full control (IMF 1999b).

Turkey experienced major inflows of capital during the first few months of 2000 (see Figures 2, 4, and 5 for measures of inflows and debt).[56] Inflation was not quite receding as fast as planned, which made for a real exchange rate appreciation and a cheapening of foreign credit. Domestic firms and banks, which were in a bad position following the earthquake of the previous year, took the opportunity to switch a portion of their debts to foreign currency. A lot of people jumped on the wagon, creating a sort of financial bubble lasting several months and only slowing down in the fall of 2000.

IMF staff members proclaimed they were satisfied with the progress of the program as late as the end of June 2000 (IMF 2000a, b)[57], despite the strain that was mounting because price increases outpaced the crawling peg designed to move with expected inflation.

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[55] The SDIF was formed in 1983 to provide deposit insurance and put under the Central Bank. It was moved under the authority of Banking Supervision and Regulation Authority in 1999.

[56] FDI inflows were negligible for most of the period, going up mostly after the privatisation portion of the IMF program picked up and some firms were available at fire sale prices following the 2000-2001 crisis (Dufour and Orhangazi 2009).

[57] Information gleaned through private conversations held during the summer of 2006 with Central Bank officials suggest that officials were aware very early on that some components of the program were fairly ambitious, given the health of the banking system at the beginning of 2000. Nonetheless, optimism seems to have ruled the day at least until the end of the summer of 2000.

Until November 2000, Turkey was also earning praise from international financial analysts and the IMF for its stabilization policies (IMF, various years). But the continuous appreciation of the currency in real terms ultimately provoked a flight from the Turkish Lira in November (see Figure 1 for real exchange rate indices). During the last week of November alone, US$5.3 billion left Turkey thanks to short-term speculative operations, causing a severe liquidity shortage in domestic financial markets. This sent overnight interest rates as high as 2,000 percent. Capital outflows were halted and devaluation fears allayed only after the IMF granted US$7.5 billion of additional support.

The government then tried to maintain course, reassure investors, and push ahead with reforms. Nevertheless, in February 2001, capital outflows were reignited by news of a dispute between the President and the Prime Minister. Jittery investors pulled US$5 billion out of Turkey on February 19th alone. The central bank's foreign reserves were depleting rapidly and overnight interest rates rose to several thousand percent, which impeded the ability of the government to raise money. Under this pressure, the pegged exchange rate was abandoned and Turkish lira devalued about 30 percent against the US dollar.

This crisis was followed by a major recession whose effects still reverberate today.[58] The extent of the economic disruption that came in the wake of the crisis underlines again the need to have a proper understanding of the causes underlying international financial crises. In the case of the Turkish crisis, one needs to account both for the financial dynamics of the year 2000, which serves as a proximate explanation of the crisis, but also for any previous process which could have engendered a state of fragility in the Turkish financial sector and thus predicated the crisis. The period between the 1994 and the 2000-2001 crises is especially notable, including an expansion that slows down in 1998, following the troubles

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[58] See Dufour and Orhangazi (2009) for a description of some of the impacts of that crisis on the Turkish economy.

in Russia, and the 1999 earthquake. Overall, the model should account both for the existence of systemic fragility and the ultimate turning point.

5.2   Competing Explanations

There exist a few different accounts of the 2000-2001 financial crisis in Turkey. In fact, there was quite a lively debate around the role played by the IMF program for some time after the events. One of the main themes to emerge from this array of papers is that the banking sector was already very fragile at the outset of the program. This state of affairs was then exacerbated during its implementation, perhaps as a result of the program itself, eventually leading to a financial crisis. Opinions differ on the actual sets of reasons behind the crisis beyond the presence of this fragility, however. Of the explanations put forward, it seems logical to proceed in the same order as the modern currency crisis literature and look at each of the three generations in turn. As third-generation models are somewhat eclectic, I will focus on two prominent avatars devised for the Turkish crisis itself. In addition to these four models, Ekinci and Erturk (2004) elaborate a hypothesis to explain the reversal of capital flows in fall 2000 that has some merit. I will review it last.

The first two categories, first and second-generation models, are analysed in detail by Özatay and Sak (2003) and readily dismissed. As their arguments are quite persuasive, I utilize most of them in my own rendering. As I detail in chapter 2, first-generation models usually locate the problem in policy inconsistencies, the canonical version being the case of an expansionary policy coupled with a fixed exchange rate. The inconsistency leads to a gradual depletion of resources and the government is eventually forced to abandon the fixed exchange rate. The reasons behind these policy choices are not discussed explicitly, as the

authorities are essentially depicted as mechanistically following a policy rule until they can't keep it up it anymore.

This story does not really seem to hold for the 2000-2001 crisis. For one thing, although government debt was quite high, it was not monetised, but rather financed through the emission of debt instruments. Moreover, corrective measures were being taken in concordance with the IMF program and if anything, the outlook was getting better in 2000 than it had been in 1998 and 1999. Part of the IMF program entailed a quasi-currency board arrangement which meant that domestic money was created solely through foreign assets, preventing any abusive use of the printing press. Far from mechanically following conflicting policies, government authorities were trying to address some of the underlying problems within the confines of the prescriptions of the IMF program.

This illustrates the model's limitations from a behavioural standpoint. While the IMF program was indeed constraining, the authorities were not simply behaving as automatons, trying to inflate the economy until the rule became untenable. Meanwhile, investors were not simply bidding their time, attacking when the situation became ripe. The events of November resemble more a panic than a coordinated attack, more in line with fears of default risk than currency depreciation. This incidentally led the IMF to force the Turkish government to guarantee any loan made to domestic banks. At the same time, leaving aside for a moment the debt build-up of the late 1990s, the fragile situation was largely a result of the actions of foreign investors and their Turkish counterparts. The model accounts neither for this enthusiastic inflow of capital (and the concomitant domestic borrowing), nor the sudden halt even though reserves seemed to be doing fine, an issue linked with to its flawed description of agent psyche and motivations.

In terms of expected outcomes, first-generation models predict a progressive

decrease in reserves preceding the actual crash, as they are expended to support the

inconsistent peg, but no such trend was observed before the crisis erupted in November

2000. If anything, reserves were higher at that point than they had been at the outset of the

program (Figure 2).[59] Finally, 'fundamentals' were not great, but save for the soaring current

account deficit (Figure 3), which could be argued not to have been that dangerous given its

one-off nature (rather than being a structural problem) (Ekinci and Erturk 2004) and the

high volume of reserves available, the situation was not worse than in 1999. All in all, one

would be hard-pressed to fit the crisis in a first-generation framework.

Similar difficulties are encountered when second-generation models are considered.

The general idea behind this class of models is that government and investors should be

considered on an equal footing and both be depicted as rational maximisers. The

government tries to arbitrate between different policies, such as low unemployment or

output growth, and their fixed exchange rate commitment (including the value of that

commitment in terms of credibility). The government then simply chooses whether or not

to devalue by figuring out the path of action that bears the least cost (or most reward).

Investors affect this choice by forming expectations regarding the likelihood of devaluation

and acting accordingly, putting further pressure on the government if they indeed expect a

devaluation to occur, bringing a self-fulfilling component in the model. Amongst other

things, this class of models predicts a discrete jump in the exchange rate if there is a crisis, a

feature that was certainly present in the Turkish case. Beyond that, though, is this a good

description of the 2000-2001 crisis in Turkey?

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[59] Figure 2 also shows how short-run debt had risen, however, an issue I take on below.

One problem in trying to assess their relevance for the analysis of the Turkish crisis, or any other financial crisis for that matter, is that second-generation models rely on self-fulfilling prophecies and thus on changing expectations, something that can't really be observed in open international markets, at least not for all the relevant players. It can always be claimed tautologically after the fact that the run on the currency and the subsequent depreciation is evidence of a realised prophecy, but this is not particularly illuminating by itself.

In the Turkish case, it seems that the sentiment was good fairly late in the process. Akyüz and Boratav (2003) argue that there is some evidence that expectations became less optimistic after the summer, eventually leading up to the problems which occurred in November. Then again, as I relate above, no evidence of major concerns could be found on the part of the IMF or the financial analysts it quoted in its publications (IMF, various years) until November. Finally, interviews with officials of the Central Bank of the Republic of Turkey who were present during those years yield mixed results. Some do claim that there were concerns inside the Bank, but this is asserted in hindsight. Overall, this is not very conclusive.

Moreover, agents got it wrong the first time. The country did not devalue in November, instead managing as they could for a few more months. The prophecy was thus not fulfilled, at least not the first time. More generally, one problem with second-generation models is their short horizon. They don't have much to say about the factors explaining the optimism of the first few months, once again an important factor in making the situation ripe for crisis, nor even the reasons for the reversal, especially if it does not quite lead to currency devaluation in the end. Meanwhile, the authorities, who are supposed to be maximising, rather seem to react as they can. They supported the peg as long as they could

and finally let it go when it became untenable. Not really the hallmark of a cost-benefit analysis, with an optimal moment chosen for devaluation.

At least another important element constitutive of second-generation frameworks appears to have been absent. At the centre of second generation models is the existence of a trade-off, so that governments actually make the choice of abandoning the peg to pursue other objectives, such as expansionary fiscal or monetary policies. Such a trade-off, or even the notion of 'choice', is hard to find in the case of the 2000-2001 crisis. For one thing, the crisis was not followed by any sort of expansionary policy and the economy did not fare particularly well, as output contracted sharply and unemployment rose quickly (Tables 5 and 6). Moreover, the government attempted to stick with the program as long as it could, muddling through for a couple of months after the initial troubles in November, until the situation became unsustainable. In fact, virtually the only characteristic of the Turkish 2000-2001 crisis that fits a second-generation model is the discrete jump in the exchange rate following the abandonment of the peg (Figure 1). This probably constitutes further indictment of first-generation models, but can hardly be said to be rock-solid proof in favour of second-generation models.

So first- and second-generation models fail to provide much explanation for the Turkish crisis, what about third-generation models? Amidst the discussions that followed the crisis, two different versions of a third-generation model emerged. Akyüz and Boratav (2003) lay out a hypothesis centred on the flaws of the IMF programs itself, which they deem to have made an already fragile financial system even more vulnerable, and Özatay and Sak (2003) lay stress mostly on the fragile state of the banking sector. I look at each other in turn.

Akyüz and Boratav's argument is two-pronged: The IMF-program attacked the profitability of the banking sector and it led to an overvaluation of the currency, which had

deleterious effects, notably a high current account deficit. Regarding banking profitability, Akyüz and Boratav point to the dependency of the banking sector on high-yielding government debt instrument. Throughout the 1990s, following a complete current account liberalisation in 1989, the easy availability of secure foreign assets and the instability of inflation forced the government to offer a very large spread on debt instruments, which amounted to a real interest rate of over 15% on average. The government was eventually led to engage in Ponzi financing, borrowing to pay the interest on the debt, and the banking sector gradually geared a large portion of its activities towards the arbitrage opportunities offered by this rising indebtedness and the high interest spreads. By the time the IMF stabilisation program was put in place, a lot of domestic banks held highly leveraged positions in government debt instruments whose viability depended on the continuation of high nominal interest rates on these instruments. However, since the IMF program was designed to address fiscal imbalances, notably through a decrease in interest rates, it potentially endangered this source of revenue for the banking system.

In the event, inflation proved to be stickier than interest rates, so that real interest rates eventually ended up being negative, hurting the balance sheet of domestic banks engaged in the trade of government debt instruments. At the same time, however, currency overvaluation meant that interest rates in dollars were still fairly high, of the order of 10-11%, compensating somewhat for the negative domestic interest rates, as long as the banks were willing to have recourse to external financing. This seems to have created a situation whereby banks were increasingly exposed to foreign exchange risk, as well as being engaged in speculative behaviour to stay afloat and thus being highly leveraged.

This leads us to the second part of the explanation: The overvaluation of the currency and the increasing current account deficit eventually affected the confidence of

foreign investors in the sustainability of the peg, signs of which appeared in early fall. This erosion in confidence led to a drying out of foreign capital, culminating in a widespread refusal on the part of foreign creditors to roll-over their loan contracts in November (Figures 4 and 5), which in turn generated a scramble by domestic banks for foreign currency to close their positions. This then implied an increase in short-run interest rates, given the quasi currency board arrangement. Highly leverage banks keeled, notably Demirbank, one of the main dealers on the primary market for government bonds. A similar story then holds for the second bout of the crisis.

This explanation offers several interesting insights, notably regarding the role played by government debt dynamics, but it also begs several questions. As Ekinci and Erturk (2004) point out, an explanation of the erosion in the confidence of foreign investors that is solely reliant on currency overvaluation and the current account deficit is hard to accept for the same reasons that first-generation models were rejected: The current account deficit was indeed high, but it was a one-off event and the accumulated deficit was not particularly large. Consequently, this part of the story needs to be improved, a consideration which is important given that the increase in fragility caused by the program appears to become mostly important *after* the reversal in capital flows. Regarding the underlying fragility, their depiction of a banking sector doped by public debt dynamics seems to be fairly accurate, although I think it is only one part of the story. As I argue above and in the next chapter, I think that domestic dynamics were much wider and that some of the tensions in the real sector prior to the crisis should be brought into the story. Given the major contraction in output, it is hard to believe that the problems were only located in the banking sector. Perhaps more to the point, this dependence on government debt is taken for granted rather than explained, leaving a crucial part of the story in the form of an exogenous factor.

Another element that is unclear about Akyüz and Boratav's story is whether banks were looking for high interest rates per se, as they argue, or whether they were speculating on the margins.[60] In the latter case, decreasing interest rates may not be that problematic, as they imply an increase in the price of securities and thus an arbitrage opportunity as long as banks are willing to sell their securities when interest rates have lowered rather than wait out for the realisation of the interest.[61] In other words, there is a trade-off between carrying a high load of securities and realising the full interest once the securities come due or making a quicker buck on price differentials. The actual choice of action depends on a few factors, such as the liquidity of the market for securities and the pace of inflation. Under the situation that prevailed in 2000, with inflation decreasing slower than interest rates, a fairly liquid market as long as capital was flowing in, and a need for quick capital gains on the part of a banking sector that had entered the year 2000 in rather battered shape, as I argue later, it looks like banks were bidding on margins. In fact, their very inability to wait the full time of the securities' maturity may have been one of the main proximate causes of the troubles in fall 2000, when the decreasing trend in interest rates reversed. In my opinion, this calls for the jettisoning of Akyüz and Boratav's contention about the banking sector's need for high interest rates.

In sum, Akyüz and Boratav (2003) are right in stating that the Turkish banking sector was in a fragile state when the program started, but this only pushes the question further: Why was the banking sector in such a state? Similarly, their account of the loss of confidence of foreign investors is not very detailed, to say the least, yet again begging for

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[60] I want to thank Erdal Yilmaz for discussing this issue in depth with me.
[61] The interest earned on a security is equal to its final value, say 100 liras, minus its price, say 80 liras. A decrease in interest rate is equivalent to an increase in the price, say to 90 liras. If this happens, the security can be re-sold for more money than it was bought, here a differential of 10 liras, so there is money to be made on the price difference if the security holder is not willing to wait until its maturity. Moreover, if the security is used as collateral, a decrease in interest rate implies an increase in its value, and vice versa.

further explanation. Finally, the actual behaviour of banks regarding their bond portfolio is questionable. All three components need to be improved upon.

Özatay and Sak (2003) recuperate a large part of Akyüz and Boratav's analysis in their elaboration of a fourth account of the crisis, but instead lay stress mostly on the fragile state of the banking sector. Before getting into this, however, they first discuss a couple of possible sources of system-wide fragility.

First, they note that the situation was not particularly dire with respect to total credit over GDP, notwithstanding an increase in 2000 that was in large part driven by consumer credit. If anything, they contend, the banking sector was less exposed at the time of the crisis than during the middle of the decade: The main portion of the funds lent to the real sector had already been handed out by 2000 (see Figures 6, 7, and 8).[62,63] While this is true, I think that there dismissal of debt dynamics as an explanation shows to much of a focus on the proximate financial dynamics right before the crisis. The fact that most of domestic debt of NFCs was incurred before 2000 sends us back to the period preceding that year to study the determinants of credit allocation. Moreover, the fact that the level of domestic loans did not increase does not by itself mean that the underlying level of fragility already existing was not an important factor in the events of 2000-2001.

Second, they come basically to the same conclusion with respect to total liquid liabilities over reserves. The ratio of short-run debt to foreign exchange reserves is charted in Figures 9 and 10.[64] While there is indeed an increase in 2000 and 2001, that increase is

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[62] In other words, there was no large net increase in the volume of loans outstanding to the real sector.
[63] It is hard to navigate through Turkish credit statistics, as different sources give different numbers, sometimes claiming to have gotten them from the same primary source! In any case, the credit data I have seems to differ from Özatay and Sak's, but the two are in broad agreement. I thank Cafer Kaplan for his help in interpreting credit statistics.
[64] There are two measures of international reserves in charts 2, 9, and 10: Total net international reserves and Central foreign exchange reserves. The relevant amount of reserves on which the country can rely for the defence of the currency and the service of external debts probably lies between the bounds of those two series;

relatively modest by historical standards. Then again, although the size of the increase may not have meant a problematic deterioration of "fundamentals", the fact that the spike was localised might have had an important effect on expectations. Moreover, both debt and reserves were increasing at the same time during the year 2000, so what looks like a stable situation when we just look at the ratio of the two is actually one of increasing indebtedness coupled with a piling up of reserves, in two different places – debt in the banking sector and reserves located in large part in the central bank. It should be clear that there was indeed a lending boom fuelled by foreign capital, as can be seen in Figure 2, where the levels of short-run debt and international reserves are charted side by side. Finally, it should also be noted that the increase in debt was not confined to short-run liabilities. Comparing the evolution of the ratio of short-run foreign debt over GNP with that of total debt, it can be seen that the increase in long-run debt was responsible for a little more than half the increase in total debt (see Table 1).[65] Most of those long-term liabilities were incurred by non-financial firms, which points to a hole in the stories relying only on the banking sector.

Özatay and Sak then turn to measures of risk proper, namely indicators of credit risk, currency risk, and interest rate risk. For credit risk, they look at the ratio of non-performing loans over the total amount of loans and show that this ratio started to increase in 1998, a trend that continued through 1999, and stabilised in 2000 (see Figure 11 and Table 2).[66] Regarding currency risk, they show a rise in the ratio of foreign exchange liabilities to foreign

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all the reserves of the Central Bank can be used for that purpose, as well as a portion of the privately held reserves. As I have no way of knowing what portion of private debt could be called upon, I simply lay out both series, which should be viewed as upper and lower bounds respectively.

[65] It may appear from the ratio of total debt to GDP in table 1 that most of the increase in debt occurred in 1999, not in 2000. This is mostly due to the deep recession following the 1999 earthquake, however, and not to an external lending boom in 1999.

[66] It is hard to get reliable data on non-performing loans in Turkey, as their existence is often revealed only when the creditor goes bankrupt and is taken over by the SDIF. The three estimates I found in the literature differ in levels, but they show roughly the same pattern, so I deem it relatively safe to assume they display the right trend.

exchange assets, notably for liquid assets and liabilities, as early as 1998, though the process clearly accelerated in 2000. This illustrates that the flow of foreign credit was actually partially used in domestic markets and that banks were vulnerable to sudden reversals in capital flows or currency depreciation. Finally, Özatay and Sak show that there was a maturity mismatch in domestic debt, as banks lend at longer maturities than they are able to borrow. The problem seems fairly pronounced already by 1999, but it clearly gets worse in 2000 on most accounts, as many banks start borrowing heavily in the overnight market (see Table 3 for various indicators of currency and credit risks). Özatay and Sak then rightly argue that the banking sector's vulnerability to interest rate risk, the risk that there is an interest hike in the short run and that they end up having to pay higher interest rates than they get, went from bad to worse during the lending boom of 2000.

As I argue below, though, there is another problem associated with this maturity mismatch: If the decreasing trend in interest rate reverses, the value of the portfolio of banks heavily invested in securities, used as collateral for their own borrowing, will suddenly decrease, which might prompt their creditor to recall their loans. In the presence of a maturity mismatch, banks may then be unable to repay their creditors and go bankrupt. Bankruptcy aside, the problem is likely to spread as the banks originally affected by the recall scramble to pay back their loans and put pressure on their own debtors.

Having laid out these different indicators, Özatay and Sak then single out Demirbank from the rest of the private banking sector. Essentially, they show that this bank had a much higher share of government debt instruments than the rest of the sector, about half of which had long-term maturities by the time of the crisis, and that they financed their activities through short-term borrowing, mainly bank repos. Added to this, they argue that

Demirbank had a market-maker position in the primary government debt instrument market. Therein lays the core of their explanation for the November crisis.

Due to several factors, such as slow reforms and loss of credibility in the banking system following some criminal investigations, funds eventually dried out in November and Demirbank found itself unable to borrow in the overnight market to roll-over its position. The consequent sell-off of some of its portfolio increased interest rates in the secondary markets, forcing in turn some other banks to liquidate their positions. Since government debt was used as collateral for foreign borrowing, this implied a spike in the demand for foreign funds. At first, the central bank refused to loan money to the troubled banks in keeping with the quasi-currency board arrangement, so interest rates shot up and reserves decreased. Ultimately, though, problems were halted when the central bank started acting as the lender of last resort and the situation calmed further when the IMF consented to a 7.5 billion loan. The crisis proved fatal for Demirbank, however, and was particularly hurtful for state banks, given their greater exposure to interest rate risks. Finally, Özatay and Sak argue that the absence of the prime market-maker in the primary market for government debt instruments led to a major increase in real interest rate and thus put the sustainability of the peg into question. Eventually, there was a run on the currency which led to the abandonment of the peg, which in turn generated a major crisis given the exposure of private banks to exchange rate risk.

Özatay and Sak's focus on banking sector dynamics helps to integrate this very important part of the story into the overall narrative. In this sense, it proves very useful for an understanding of the processes that may have led to the 2000-2001 crisis. However, apart from the focus on the features of the program itself, the same criticisms that were levied against the account of Akyüz and Boratav apply here. The detailed depiction of banking

sector fragility helps to understand what happened once there was a reversal in capital flows, but hardly serves as an explanation of this reversal. Özatay and Sak try to address this issue by listing a few triggering factors, such as slow reforms and the spectacular trials of some bank financiers, but I find their story lacking: Is not slow reform better than no reform, at least if we believe, as they seem to do, that the goals of the reforms were laudable? Moreover, spectacular trials probably did not give much new information – in any case, the timing appears to be off. Consequently, we still need a theory to explain the dynamics in foreign exchange markets. Similarly, banking fragility is posited rather than explained, leaving a large portion of the story behind. Jettisoning total credit over GDP as a factor, on the basis that it did not increase that much in 2000, simply sends us back to the previous years to find the reason for the high overall level of indebtedness. That said, a lot of the points they make about different risk measures are quite valid; the main problem is that they don't theorise much about the dynamics that got the economy there once they outline the "facts".

It appears that while third-generation accounts offer some insights regarding the fragility of the Turkish financial sector, they still leave us in the dark regarding the various dynamics animating it, which may in turn have led to the crisis. They also leave the non-financial sector out, although it was responsible for a large portion of the foreign borrowing. Moreover, as is typical in these models, Akyüz and Boratav (2003) and Özatay and Sak (2003) do not really have much to say regarding the behaviour of the actors in these markets. If financial markets were becoming progressively riskier as time went on, starting after the 1994 crisis, why were they not modifying their behaviour? Similarly, while Özatay and Sak provide some reasons for the change of heart in November, they don't detail much why these reasons should have suddenly mattered. The absence of a precise analysis of the factors underlying behaviour and expectations is problematic in that it makes it hard to

understand why firms made the decisions that led to this rise in fragility, why "indicators of risk" progressed the way they did. Occulting these aspects removes an important part of the analysis of the dynamics of the Turkish economy, which is useful in determining the relative importance of different events in setting up the stage for a crisis. Finally, both stories focus on domestic dynamics, without much regards for foreign investors. Ekinci and Erturk (2004) supply a good account of that side of the story.

Ekinci and Erturk's (2004) narrative mainly aims at supplementing the fragility stories with a theoretical explanation of foreign exchange market dynamics. For them, the problem lays in the speculative character of the inflows that financed government debt instruments. Briefly put, they base their argument on a modified open interest rate parity condition where they replace the domestic interest rate by the expected change in the price of the asset under the hypothesis that foreign investors are actually not looking to hold an instrument to maturity, but rather to maximise the price arbitrage. The argument then is that as long as interest rates are expected to decrease, say because the program is credible and the rate of depreciation or the risk premium will decrease, capital will flow in. As soon as investors believe that this downward movement has come to an end, they will start selling their position to realise the accumulated capital gain, which provokes a rise in interest rate and obliterates the said capital gain, rendering the timing of exit very important.

This, in essence, is what they believe to have happened in 2000. They detail the story somewhat, but the important thing is that capital inflows started to decrease after the summer, possibly after foreign investors sobered up. This halted the downward movement in interest rate, which reinforced the movement and left Turkish banks with a portfolio of government debt assets they were unable to hold and eventually precipitated a crisis. The way in which Ekinci and Erturk's narrative brings in foreign investors is very interesting.

Unlike in the previous two explanations, where they were left in the background, they are the prime actors in this story. In this sense, Ekinci and Erturk's account is quite complementary to those of Akyüz and Boratav and Özatay and Sak. At the same time, however, I think it still has important shortcomings.

Three elements are needed for this story to hold, quite apart from the modelling hypotheses. It must be postulated that (1) foreign investors held government securities directly rather than lending money to Turkish banks for buying securities; (2) foreign investors were not interested in waiting for maturity; and (3) the amount of debt securities held by foreign investors was important enough for them to have an impact on the sustainability of the peg. The first is needed since the argument relies on what foreign investors or entities are aiming for. If they are simply lending money to the banks, then the issue is one of general solvency rather than a direct linkage with interest rate movements. The second element simply states that we need to be dealing with traders with a very short horizon. The third element deals with the pertinence of the argument: Even if Ekinci and Erturk are right, is this process enough to trigger a crisis, either directly or through emulation? Each of the three hypotheses has a kernel of truth in it, but they are all somewhat problematic.

Foreign investors did own and trade a fairly large amount of government securities directly, but I am not sure that foreign investors owned enough of government debt instruments to make a difference, both on the other holders of these instruments and their prices. Portfolio investment in debt securities is indeed important during 2000 and appears to be roughly equal to credit inflows, and it is true that there is an important reversal in November, though not much before (Figures 4 and 5). It must be remembered, however, that the balance sheet of Turkish banks was already laden with government securities well

before this boom in portfolio inflow. Consequently, the extent of the influence of portfolio inflow on the government securities market is unclear.

I have already analysed in some length the interest that investors may have in pursuing margins rather than waiting for maturity, which I deem to be a possible strategy. However, I think it is overplayed in this context. Fluctuating interest rates seem like a win-win game if interest rates are always relatively high, and they were, so investors can wait: If interest rates decrease, there is a capital gain to be made in an active market and if interest rates increase, then investors can sit on the securities until interest rates decrease again or the securities come due (which, was never more than a few months away). In fact, it seems to me that without an added depreciation risk, there is not much problem. It is notable in that regard that there was no massive sell-off until there was a high level of pressure on the currency, in November. The November spike could even also be a reflection of people's desire for liquidity in the event of a run on the currency. Finally, problems could also arise if foreign investors were heavily leveraged and suffered from a problem of maturity mismatch: A loan recall triggered by a decrease in the value of their portfolio could generate important difficulties or even endanger their solvency. Domestic banks certainly suffered from this problem, but were international investors really in the same predicament?

Thirdly, contrary to what Ekinci and Erturk seem to imply, the level of potential portfolio outflow was actually fairly small compared to the level of reserves available to the Central Bank. The November outflow amounted to the greater part of the portfolio stocks outstanding and even then, it did not reach more than a fifth of the reserves. Under those conditions, it is hard to see the peg as being endangered by an isolated reversal in capital flows. More generally, it seems that the external market dynamics depicted by Ekinci and Erturk cannot stand on their own as an explanation of the crisis. In addition to a narrative

recounting the increase in the fragility of the Turkish financial system before the crisis, which can always be taken in one of the other explanations I review, there needs to be a further step linking portfolio outflows with other processes liable to create a crisis. That is to say, it is not that Ekinci and Erturk are wrong, but rather that their account is incomplete.

Finally, for a theory that relies heavily on swings in expectations, it has interestingly little to say on how these expectations are formed. This is an important lacuna. Asserting that expectations changed when flows did is not exactly illuminating, especially if the objective is to be able to discern similar patterns in other contexts. While it is plausible that the speed of the original inflows picked up as people were becoming increasingly confident, it would have been useful for Ekinci and Erturk to explain further the slowdown they allude to in the fall.

To sum up, the existing frameworks appear to be unable to provide much guidance for the Turkish crisis. The first two generations are completely off the mark, while third-generation narratives fall short of explaining much of the prevailing dynamics, though they are useful in pointing some sources of fragility. Ekinci and Erturk's (2004) story is useful to understand the functioning of foreign markets, but there again they focus on a fairly short window of time and leave much in the background. What is lacking, in my view, is twofold: On the one hand, we need a framework wherein the actions of investors are explained in greater degree, including the original run up of fragility and the eventual collapse of the peg; on the other hand, we need a framework where both non-financial and financial sectors are linked and interact together, rather than a banking sector existing in a vacuum, as both proved form important parts of the puzzle. In the next chapter, I attempt to generate a narrative of the events that led to the 2000-2001 crisis which addresses these short-comings,

taking a longer-term perspective, introducing the real sector, and focusing on agent

behaviour.

CHAPTER 6

EMPIRICAL EXPLORATION OF THE TURKISH CRISIS

A few themes emerged from the critical assessment of existing approaches in the preceding chapter. Of special interest to my endeavour to build a joint framework with behavioural and Minskian bases are their problematic characterisation of agents involved and the relative lack of a long-term perspective to explain some of the fragility observed and described. In this chapter, I aim to fill some of these gaps by looking at the entire inter-crisis period and focusing explicitly on agent expectations and behaviour, using my joint framework as guide. In the process, I try to see if that framework has any relevance to the 2000-2001 Turkish crisis, which thus implicitly provides a test for that framework.

In chapter 4, in a nutshell, I describe agents as forming expectations by elaborating scenarios based on a subset of information considered *representative*, which they select based on what is most *available* to them at that point. Agents are largely influenced by priors, which they may revise suddenly if outcomes differ sufficiently from their expectations for the difference to be salient, and tend to look for information confirming these priors. In this way, they formulate best guesses based on these priors and build scenarios around them. Agents then exhibit a certain degree of confidence about these guesses and scenarios and also about their own ability to generate positive results.

In the context of the Turkish economy, with a crisis in 1994, an expansion for a few years afterwards, followed by a couple of exogenous shocks, another short expansion and a financial crisis, this type of expectations-formation framework could play out in the following way. After the 1994 crisis, widespread failures and bad outcomes are salient and more likely to be seen as representative (and so are firms in trouble). Agents are likely not to

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be very confident, both in their ability to guess if they got it wrong before the crisis and in their ability to generate good outcomes in this environment. This should make for relatively pessimistic expectations – perhaps too much so. The concomitant investment and borrowing/lending behaviour should be prudent, perhaps too much, which might slow down recovery a bit.

Eventually, an expansion gets underway, with some agents seeing some of the firms experiencing success as representative of good things to come while for others, the recent problems are still relatively salient. Overall, expectations should be roughly in line with realisations on average, as people are neither over-confident nor under-confident in majority. As the expansion proceed, however, people will slowly regain confidence, perhaps as they experience a few good outcomes in a row, perhaps because more successes become salient in various ways (the media, a greater share of competitors experiencing successes, etc.). As good news become increasingly salient and successes representative, agents are then liable to become gradually over-confident and start borrowing or lending increasingly more than actual profit streams warrant. This fuels the expansion, but also brings in some fragility in the system.

Such a process could end endogenously, as this build-up in fragility and the disconnect between the cost of external financing for non-financial corporations and their profit stream imply a rising number of firms having problems servicing their debts. In the Turkish case, while the expansion did indeed slow down a bit by itself, two exogenous shocks came rocking the boat: the Rouble crisis in Russia in 1998 and an earthquake the next year. If the system had indeed some in-built fragility, these shocks were liable to send it downward. In the process, it would produce a similar result than the 1994 crisis, dispelling

agent over-confidence and making failures more salient and representative. This should bring expectations and outcomes broadly in-line, provided the shock is large enough.

Then comes the IMF plan and with it an injection of capital that restarts the economy and a seral of approval which could bring confidence back. Spirits are unlikely to go back up right away, but if the program seems to work for a while and its successes are trumpeted enough, these successes could become fairly salient and lead to the belief that the recession after the earthquake is a thing of the past and that the country is on a new path upwards. This could in turn lead to investment and borrowing behaviours similar to the latter stage of the previous expansion. If on top of it capital from abroad is relatively cheap because the currency is over-valued, Turkish firms could switch some of the domestic debts they have trouble servicing for foreign ones. More fragility is added to the one already present, setting the stage for another crisis.

This story calls for an investigation of both agent expectations and their investment and borrowing or lending behaviour. For expectations, the data is unfortunately not detailed enough to test directly the mechanism I outline, such as what may have been salient or representative at different junctures. What may be tested, however, is whether or not overall expectations pattern resemble something that could have been generated via such mechanisms. To this end, I compare behavioural expectations with the two alternatives I outlined in chapter 4, namely rational expectations (RE) and backward-looking expectations (BLE).

Looking at investment and financing behaviour, I run into another limitation of the data: It is not possible to link observed expectations patterns directly to behaviour for individual units. However, it is possible to look at overall patterns of behaviour and see if they are congruent with a behavioural expectations formation mechanism, such as the one I

outline above. This would mean, broadly put an increase in risk taking, observable in the volume of investment and the amount of loans firms take on, as well as a concomitant rise in debt-servicing burden compared to the profit flows stemming from the investment and providing resources to service debt.

I analyse expectations and behaviour separately, starting with expectations and then moving on to behaviour itself.[67]

6.1   Expectations Patterns

There exist two expectation surveys in Turkey which can be used to assess the state of optimism (or pessimism) of the business community, both of which use the managers of manufacturing firms as their samples.[68] The Central Bank conducts a survey with a fixed panel of the largest manufacturing firms, while the State Institute of Statistics (Turkstat) surveys all manufacturing firms, obtaining a response rate which hovers around 70-75% (State Institute of Statistics, various years). Surveys also differ with respect to their frequency – the Central Bank conducts a monthly survey, while Turkstat's survey has a quarterly frequency – and the questions they contain, making them fairly complementary with one another. I use them both in what follows, though only the Turkstat survey allows a direct matching of expectations and subsequent outcomes.[69] For both surveys, I was only able to collect overall proportion of firms in different categories; I was not able to have access to micro-data.

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[67] See Appendix C for further analyses of these issues via the use of econometric techniques.

[68] See Appendix B for a further description of the expectations data.

[69] To my knowledge, this is the first such use of the Turkstat survey. The data is was not widely disseminated until fairly recently – when I worked there, in the summer of 2006, even the people at the Central Bank of the Republic of Turkey did not have an electronic copy of the data on hand and where missing several of the original books, which had to be ordered from the Turkstat archives. In fact, most of what I use I had to recopy by hand, an endeavour which took a few weeks.

The first task is to determine which questions in these surveys are important and what variables I should focus my attention on. After interviewing academics and people who were involved in policy-making during the 1990s and the 2000-2001 crisis, including officials from international institutions, I narrowed my focus on a subset of variables that appeared to have played an important role in those years. Figures 25 and 26, built with data from the Central Bank survey, give an idea of some of the variables that were important in Turkey during that period. Asked about the factors that are most likely to restrict production or investment, non-financial corporation (NFC) managers singled out demand as the most important one in both cases. The availability and the cost of credit are also important for investment, but decreasingly so during the second part of the decade, until the crisis hits in 2000-2001. By contrast, other factors, such as the availability and cost of labour, seem to have been considered to play a minor role. I therefore focused my attention on credit and demand. I then consulted with the people responsible for generating and analysing expectation surveys at the Central Bank and was told that, given their experience in administering such surveys, some of the questions were unlikely to have very reliable answers. Finally, for some questions, the primary data was clearly faulty or was simply missing.

From the Turkstat survey, this procedure left me with three questions that could be useful for the analysis. For each of them, managers are asked to say if the value of a given variable increased, stayed the same, or decreased in the current quarter compared to the previous one, and what they expect the direction of the change will be in the next quarter. This format allows me to see if managers were on average right on the mark, overly optimistic (wrongly expect growth), or overly pessimistic (wrongly expect a decrease) by lagging the surveys by one quarter and comparing expected outcomes with realisations in the

next period. For example, if 30% of managers expect an increase in the next quarter but it turns out three months later that only 20% saw an increase, expectations are deemed to have been overly optimistic. Similarly, if 30% expected a decrease but 40% ended up experiencing one, expectations are again deemed to have been overly optimistic. My three variables of choice are production, domestic sales, and new orders, which can all be considered to be ways to get at the issue of domestic demand, though production is more general. I also gathered data on labour needs, a variable that did not seem too important, for illustration and comparison purposes. Data for all four variables can be viewed in Table A-1. Finally, issues related to credit are analysed further in the next sub-section.

The overall percentage of managers predicting an increase in each of the three variables of interest is shown in Figure 15. There seems to be a moderate rise in the number of people predicting an increase in these variables after the 1994 crisis, at least until 1997. That percentage goes down following the successive troubles in 1998 and 1999, up again for a few quarters after the earthquake, and finally down with the crisis. This corresponds roughly with the overall expansion and investment patterns mentioned in the previous chapter, though the variations are admittedly relatively small.

Following the analysis in Chapter 4, however, it might be more meaningful to compare the basic expectations data with actual results. That is to say, the point is not only to see if people became more or less optimistic, but whether they got detached from reality by expecting better or worse outcomes than ended up happening. In this way, we can investigate whether agents were on average overly optimistic or pessimistic and if there are patterns in the data, allowing us in the process to compare RE, BLE, and behavioural expectations.

First, in Figures 16, 17, and 33a, b, c, I take the difference between optimists and pessimists to get a relative proportion of optimist firms, and then between expected and realised outcomes, once for all firms in the sample (Figure 16) and another time for private firms only (Figures 17, 33a, b, c):

(1) $DD_{it+1} = ((O_{it}^{e} - P_{it}^{e}) - (O_{it+1}^{r} - P_{it+1}^{r}))$

Where DD means double difference, O the proportion of optimist firms, and P the proportion of pessimist firms. The subscript i denotes the question for which the index is calculated (new orders, domestic sales, or production), while t stands for time. Finally, the first set of brackets contains expectations (superscript e) and the second one realised outcomes (superscript r), with expectation from a given period compared to realisations in the next one. If agents are more optimistic than what outcomes turn out to warrant, the DD will be positive, and vice versa if agents are overly pessimistic.

For example, suppose that in period t, 30% of firms predicted an increase, while 20% predicted a decrease. Next quarter, 25% see an increase and 25% see a decrease. In this case, the double difference will be:

DD=((30%-20%)-(25%-25%))

DD=10%

This denotes over-optimism, since the difference in expectations between optimists and pessimists is higher than what ends up happening.

Second, in Figures 18 – 20, I only take the difference between expected and realised outcomes for each of the three variables, separately for all firms (tot) and the subset of private firms (pri):

(2) $SDO_{it+1} = O_{it}^e - O_{it+1}^r; SDP_{it+1} = P_{it}^e - P_{it+1}^r$

Where SDO is the single difference for optimists, SDP for pessimists, i represents the variable under study, the superscript e represents expectations and r realised outcomes, and t the time period. If agents have expectations that are more optimistic than outcomes warrant, SDO will have a positive value while SDP will have a negative value, and vice versa if agents are overly pessimistic. For example, assume the same numbers as previously, i. e. 30% expecting an increase, 20% expecting a decrease, 25% actually experiencing a decrease during the next quarter, and 25% experiencing an increase (so less increases than expected and more decreases). In this case, SDO would be 5% and SDP -5%, denoting over-optimism in both cases.

Looking at the double difference in Figures 16 and 17, where series for the three variables are superimposed, the patterns are congruent with my framework for all of them, whether we consider all firms or only private ones. I also graph each series separately for private firms in Figures 33a-c in order to see the individual patterns more clearly. For all three variables, the index is near 0 immediately after the 1994 crisis, denoting relatively accurate expectations at that point, before rising and stabilising at about 10-15 for a few quarters afterwards.[70] The rate of increase then picks up in 1997, with the index reaching about 40 for both groupings of firms. That is to say, at its peak by the end of the decade, the

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[70] There seems to be a general bias towards optimism in this index, for which I don't really have an explanation.

relative proportion of people holding optimistic expectations is 40 percentage points higher than the relative proportion of people experiencing growth in production, domestic sales, or new orders. These high values last for a few quarters, peaking right as the troubles in Russia are starting to filter through, and then dip with the earthquake in 1999. The double difference goes up again as things look back on track in 2000, reaching the same heights as it did before the earthquake, only to dip again after the crisis in 2001.

These results correspond with what I would expect from my framework: During the expansion, expectations for production and demand gradually move away from realised outcomes, but they come right back toward them in and after a crisis. By contrast, rational expectations would imply an index hovering around 0, with no particular trend throughout the period. In this context, backward-looking expectations would likely also imply a much quicker reversal to the mean, as any divergence is taken in account and factored in future expectations.[71] I explore more extensively the patterns associated with BLE and RE below.

It may also be noted in passing that the pattern observed for production and demand does not occur for every other variable. For example, we can look at labour needs, which was never much of a factor in Turkey during the 1994-2001 period – unemployment is relatively high, even during the expansion (Table 6) and firm managers don't see the cost or availability of labour as an important hindrance to investment or production (Figures 25 and 26). The double difference for this variable is shown in Figure 32. While there is a bit of a spike in over-optimism in 1998 for private firms, the index mostly hovers around 0 for

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[71] I implicitly assume that agents are using the realisations of these particular variables to set their expectations of future values. This also means that agents form expectations directly about these variables, rather than a higher order, such as their rate of growth. The same assumption is maintained throughout the comparison of different expectations formations process. Given the structure of the Turkish economy at that point, this seems reasonable for domestic sales and new orders. The case is less clear cut for production, as managers could have been taking expectations over changes in the rate of growth. Nevertheless, given the ups and down in GDP throughout the decade, it is probably also reasonable to assume that people had expectations on whether there would be growth in production or not.

both series. The series for all firms has an average of 2.3 and a standard deviation of 5, while the one for private firms has an average of 2.5 and a standard deviation of 7.3. So there isn't a discernable pattern of over-optimism in the case of labour needs, which is perhaps to be expected given that this variable was not central to the planning of NFCs in that period.

Coming back to production and demand, similar patterns can be seen for single differences in Figures 18-20 for all three variables and for both positive and negative expectations. Starting with production, SDO is negative right after the crisis, denoting an overshoot downward (over-pessimism). It slowly goes back up as the expansion proceeds and ends up slightly above 0 for a few quarter after 1995. The gradual increase continues, up to a peak at the end of 1998 (over 15% more managers of all NFCs predicted an increase than the number who experienced one). There is then a decrease after the crisis in 1999, followed by another peak in 2000, before the crisis. The SDP pattern for production is slightly less choppy. The series already starts in the negative after the crisis, hovers around -10% until 1997, at which point it starts going down, denoting increasing under-pessimism. It reaches about -30% in 1998, as 30% less managers predicted a decrease in production than the number who experienced it. The index then reverts back towards 0 around the time of the earthquake, getting back to about -10, before plunging again – below -30% in the case of private firms – during the 2000 expansion and finally reverting back after the crisis.

Domestic sales exhibit similar, if smoother, trends. SDO is negative after the crisis, denoting under-optimism, getting back to 0 midway through 1995. Starting early 1997 for all firms, and at the end of that year for private firms, managers start exhibiting over-optimism. SDO gradually increases, peaking at more than 20% in 1998 and generally staying above 10% until the earthquake for all firms, and at a little lower level for private firms. The earthquake sends expectations back down towards outcomes and SDO once again goes in the negative,

implying under-optimism. SDO then goes back up briefly during 2000. SDP follows a mirror pattern, once again starting around -10%. The index is fairly stable until 1997, before plunging down to about -30%. It reverts back towards 0 in 1999 and early 2000, goes back down to -30% by the end of that second short-lived expansion, before reverting back up again.

Finally, SDO for new orders once again starts in the negative after the 1994 crisis before rising above 0 in 1995. It stays roughly positive for a few quarters, before expanding over 10% in 1998 (reaching almost 20% for private firms), reverting back in 1999, exploding over 20% in 2000 and reverting back again after the crisis. SDP for new orders starts negative after the crisis and basically hovers around -5% until 1997, at which point it starts decreasing gradually, going all the way to -20% in 1998. SDP then reverts back towards 0 during the earthquake, goes back down during late 2000, once again reaching -20%, before reverting again after the crisis.

While the patterns are sometimes choppy, the general trends once again support my framework. Expectations immediately after the 1994 crisis start close to outcomes – or slightly below, denoting under-optimism right after the crisis – then stay roughly in line with realisations for a few quarters as the economy starts growing again. Eventually, however, expectations gradually get divorced from outcomes – mostly starting in 1997. The over-optimism and under-pessimism peaks in late 1998 early 1999, as troubles start brewing, and then expectations get back in line with outcomes after the earthquake. There is an other episode of over-optimism and under-pessimism during the short-lived expansion in 2000, before another readjustment after the financial crisis. Just like with the double difference, there seems to be a general optimistic bias which I can't quite explain with respect to pessimistic expectations – there are very rarely enough people predicting bad outcomes –

but otherwise, all of this lends support to my framework. At the same time, these expectation patterns differ from what would obtain under RE or BLE. In both cases, there would be a much quicker reversal towards 0 and no gradual move away from actual outcomes.

To further assess the possible validity of different expectations models in explaining the observed patterns, I simulate analytical representations of BLE, RE, and my framework using realised outcomes and compare them to actual expectation patterns. In so doing, I implicitly assume that agents are using the realisations of these particular variables to set their own predictions. Once expectations are simulated, I take a single difference (SDO and SDP), as above.

For BLE, I simulate two models: One where agents simply project the outcome of the current period over the future and another taking a moving average of outcomes over the previous three periods, with decreasing weights (4/7, 2/7, 1/7, for periods t, t-1, and t-2 respectively):

$$(3) \quad \begin{aligned} &E^{BL1}(x_{t+1}) = x_t; or \\ &E^{BL2}(x_{t+1}) = (4/7) * x_t + (2/7) * x_{t-1} + (1/7) * x_{t-2} \end{aligned}$$

Where x represents the variable under consideration (domestic sales, new orders, or production). Given that the data is qualitative in nature and represents the proportion of firms expecting and experiencing a decrease, an increase, or the status quo, I take the value of x to be the proportion of firm in one category (so if 50% of firms experienced an increase in new orders in period t, x takes a value of 50 for that period). In a sense, these can be

viewed as the probability any given firm may end up with one outcome or another. While these weights are somewhat arbitrary, different setups gave qualitatively similar results.

For RE, I simply assumed that agents had perfect information but that there could be unforeseen shocks:

$$(4)\ E^{RE}(x_{t+1}) = x_{t+1} + \varepsilon_{t+1}$$

Where x once again represents the outcome of the variable under study (new orders, domestic sales, or production), while ε is the random shock. In other words, agents always guess the outcome right, up to a random exogenous shock. In practice, I let the shocks vary within an interval of one standard deviation of the particular series under consideration:

$$(5)\ \varepsilon_t \in \left[-SD(x), SD(x)\right]$$

I use a random number generator to get a series of values for the shocks. Of course, simply looking at the expectations pattern sheds strong doubt on the validity of RE, as I note above, but given that I only have three variables, it is conceivable that a series of shocks could have generated these exact expectations patterns. I therefore simulate RE four hundred times for each variable and see how many instances are somewhat close to the actual patterns.

For my framework, the situation is somewhat more complex because behavioural heuristics imply that expectations are likely to be generated differently for each variable, so it is not valid to use a single blanket equation for all three variables. Since all three variables exhibited similar patterns, however, we can concentrate on one of them for illustration and

comparison purposes, so I focus on new orders. Moreover, expectation formation processes are likely to be context-specific and their formalisation should thus be informed by the actual context in which they happen. The following equations should thus be considered to apply to Turkey at that particular moment, though they could of course inform similar processes in different places and times.

The first thing to consider is that even in the depth of recession in 1994 or in 2000-2001, there were still people holding optimistic expectations (see Figure 15). The converse is also true for people holding pessimistic expectations in good times. We could thus assume that there is a base number of firms holding positive or negative expectations throughout. In this case, I simply assume that the base value for pessimistic expectations is the minimum of the series, i.e. the smallest number of firms experiencing bad outcomes during the period studied. For optimists, I set the base value at the maximum of the series, i.e. the maximum number of firms experiencing good outcomes. The task is then to determine how many more managers are going to be pessimistic or how many less managers are going to be optimistic than these extreme values at different moments.

Linking back to the previous discussion of behavioural heuristics, agents will generally be looking at different sources of information to establish their expectations. During an expansion, such as the one that occurred in Turkey after the 1994 crisis, bad news should be decreasingly *available* and vice versa for good news. In that sense, bad news should have a decreasing influence on expectations while good news have an increasing impact. This is reinforced by the fact that people can't perceive *covariations* very well, and tend to look for *corroborative evidence*, so that even if there was a slow deterioration, many would probably not detect it. However, if there is a major drop or increase, it would probably be

seen as *representative* of a regime change and bring about an adaptation in behaviour. This yields the following formalisation:

- For pessimistic expectations

(6) $E^{nf-}(x_{t+1}^p) = \min(x_t^p) + (x_{t+1}^p - \min(x_t^p))/t^{1/2}$ for $t = 1,...,n$, starting after a crisis, if $(x_t^p - x_{t-1}^p) \in \left[-SD(x^p), SD(x^p)\right]$ and $E^{nf-}(x_{t+1}^p) = x_{t+1}^p$ otherwise.

Where SD is once again the standard deviation of the series. The minimum of the series is established as a base probability, to which are added negative news in the form of the difference between the actual future outcome and that base probability. To represent the fact that the impact of these negative news is dampened through an expansion, their decreasing *salience* during that period, I divide their impact by the square root of the time elapsed since a crisis. In this case, "t" is set to one at the end of 1994. Finally, if there is a huge jump, which I represent as a realisation falling more than one standard deviation away from the previous one, I assume agents sober up and adjust perfectly next period, and the process starts again.

- For optimistic expectations

(7) $E^{nf+}(x_{t+1}^o) = \max(x_t^o) + (x_{t+1}^o - \max(x_t^o))/t^{1/3}$ for $t = 1,...,n$, starting after a crisis, if $(x_t^o - x_{t-1}^o) \in \left[-SD(x^o), SD(x^o)\right]$ and $E^{nf+}(x_{t+1}^o) = x_{t+1}^o$ otherwise.

This is essentially the converse of the equation above, using the maximum of the series as a base probability and once again dampening any bad news by the time elapsed during the expansion. Once again, the time trend is restarted after the crisis. I take the cubic root this time to account for the fact that it is easier to hover between expectations of increases and status quo than either and pessimistic as an expansion proceeds, since status quo often means keeping business at a level already above what it was a few periods before. Note also that both equations are consistent with the idea that similar news are perceived differently at different moments in time, one of the hallmark of the framework described in Chapter 4. Assuming that the same set of information would generate the same realisation, they will impact expectations differently depending on the time periods in this behavioural framework.

Admittedly, this specification works better for a crisis that is followed by an expansion, rather than a prolonged recession. This is fine in the Turkish case, but may not fit as well in other contexts. If there is a long recession, expectations might be overly pessimistic for a time, which would call for another variable in addition to or in place of the one dampening bad news (there might still be a gradual decrease of the trauma as time elapses after the crisis). Moreover, it may be observed that if

(8) $\frac{dX}{dt} = \frac{1}{2t^{1/2}}$

For pessimists, that is to say, if the rate of change of the variable decreases at a regular rate allowing to just compensate the dampening effect of changing time, expectations will stay the same. This makes sense: In this case, bad news are increasing, but at a rate that

makes the increment imperceptible to the agents. A similar rule applies for optimistic expectations.

Before looking at simulations results, it might be useful to compare directly actual expectations and actual results for new orders. In Figures 34a I lay out positive expectations and results, while I do the same for their negative counterparts in Figure 34b. Positive outcomes and expectations are relatively close together after the 1994 crisis, with expectations even under-shooting for a few quarters, while they start diverging in late 1995, as expectations of growth remain more buoyant than outcomes warrant. Results and expectations converge back shortly in early 1997, before diverging again, this time in a major way. Expectations do follow outcomes downward, as growth in demand is effectively slowing down, reaching a low at the end of the year when the Rouble crisis has fully hit. Outcomes and expectations converge again after the second shock in 1999, and then diverge for a second time in 2000, until expectations catch back with outcomes after the crisis.

A similar story holds for pessimistic expectations and negative outcomes, though as I observe above, there is a bit of a discrepancy early on, with lower pessimistic expectations than outcomes. Towards the end of the expansion, in 1998, as negative outcomes start mounting, pessimistic expectations also start increasing, but the adjustment is largely insufficient. Expectations and outcomes coverge again after the second shock, only to diverge again during the IMF plan. The financial crisis then sends both series converging again (almost exactly so, actually). The patterns for both positive outcomes / optimistic expectations and negative outcomes / pessimistic expectations are in line with the above description of single and double differences, as they exhibit increasing divergence during an expansion and convergence after a crisis. Do any of the three theoretical alternatives generate expectations that are congruent with these patterns? Let's see.

The results of the simulations are presented in Figures 21 to 24. Starting with RE, Figures 21 and 22 contain an example of RE used to generate a simple difference for new orders, which I compare to the actual simple difference generated from the data. There is essentially no relation between the two. RE expectedly hovers around 0, reverting relatively rapidly and thus giving rise to a fairly choppy pattern – this is quite different from the gradual divergence during the expansion that can be observed in the actual data and the reversal timed around the crisis, for example. Now, this was to be expected if we took one instance of RE at random, given the way these expectations are generated. I therefore generated RE four hundred times for each of the three variables (one hundred times for pessimistic expectations and one hundred times for optimistic expectations, each for all firms and then only private ones) and calculated a coefficient of correlation to assess the extent to which each repetition is close to the actual patterns. In none of the cases do I get more than a couple of repetitions with coefficients of correlation above 0.4, and none above 0.5. This supports my contention that the patterns are not random and that RE are inadequate in describing them.

Second, I then lay out the two backward-looking expectations for private firms in Figures 23a and 23b, for pessimistic and optimistic expectations respectively. In either case it can be seen that, while BLE performs better than RE, it still does not do a great job. In fact, it reproduces much of the disconnect observed when actual expectations were compared with outcomes in Figures 34a, b, especially in 1998 and in 2000-2001. During those periods, the discrepancy sometimes reaches over 12% for optimists and over 20% for pessimists. In fact, for all three variables, 3-periods optimistic BLE lay within one standard deviation of actual expectations less than two thirds of the time and 3-periods pessimistic BLE virtually never do (Table 8). The same is essentially true of 1-period BLE.

To see if my framework does a better job of representing expectations for new orders, I put it side-by-side with actual expectations and 3-periods BLE in Figures 24a and 24b, once again respectively for pessimistic and optimistic expectations and for private firms. It can be seen that my framework generates expectations that are much closer to what is observed than BLE does both for optimists and pessimists. In fact, the main divergence between my framework and actual expectations for pessimists is that the base value is too high. If we decrease it just a bit (say by about 2 percent), the two curves are almost the same. For optimists, the issue is that it takes more than one period for actual expectations to be revised downward after a crisis (they do plunge, but start to do so two periods after the reversal of the trend, not one as hypothesised), so there is a disconnect between the behavioural framework and actual expectations right after the crisis. Otherwise, once again, my framework generates expectations that are much closer to actual ones than BLE, in either of its incarnation. As can be seen in Table 8, many more instances of pessimistic behavioural expectations are within one standard deviation of actual expectations than either BLE frameworks, and so are relatively more optimistic behavioural expectations.

In sum, it seems that the managers of non-financial corporations do not form expectations as rational agents would, a fact which should be taken into account in any theory purporting to explain the financial crisis. By contrast, my analytical framework based on psychological heuristics does a much better job in explaining and reproducing the expectations patterns we observe. This suggests both that the rational agent framework should be jettisoned for the study of crises and that the psychological traits I identify could prove a fruitful alternative.

6.2   Agent Behaviour

The foregoing analysis of expectations suggests that agents indeed became increasingly disconnected from reality as the expansion proceeded before the 2000-2001 crisis. This should be reflected in gradually increasing investment and indebtedness during the period, at a pace that outstrips increases in profits. That is to say, firms should increase their leverage faster than the resources to service their debts flow to them. Following the same logic, financial institutions should gradually relax the constraint they put on lending, accommodating credit-hungry firms in the process. By contrast, if managers held RE about future profit flows, they would not borrow in a way that gradually eats up those profit flows and would "under-borrow" just as many times they "over-borrow". If they held BLE, the divergence should also not increase through time, as managers would constantly revise their expectations to make them conform to realised outcomes.

To examine these different possibilities, I first look at investment and credit levels, and then at the way debt-servicing costs evolved compared to profits for non-financial firms, which would measure the prudence of these firms' managers, and then some indices of lending constraint on the part of bankers.

6.2.1   Real Sector

As laid out in Chapter 4, investment patterns in the real sector seem to conform to the same logic as expectations, which is not particularly surprising given that investment is in large part driven by expectations of future profitability (Figures 12, 13, and 14). This is mainly true for private non-residential investment, as public and residential investments clearly respond to different imperatives (Figures 12 and 13). The pattern is perhaps more clearly visible in the seasonally adjusted quarterly investment series (Figure 14), where three

peaks can be seen: One before each of the financial crises, in 1993 and 2000, as well as another one around the end of 1997 – beginning of 1998. Once again, investment rises from the 1994 crisis until the 1998 slowdown in Russia, which delivered an important blow to the export sector, quickly to be followed by the important economic disruption in 1999 due to the earthquake, and investment only picked up again in 2000 before it came crashing down after the financial crisis. Investment being pro-cyclical in this way is not particularly surprising; what is more illuminating, in line with the previous discussion of expectations, is that while non-financial corporations (NFCs) were investing, they were also becoming increasingly leveraged, reflecting the increased "over-optimism" we observe in the survey data.

After a peak in early 1994, loans to NFCs decrease as the financial crisis hits and some are recalled while others are written off as firms go bankrupt (Figure 7). The level of loans then bottoms out for a while before slowly starting to increase again in 1995. The pace rapidly picks up and the rate of increase remains high until the end of 1998, when the loan level peaks. It then remains constant for a few months, before dropping somewhat when some banks keel over, unable to carry all the bad debt left on their balance sheet after the earthquake, and fall under the purview of the SDIF. There is a short-lived increase again in 2000, which is brought to a sudden halt by the 2001 financial crisis. The variation in the levels of loans to NFCs basically mirrors the evolution of the investment pattern with a small lag, but there is one major difference: When investment slows down in 1998 following bad news in Russia, the loan level stays up as NFCs find themselves both unable to invest and to repay their debt, a situation which only gets worse in 1999; the "over-optimism" of managers catches up with them.

By the time the IMF program starts in January 2000, both NFCs and banks are loaded with a high level of "bad" debt, too high for the NFCs to service properly and thus underperforming from the banks' point of view (see Figure 11 and Table 2 for measures of non-performing loans). As is noted in Chapter 4, some people who analysed the 2000-2001 crisis (notably Özatay and Sak 2003) dismiss the credit level as a factor because most of the loans were handed out before 1999, whereas this is precisely the point: The system got increasingly fragile as the post-1994 crisis economic expansion proceeded and was in a fairly bad shape by the end of 1999 after successive exogenous bad news. The stage was set for speculative behaviour in late 1999 early 2000 as an attempt to get out of that predicament... and this is what happened. Shortly put, not only did investment become more speculative, but banks and real sector firms turned towards the external sector in order to try to use the fact that the currency was overvalued to find financing at better rates.

Another way to look at the influence of "over-optimistic" expectations on investment and financing behaviour, and thus on the fragility of the system, is to evaluate the ability of non-financial firms to pay their debts, be they immediate or prospective.[72] This can then be considered to be a proxy for the level of tolerance to risk of firms' managers: The more these managers' expectations get away from realised outcomes, the greater the debt load they accumulate against the firms' profit stream, and the higher the probability these firms will find themselves unable to service their debts when they come due, *ceteris paribus*.

Using a flow-of-funds accounting framework, it is possible to distinguish various levels of solvency for a firm depending on the way it finances its investment projects.

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[72] The portion of my analysis which uses a stock-flow accounting framework is inspired by a theoretical paper by Foley (2001) and a discussion and partial attempt at application by Shroeder (2002), and the category names are taken from Minsky (1982). Shroeder's paper is, to my knowledge, the only such use of this flow of funds framework to the study of a crisis (in her case, the Asian crisis of the late 1990s).

Considered abstractly, one can divide the sources of a firm's funds between profits, borrowing, and new equity and the uses of funds between taxes, investment (both real and financial investment), dividends, and interest payments. Simplifying further, borrowing and new equity can be grouped in a category of "external financing", while interest and dividend payments can both be categorised as the costs of that external financing. This gives the following equation:

(9) $(P-T)+F=I+C$

Where P stands for profits, T for taxes, F for external financing, I for investment net of depreciation, and C for the cost of external financing.[73] Following Minsky (1982), it is then possible to characterise three different states for the finances of a NFC – hedged, speculative, and Ponzi – depending on its degree of financial fragility. If a firm's profits are sufficient to meet both its investment needs and its financing costs, so that total debt should be decreasing, the firm is considered to be fairly financially secure and is classified as *hedged*. If profits are greater than financing costs but smaller than the sum of these costs plus investment, the firm has to increase its debt load and as such it is considered to be in a more fragile position and classified as *speculative*. Finally, if a firm even has to borrow to pay the costs of its external financing, it is deemed to be in a fairly fragile state and classified as *Ponzi*, in reference to the New York financier who devised, in the early twentieth century, an investment scheme that was just as sustainable as this firm's position.

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[73] In a situation of high inflation, such as in Turkey in the 1990s, a large portion of the "cost of financing" will implicitly be constituted of principal repayment. Nonetheless, what matters from the point of view of the firm is the amount of money it has to pay at a given point compared to the resources it has to do so. That is to say, it is the nominal obligations that matter.

Firms can hover between different states and even become *Ponzi* for a while without ultimately keeling over and becoming bankrupt. For one thing, this analysis does not take into account prospective cash-flows and the probability that these cash-flows could materialise, both of which are virtually impossible to measure. The fragility associated with a given state of affairs, say a *speculative* position, depends heavily on the expectations of future profit stream and the likelihood that these expectations will be realised. Nonetheless, a *speculative* or a *Ponzi* position is never devoid of risk. To get away from this problem, as well as generate a picture of the economy-wide level of financial fragility, one can consider aggregates of firms within a country, either by calculating the proportion of firms in given states or by aggregating the different accounting categories. I follow the second strategy here, for ease of manipulation and exposition, but micro-data essentially generates the same picture.

Using the corporate accounts compiled by the Central Bank, which encompass the majority of sizeable non-financial firms in the country, I devise an equation representing the balance between sources and uses of funds.[74] I then isolate all the variables from the equation above – after-tax profits, borrowing[75], increase in equity, net investment, and financing costs – and balance the equation with what I call a "fudge factor", which encompasses a few categories I have trouble classifying.[76] I then use the profit, investment, and financing costs categories to see if different firm aggregates fall under a *hedged*, *speculative*, or *Ponzi* state. The two firm aggregates I focus on in this regard are private manufacturing firms and all private firms. Formally, I calculate the following ratios, which I term the "Foley

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[74] See Appendix B for a further description of the Central Bank corporate accounts.

[75] Given the way balance sheets are compiled for Turkey, I have access to the net change in liabilities. In this way, some of the nominal obligations of firms are swept under the rug... Though in some sense, as a sector, these loans could be considered to have implicitly been rolled over.

[76] These categories are the following: Flowless expenditures and income, extraordinary operations, and changes in the share premium account. Values taken by the fudge factor are relatively small compared to any of the other categories for all years considered.

Index" after Duncan Foley, as the idea to take that ratio came while reading an article of his (Foley 2001):

$$(10) \quad FI_1 = \left(\frac{profits}{Financing \; \cos ts} \right) \; and \; FI_2 = \left(\frac{profits}{Investment + Financing \; \cos ts} \right)$$

If FI_2 is more than one, firms are able to service both their debts and their desired investment out of their profits and are thus considered to be in a hedged position. If FI_2 is less than one but FI_1 is greater than one, then firms make enough profits to service their debts, but not quite to do that and make all the investments they wants, so they are considered to be in a speculative position. Finally, if FI_1 is less than one, firms don't even make enough profits to service their debts and are thus considered to be in a Ponzi position.

I chart those two ratios in Figures 27 and 28. From both figures, it can be seen that for both sets of firms, the aggregate lies in the *speculative* zone for the entire period between the two crises, although both groups of firms come quite close to a *Ponzi* state in 1999, before crossing outright into a *Ponzi* position during the 2001 crisis. What is perhaps more interesting, however, is the evolution of the ratios: Both of them decrease almost steadily in the inter-crisis period until they bottom out in 1999. That is to say, the underlying financial fragility increases virtually every year from 1995 to 1999 for both aggregates, at which point they almost reach a *Ponzi* state. Starting in 1995, the percentage of NFCs in a *Ponzi* state also increases every year until 1999, going from 12% to 28% over that span (Figure 30). The proportion then decreases a bit to 24% in 2000, before jumping over 35% in 2001. This also denotes an increase in fragility during the expansion between the two crises.

The same pattern is also clearly visible in Figure 29, where I chart the ratio of the increase in profit over the increase in financing costs.[77] NFCs become increasingly stuck in a debt quagmire after the 1994 crisis, as each passing year between the two crises brings a lower increase in profit for each increase in financing costs, up to a point in 1998 and 1999 when profits actually increase less than financing costs.

Two trends are observable in the real sector when we look at the three sets of indicators side by side. Firstly, investment and borrowing behaviour reflect an increasingly optimistic outlook after 1994 on the part of the managers of NFCs, a trend that continues until 1998 when exogenous troubles beset the sector. Secondly, this translates into increasing levels of financial fragility for NFCs, as financing costs increase faster than profits and they near a *Ponzi* state as a group on the eve of the IMF program in 2000. Decreases in effective interest rates brought about by the program in 2000 then reverses the trend, and probably contributes to the renewed optimism on the part of managers. Increases in profits are not impressive, but a cheapening of the credit eases somewhat the bind in which real sector firms found themselves at the end of 1999, spurring an increase in investment. Domestic loans even decrease in 2000, though it appears that NFCs simply unloaded costly domestic debt and replaced it with foreign liabilities.

While it fits with the observed expectations pattern, this gradual increase in financial fragility in the inter-crisis years would not make sense in a rational actor model. Normally, agents should link borrowing to profits, either in a prospective manner as in RE, or by taking into account each successive outcome as it is realised. Moreover, under BLE or RE, there is no particular need for the index to go one way or another as agents could make mistakes both ways in any period. Instead, plausibly, we see a systematic and gradual

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[77] The spike in 2000 is due to a negative value for the increment in financing costs, as domestic interest rates decreased a lot that year and currency overvaluation cheapened foreign credit.

increase in fragility, which provides support for my framework based on psychological heuristics.

6.2.2 Finance

In the years following the 1994 financial crisis, the evolution of the financial sector mirrors that of the real sector, with the added dimension of a growing public debt. The pace at which banks lent money to the real sector increased steadily after the 1994 crisis and peaked in 1998 (Figures 6, 7, 8). From a trough of 7.6 million 1987 Turkish liras in November 1994 to a peak of 20.7 million in November 1998, loans to NFC almost tripled in the span of five years. Similarly, domestic credit went from 19.5% of GNP in 1994 to 28.8% in 1997, remaining above 26% until the crisis. Moreover, banks' purchases of government bonds followed a similar pattern at first but proceeded unabated through to the November crisis (Table 4, and Özatay and Sak 2003). Banks even started having recourse to foreign credit to buy government bonds near the end of the decade, though at a much slower pace than in 2000 (Özatay and Sak 2003).

Just as it was possible to measure the degree of over-optimism of NFC managers from the Turkstat survey, it is also possible to get an idea of the laxity of lending practices from the same survey and the one from the Central Bank. Looking back at Figure 25, there is a downward trend throughout the latter part of the 1990s in the proportion of NFC managers considering the availability and cost of credit as the main hindrance to investment. For production, the dominance of demand makes it hard to get a clear view of the impact of credit, so I isolate the proportion of managers who respond that credit constraints constitute

the main reason they do not produce at capacity in Figure 31.[78] There is a downward trend

after 1994 until the end of 1996 – mid 1997, followed by an upward trend until the end of

1999 and another downward one in 2000.[79] These two measures can be roughly interpreted

as a measure of the stringency of lending practices. The patterns observed are again broadly

consistent with the evolution of NFC managers' expectations: As they were becoming more

[overly] optimistic, so were bank managers, which reflected itself in less prudent lending

behaviour on their part. One may wonder why the percentage does not increase for

investment restriction in 1999, but maybe it is simply that credit constraints were

overshadowed by preoccupations about demand.

A decrease in that index could imply an increase in the laxity of lending practices,

which roughly corresponds to the trends observed in the loans handed out to NFCs and the

increase in their leverage. The resulting high leverage of the NFC sector and the associated

level of fragility, logically find their corollary in the financial sector: As NFCs found

themselves buried under a debt load ever harder to service by the end of the decade, the

quality of bank loans outstanding deteriorated concomitantly. Added to the swelling public

debt (Table 4), this situation may have left many banks overextended and looking for a way

out by 1999, just like NFCs, whose margin of manoeuvre had decreased progressively after

1995, leading them on aggregate close to a situation of *Ponzi* finance by 1999. The

opportunity for cheap foreign credit which arose in the course of 2000 may have provided

the emergency exit firms in both sectors sought. NFCs and banks jumped on the occasion

offered by the gradual over-valuation of the currency in 2000 to substitute expensive

domestic credit for cheap foreign loans. In the process, however, they both fuelled the

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[78] Firms are weighed in two ways for this question: either by number of firms (E) or the value of production (P). I use the latter.
[79] Admittedly, credit is not foremost on NFC managers mind with respect to production, taking a backseat to considerations of demand.

inflow of foreign capital and placed themselves in a dangerous position of currency mismatch.

All this set the stage for a foreign credit boom. During the year 2000, both short and long-term debt increased rapidly, as did international reserves (Tables 1, 7a, b, and Figures 2, 4, 5, 9 and 10). From Table 1, it can be seen that while total external debt went from 47% of GNP in 1998 to 59% of GNP in 2000, with most of the growth occurring in 2000 (once the recession of 1999 is taken into account). Most of that growth came from the private sector, whose share of the total went from 40% to almost 50% during the same period, and the proportion of short and long-term debt stayed relatively stable, This foreign credit came mostly from foreign banks, which handed out short-term credit to Turkish banks and longer term loans to NFCs, placing both types of institution in a situation of currency mismatch (Tables 7a and 7b). There was also an important inflow of portfolio investment, the greater part of which went to buy government bonds (Ekinci and Erturk 2004, Figures 4 and 5). By contrast, foreign direct investment was negligible throughout the period, and even negative in some months, only increasing after the crisis, as many otherwise solvent firms were available at a bargain (Dufour and Orhangazi 2009). All in all, banks also ended up with a high quantity of debt and a currency mismatch, so that their behaviour and that of non-financial corporations contributed to the increase in systemic fragility and set the stage for a major shakeout following the crisis.

6.3   Conclusion from the Analysis of the Crisis

Putting all this together, it is therefore possible to weave a story of the Turkish crisis from my framework and shed some light on the main dynamics behind the crisis. There was a gradual rise of optimism compared to observed outcomes on the part of NFC managers

after 1994, leading eventually to "over-optimism", as well as an increasing laxity on the part of banks. Two successive adverse shocks, in 1998 and 1999, then left NFCs and banks in need of an exit, which they found in foreign debt markets in 2000, as the over-valuation of the currency cheapens credit from abroad. There again, as the process runs its course, Turkish managers borrow to a large extent, generating systemic fragility once more. Meanwhile, foreign investors, partly playing on marginal short-run changes in interest rates, as outlined by Ekinci and Erturk (2004), invest in Turkey and fuel the process, while the boom reinforces confidence in the IMF program and positive expectations. Eventually, some important players, notably Demirbank, run into trouble and rapid liquidation and outflow ensues, as expectations reverse to a very pessimistic outlook, in turn setting the stage for a full-blown financial crisis.

In this way, my joint framework generates a plausible account of the Turkish crisis, supplementing the elements brought forwards by existing explanations and improving upon them. A focus on expectations patterns and a longer view allow for an analysis of the evolution of fragility in Turkey in the years between the two financial crises and some of the reasons behind it, providing both an illustration of some of the mechanisms in the joint framework and a way to understand better some aspects of the functioning of the Turkish economy. Given data limitations and the fact that this is only one case study, the Turkish crisis is not a definite test of my framework, but it certainly suggest it may have some usefulness to analyse financial crises.

While there was no direct comparison with a pure Minskyan framework in the analysis of the Turkish crisis, the focus is somewhat different than what such a framework might have entailed. The study of the expectation patterns, though not as detailed as the theoretical mechanisms outlined in chapter 4, is nonetheless grounded in behavioural

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heuristics generating specific predictions. This is notably illustrated by simulation results, where a formal representation based on these heuristics is shown to be congruent with actual expectations patterns. Moreover, the way similar outcomes generate different expectations at different junctures, a hallmark of the behavioural heuristics laid out in chapter 3, is also shown for different variables throughout the analysis. Overall, the introduction of behavioural elements in a Minsky story allows for a more direct and precise study of expectation patterns and their integration in a general narrative.

Observed agent behaviour is, by contrast, more in line with a typical Minsky story. The gradual rise in fragility during an expansion that is observed in Turkey, following increases in risk-taking and lowering of safety margin, and its contribution to an eventual crisis, fits right in with Minsky's financial instability hypothesis. In that sense, the addition of behavioural elements to Minsky's hypothesis helps more to delineate the underlying reasons for agents to be behaving in this way than changing the predicted outcomes in terms of borrowing, investment, etc. at least in the context of the Turkish crisis.

CHAPTER 7

CONCLUDING REMARKS

Financial crises have very deleterious effects on the economies they beset. The instability in financial markets which has accompanied their spectacular expansion in recent years makes the need to understand the underlying logic of financial crises a pressing issue. Unfortunately, the existing literature on the topic has had mixed success in trying to explain the determinants of these phenomena. This shortcoming is particularly evident in the case of the Turkish crisis, as I endeavoured to show. In my view, this lack of success is partly due to the faulty treatment of economic agents in existing models – the reliance on a paradigm of rationality that is both unrealistic and a poor heuristic device. In an effort to ameliorate that aspect of the analysis of financial crises, I elaborated an alternative framework using insights from Minsky's financial fragility hypothesis and behavioural economics – a framework in which agent expectations evolve endogenously with the economic situation and impact back on it, and where there is a synergic relationship between the real and financial sectors.

The application of my framework to the Turkish crisis of 2000-2001 seems to shed some light on it. Not only does the framework fit the historical experience, but it also allows me to project the analysis in a longer time-frame than what an analysis restricted to the crisis period and the months immediately preceding it would allow. In this way, I am able to study the processes that might have set the stage for the financial boom of 2000, which itself ultimately ended in a major financial crisis. One of the lessons that can be drawn from this exercise is that agents' expectation formation processes can inherently have destabilising effects, so that it may not always be optimal to let financial markets operate on their own. Rather, it may be pertinent to investigate further the psychological determinants of

expectations formation to understand how to devise regulation adapted to agents' decision rules, so as to find ways to counteract these de-stabilising tendencies.

Of course, the Turkish crisis is only one instance of a major international financial crisis and it would be useful to validate my framework with other experiences. Some work has already been done along Minskian lines for Latin America (Cruz, Amann, and Walter 2005, and De Paula and Alvès 2000) and for the Asian crisis (Arestis and Glickman 2002, and Wade 1998, 2000), and there seems to be some evidence that such a framework provides useful guidance in these instances. Although the analytical thrust of these papers is somewhat different than mine, as it basically adopts Minsky's viewpoint as is, their results are certainly indications that a better definition of agent behaviour, coupled with an analysis of the synergic relationship between the real and financial sector, can help explain international financial crises.

APPENDIX A

EXAMPLE OF A BEHAVIOURAL CHANNEL

This appendix is intended as a schematic illustration of a behavioural expectations formation mechanism. Such mechanisms remain context- and variable-specific, so the situation delineated in this appendix is simply a general example. Nonetheless, to bring it closer to the case study analysed later, I look at demand as a variable, since it was an important consideration in Turkey prior to the 2000-2001 crisis. I further focus on its incarnation through "new orders".

A) Object of expectations

Agents are forming expectations about new orders. This in turn influences the amount of investments they deem necessary and concomitantly the amount of borrowing they will do. Greater demand expectations will tend to push up perceived investment needs and thus possible demand for borrowing.

B) General role of behavioural heuristics (simplified from the chapter 3 exposition)

    a. Representativeness

        i. Agents focus on a subset of information when determining how many new orders they are likely to get.

        ii. Some information is deemed more representative of the general trend.

    b. Availability

        i. Some information is more salient than other.

c. Confidence

    i. Subjectively move over-time; reinforced through successes, broken following failures.

d. Causality

    i. Inability to properly discern causality, leading under certain circumstances to an illusion of control, whereby agents feel more responsibility for different outcomes than they "should".

e. Covariance

    i. Inability to discern covariance between different variables unless it is very strong and overestimation of correlation when priors are held to that effect.

f. Multi-stage probability (MSP)

    i. To the extent that it is possible to infer probabilities about the future, people don't do it properly. Important bias in favour of scenarios built around the "best guess" of the agent.

g. Learning

    i. People look for corroborative evidence. General conservative bias.

C) Overall...

Agents will build scenarios based on pieces of information deemed *representative*, the selection of which is largely determined by the *availability* of this information. In looking for information, they are largely influenced by priors (*learning, covariance*), priors which may change suddenly if outcomes largely differ from expectations. These scenarios are built around agents' best guess, which is linked to the way they compute *multi-stage probabilities*.

Confidence plays two related roles: Agents are more or less confident about these guesses depending on their track record, a point also made by Minsky and linked to their inability to establish *causality*, but also more or less confident about "beating the market", i.e. generating good results.

D) Context

The analysis starts after a crisis.

E) Mechanism

1. The crisis breeds under-confidence.

   o To the extent that agents got it wrong, they will lose confidence in their predictive ability.

   o A string of success is followed by a string of failures.

   o Lower confidence in ability to generate good results.

2. Observed failures and decreases in orders among other firms are deemed representative and are more salient.

This makes for expected new orders which will decrease and probably undershoot for a while. This in turn brings down investment demand, which further depresses the economy, and the cycle continues.

This could go on for a while, but the economy might also bottom out. Various factors may contribute to the latter scenario, such as government intervention (automatic stabilisers, etc.), new entrants on the market, circumscribed downturn, etc. Regarding behavioural heuristics, there are contradictory effects: People will slowly regain confidence in their predictive ability, but it may be hard to build anything but negative scenarios as the

downturn continues, while waning memories of the crisis will allow other information to filter through. To the extent that the latter effect dominates, perhaps helped by some of the factors mentioned previously, expectations of new orders will start going up again and with it, investment demand and overall production.

3. As times get better, there will be profit opportunities and the successes of those grabbing them are likely to be salient, slowly buoying up optimism, though agents remain cautious.
   o The idea is that it is still hard to determine whether things have turned and thus to pick what results are the most representative. Signals are mixed.
4. Slow return of confidence.
   o Some false starts.
   o Memories of the crisis lingers.

This heralds a period where expectations and outcomes for new orders should be in line. Some firms are doing fine, other still recovering, and people are generally prudent. This in turn should make for fair investment demand and growth.

5. As the expansion proceeds, successes and positive information become increasingly available, while firms that are doing well seem to be representative.
   o A few good outcomes start being extrapolated.
   o Bad outcomes/signals are increasingly disregarded.

- o So for a similar set of bad and good outcomes, of good and bad news, the good start being given more weight in expectations formations than the bad.
  - This means that expectations will increasingly overshoot outcomes (relatively less pessimism and more optimism than is warranted).
  - Of course, the relative proportion of good news does go up for a while – this means that expectations increase more than what the underlying evolution of the economy would have warranted.
  - o Prior slowly evolve and growth becomes the new default scenario.
6. As the overall number of successes increases, confidence comes back... and overshoots as well.

An increase in expectations for new orders increases the demand for investment, as firms strive to build enough capacity to respond to the prospective demand, and thus fuels growth. Increased investment likely involves borrowing as well. If expectations of new orders outstrip realisations, there will be an upward pressure on the ratio of financial commitments to profit flows, i.e. there is a decrease in firms relative ability to service their debts. That is to say, this will contribute to an increase in fragility in the economy. Interestingly, if expectations for new orders outstrip outcomes period after period, there might be extra capacity built in and thus a slowdown in investment eventually, depending on the relative evolution of expectations and capacity. So fragility increases while the system nurtures the seed of a slowdown in growth.

This contributes to a situation conducive to crises. Fragility increases, investment might actually slowdown overall, and an increasing number of firms start having problem

servicing their debts (or at least, they operate on smaller margins). Incidentally, lower net profit margins may also mean a greater need for borrowing to sustain desired investment levels.

Eventually, there might be a crisis, either because a critical mass of firms cannot service their debts or repay, or because there is an external event, etc. There is then a brutal reassessment of expectations and we are back at the beginning of this story.

APPENDIX B

DATA SOURCES AND EXPLANATIONS

Expectations

1. Turkstat Survey

The Turkstat survey is quarterly and the managers of all manufacturing firms are surveyed, with a response rate of about 70-75%. Managers are asked whether a given variable (e.g. new orders) did increase, decrease, or stay the same in the current quarter and whether that variable is expected to increase, decrease or stay the same in the next quarter. The data are expressed in percentages of firms giving a specific answer, weighed by the production value or the number of establishments (I use the former), and reported separately for private and public firms, along with an aggregate category for the whole sector.

The source of the data is the following:

Manufacturing Industry (quarterly) Employment, Payments, Production, and Tendencies (provisional results), 1993-4 to 2000-2001, State Institute of Statistics, Prime Ministry, Republic of Turkey, Ankara.

They are now also available online on the Turkstat website, at

http://www.turkstat.gov.tr/jsp/duyuru/upload/vt_en/vt.htm.

I took the raw data and de-seasonalised it using Demetra, a software provided by the Central Bank of the Republic of Turkey (CBRT).[80] The data was also adjusted so that the percentages would add to 100 (the original data adds up to 100, but Demetra introduces small variations justifying the adjustment).

From this basic data, I calculate various indices.

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[80] The raw data is available upon request, as are the different transformations described in this appendix.

First, I take the difference between optimists and pessimists to get a relative proportion of optimist firms, and then between expected and realised outcomes, once for all firms in the sample and another time for private firms only (results may be seen in Figures 16, 17, 32, 33a, b, c):

(B.1) $DD_{it+1} = ((O_{it}^e - P_{it}^e) - (O_{it+1}^r - P_{it+1}^r))$

Where *DD* means double difference, *O* the proportion of optimist firms, and *P* the proportion of pessimist firms. The subscript *i* denotes the question for which the index is calculated (new orders, domestic sales, or production), while *t* stands for time. Finally, the first set of brackets contains expectations (superscript *e*) and the second one realised outcomes (superscript *r*), with expectation from a given period compared to realisations in the next one.

For example, for production, looking at all firms in the second quarter of 1994 and taking the column names...

$DD_{p, 1994Q2} = ((P10-P12)-(P1-P3))$

With P1 and P3 taken for the second quarter, and P10 and P12 for the first one.

$DD_{p, 1994Q2,} = (25.4-51.2)-(13.5-75.6)$

$DD_{p, 1994Q2,} = (-25.8)-(-62.1)$

$DD_{p, 1994Q2,} = 36.3$

This denotes over-optimism, as the number of relative pessimistic expectations was much lower than what ended up happening. All the units are percentages, so the DD index is also expressed as a percentage, though technically, the results could be over 100 or even be negative.

Second, I take only the difference between expected and realised outcomes for each of the three variables, separately for all firms and the subset of private firms (results may be seen in Figures 18-20):

(B.2) $SDO_{it+1} = O_{it}^e - O_{it+1}^r; SDP_{it+1} = P_{it}^e - P_{it+1}^r$

Where SDO is the single difference for optimists, SDP for pessimists, i represents the variable under study, the superscript e represents expectations and r realised outcomes, and t the time period. If agents have expectations that are more optimistic than outcomes warrant, SDO will have a positive value while SDP will have a negative value, and vice versa if agents are overly pessimistic.

Let's again take the second quarter of 1994 as an example, for production and for all firms, and using the column names:

SDO$_{p, 1994Q2}$=P10-P1

With P10 taken for the first quarter and P1 for the second one;

SDO$_{p, 1994Q2}$=25.4-13.5

SDO$_{p, 1994Q2}$=11.9

This denotes over-optimism, since there were more positive expectations than positive realisations. Once again, the unit is percentages, though the value of the index could be negative if there were more positive realisations than expectations (in which case, there would be over-pessimism).

Third, I calculate backward-looking expectations (BLE) by projecting a weighted average of actual outcomes into the future, using the raw outcome data. I compute two different versions, one where agents simply project the current period into the future and another where they use decreasing weights over the past three periods (4/7, 2/7, 1/7, for periods t, t-1, and t-2 respectively):

$$(\text{B.3}) \quad \begin{aligned} & E^{BL1}(x_{t+1}) = x_t; or \\ & E^{BL2}(x_{t+1}) = (4/7)*x_t + (2/7)*x_{t-1} + (1/7)*x_{t-2} \end{aligned}$$

Where x represents the variable under consideration (domestic sales, new orders, or production). Given that the data is qualitative in nature and represents the proportion of firms expecting and experiencing a decrease, an increase, or the status quo, I take the value of x to be the proportion of firm in one category (so if 50% of firms experienced an increase in new orders in period t, x takes a value of 50 for that period). In a sense, these can be viewed as the probability any given firm may end up with one outcome or another. While these weights are somewhat arbitrary, different setups gave qualitatively similar results.

Fourth, I compute rational expectations (RE) by assuming that agents always get it right, up to an exogenous shock.

(B.4) $E^{RE}(x_{t+1}) = x_{t+1} + \varepsilon_{t+1}$

Where x once again represents the outcome of the variable under study (new orders, domestic sales, or production), while ε is the random shock. In practice, I let the shocks vary within an interval of one standard deviation of the particular series under consideration:

(B.5) $\varepsilon_t \in [-SD(x), SD(x)]$

I use the random number generator from www.random.org to get a series of values for the shocks. I simulate a series of 400 series of shocks for each variable (100 for optimist expectations, 100 for pessimist expectations, each for all firms and private firms). I then calculate coefficients of correlations to compare each of the rational expectations series to the actual expectations.

Fifth, I calculate behavioural expectations informed by the theoretical framework developed in chapter 4. I use the following formalisation:

- For pessimistic expectations

(B.6) $E^{nf-}(x^p_{t+1}) = \min(x^p_t) + (x^p_{t+1} - \min(x^p_t))/t^{1/2}$ for $t = 1,...,n$, starting after a crisis, if

$(x^p_t - x^p_{t-1}) \in [-SD(x^p), SD(x^p)]$ and $E^{nf-}(x^p_{t+1}) = x^p_{t+1}$ otherwise.

Where SD is once again the standard deviation of the series. The minimum of the series is established as a base probability, to which are added negative news in the form of the difference between the actual future outcome and that base probability. To represent the

fact that the impact of these negative news is dampened through an expansion, their decreasing *salience* during that period, I divide their impact by the square root of the time elapsed since a crisis. In this case, "t" is set to one at the end of 1994. Finally, if there is a huge jump, which I represent as a realisation falling more than one standard deviation away from the previous one, I assume agents sober up and adjust perfectly next period, and the process starts again.

- For optimistic expectations

(B.7) $E^{nf+}(x_{t+1}^o) = \max(x_t^o) + (x_{t+1}^o - \max(x_t^o))/t^{1/3}$ for $t = 1,...,n$, starting after a crisis, if

$(x_t^o - x_{t-1}^o) \in \left[-SD(x^o), SD(x^o)\right]$ and $E^{nf+}(x_{t+1}^o) = x_{t+1}^o$ otherwise.

This is essentially the converse of the equation above, using the maximum of the series as a base probability and once again dampening any bad news by the time elapsed during the expansion. Once again, the time trend is restarted after the crisis. I take the cubic root this time to account for the fact that it is easier to hover between expectations of increases and status quo than either and pessimistic as an expansion proceeds, since status quo often means keeping business at a level already above what it was a few periods before.

2. Survey from The Central Bank of the Republic of Turkey

The CBRT survey uses a fixed panel of the largest manufacturing firms and is monthly. Information about this survey, along with the data, is available online on the website of the CBRT, at http://www.tcmb.gov.tr/yeni/eng/. There as well the data was de-seasonalised using Demetra.

Real Sector

1. Foley Index

To calculate the Foley Index, I use data on the flow of funds accounts of non-financial corporations, as well as the balance sheets of individual firms. The CBRT collects detailed data on the balance sheets and the flow of funds of non-financial companies, which it then aggregated by sector.

The CBRT publishes accounts every year for the previous three years: Company Accounts (1992-1994, 1993-1995 ... 2001-2004), Central Bank of the Republic of Turkey, Ankara.

Sector aggregates are available publicly through the CBRT website: http://www.tcmb.gov.tr/yeni/eng/. While working over there, I had access to the micro data on which the aggregates are based.

The number of firms included in these accounts varies from year to year. For all private firms, it goes from 9 150 in 1994 to 7 461 in 2001, with a notable drop in 1998, after which it hovers around 7 500. Private manufacturing companies go from 3 838 in 1994 to 3 724 in 2003, varying between 4 459 and 3 353 in the interim. It should be noted that the sample size is kept stable for the three-year period in each of the books, but I used one year per book (the most recent).

For the Foley Index, I used two statements: (a) Sources and Uses of Funds; (b) Income Statements. Both of them are derived from the general balance sheet.

The basic formula, an accounting identity equating possible uses with possible sources, is the following:

(B.8) $I+R+Tx=P+B+E$

Where I stands for investment; R for financing costs (including dividends); Tx for taxes; P for profits, B for borrowing, E for new equity.

In practice, given the categories available in the CBRT company accounts, this becomes

(B.9) (Ic+If-dep)+Tx+Fin=Pop+(Bsr+Blr)+OF+Fudge

Where Ic is gross current investment; If is gross fixed investment; Dep is depreciation; Tx is taxes, Fin is financing expenses (including dividends); Pop is operating profits; Bsr is the increase in short-term liabilities; Blr the increase in long-run liabilities; OF the increase in own funds (including reserves from retained earnings); and FUDGE is comprised of expenses and income without flows, the share premium account, and external operations.

The Fudge category was included to balance out the equation, with categories I did not really know how to classify. It is very small compared to the other categories.

I then take taxes out from profits and build two ratios to ease out interpretation:

(after-tax operating profits)/Fin;

(after-tax operating profits)/(Fin + net investment)

In this way, I leave the increase in own funds and borrowing in the background, as well as the fudge factor.

Firms are considered to be in a *Ponzi* state if the first ratio is less than one, such that after tax profits are not sufficient to service their financial obligations; in a *speculative* state if the first ratio is more than one, so firms have enough to service their financing obligations but not enough to invest afterwards; and in a *hedged* state if the second ratio is more than one, so that firms have high enough profits to both service their financial obligations and investment needs.

APPENDIX C

ECONOMETRIC EXPLORATIONS

There are a few linkages that could be explored in more details in the context of the analysis of the Turkish crisis in Chapter 6. In this appendix, I study some of them via the use of econometric methods. While I go through each set of relationships separately, I attempt to place them in the broader analysis by relating them to each other and to the overall narrative in the chapter.

The use of such methods requires the partial suspension of some of the postulates on which the analysis has been based so far. The existence of fundamental uncertainty, for example, precludes the existence of stable relationships over time between the macro-variables I have been using. The study of any such relationship is likely to modify people's perception of reality and behaviour, which would then change the relationship itself. This is added to the possibility of "black swans" and a myriad of events that are swept under the broad variables used or within the error term, which in turn makes it likely that said error term does not have the requisite well-behaved characteristics necessary for the analysis. Nonetheless, I ask the reader to bear with me throughout the exercise; I don't see any of the results detailed below as definitive, but maybe they can be useful in fleshing out further some aspects of the story. I should also add that this I do not make a full-fledged critique of the methods here – this is left for another day and another place. I simply assume that enough of the requisite maintained hypotheses on the data are present to give the analysis some meaning.

Given the data at my disposal, some of which is described in the data appendix (appendix B), the following relationships can be explored:

1. Variables correlated with borrowing and investment behaviour;

To investigate these relationships, I have a micro-dataset with elements from the balance sheets of a sample of Turkish non-financial corporations. It is therefore possible to relate borrowing and investment behaviour to other elements of those balance sheets, such as demand or profit. The question, then, is to see if beyond a usual set of factors, it is possible to tease out some variables correlated with borrowing or investment that are congruent with the behavioural analysis developed thus far (e.g. some of the processes described in appendix A).

2. Factors behind the *Ponzi* status of certain firms;

Using the same micro-dataset on firm balance sheets, it is possible to calculate the Foley index for individual firms. It is then possible to investigate if some variables are correlated with the fact that a firm is in a *Ponzi* state or not.

3. Links between expectations and investment or output;

Expectations series are quarterly and, by their very nature, can't be processed at another frequency and thus cannot be used alongside the micro dataset. Aggregate investment is also available at a quarterly frequency, so it could presumably be analysed alongside expectations series (or their transform). The general research question is then to see if and how expectations can be linked to investment demand.

Borrowing and Investment

I first start with an analysis of borrowing and investment behaviour in this first sub-section. I try to see if the amount of investment or funds borrowed by Turkish non-financial corporations is correlated with other elements of their balance sheets and if some channels whereby expectations play their part can be identified. I start with investment and first look at a common investment theory to select some basic variables to include in the regression. I then try to design some behavioural channels linked to the theories expounded in the previous chapters. A study of some of the variables correlated with borrowing follows.

There is no dearth of investment theories, each with their focus and subset of variables. Nevertheless, it is possible to get a basis for analysis by specifying a simple investment model, following Orhangazi (2008):

$$(C.1)\ I = f(\pi, S, D, F)$$

Where investment (I)[81] is made to depend on profits (π), sales (S), the debt stock (D), and financial payments (F)[82].[83] Orhangazi (1998) also has a financial profits variable, but it is of debatable relevance for Turkish non-financial corporations, so I don't include it. Following his analysis, it could be hypothesised that profit and sales should impact investment positively, while the impact of financial payments, part of investment cost, should be negative. The level of debt can have an ambiguous impact, depending on how high it is

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[81] Investment is defined as the growth in total assets, combining both current and fixed investment.
[82] Financial payments are operationalised by using the payments made by a firm to service its liabilities. Technically, this abstracts from dividends, but since dividends were not an important cost for most firms, it constitutes a good approximation of the payments made to financial markets.
[83] See Table 13 for a list of the variables used in this appendix.

relative to what is perceived acceptable. At high levels, more debt could slow down investment, while it could speed it up at low levels. In sort:

$$I_\pi > 0; I_S > 0; I_F < 0; \ I_D \lesseqgtr 0$$

The next step is to add a behavioural channel to this baseline specification. Linking back to the previous analysis in chapters 3 and 5, the impact of each of these variables on expectations should change through time. That is to say, any given level or change in sales, profit, debt, or financing costs should be viewed differently at different moments of the cycle. For example, agents could interpret a certain level of sales more positively after a few years have elapsed since the last crisis, greater financial laxity could generate more tolerance to debt, etc.

To represent this possible influence of expectations, I multiply these variables by a time trend. My hypothesis is that the coefficient on this cross-variable should be positive for profits, sales, and financial payments. For sales and profit, this would imply that any given sales or profit levels would generate more optimistic expectations for future results as the expansion proceeds. For financial payments, the implication would be that the negative impact of their level decreases through time. Finally, for debt, the issue is more complicated. Even if the ceiling on the level of acceptable debt was raised through time, the end result remains ambiguous, since it depends on the level at the start (e.g. if the level was not binding at the outset, then its change might not be such a factor). While I include a cross-variable along with the others, I remain agnostic regarding the possible sign of its coefficient. These

hypotheses only hold for a given segment of the business cycle and thus are tested only for the period of economic expansion between the two crises.[84]

Taking the double derivative of investment with respect to time and each the variables, the expected signs are thus:

$$I_{ST} > 0; \ I_{\pi T} > 0; \ I_{FT} > 0; I_{DT} \lessgtr 0$$

Put differently, I hypothesize that the first derivative of investment with respect to sales, profits, financial payments, or the debt stock has the following form:

$$\frac{\partial I}{\partial x} = \alpha + \theta t$$

Where "x" stands for either of the four variables. While α could be positive or negative depending on the variable, θ is the coefficient of interest for my framework. If the behavioural expectations framework described in chapters 3 and 5 is right, the coefficient on time should be positive for sales, profits, and financial payments during an expansion. In the first two cases, a positive coefficient would be congruent with an increase in the *salience* and *representativeness* of positive results as the expansion proceeds. A positive value of θ for financial payments would then be congruent with an increase in laxity throughout the period, perhaps as a result of waning memories of the crisis and the development of *overconfidence*. Negative or statistically insignificant results for θ could, by contrast, suggest that something

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[84] The theory also has implications for turning points and the downturn, but in the Turkish case, both turning points straddle a year and I do not have enough data for the downturn following the crisis. Consequently, the inter-crisis upturn appears to be the most relevant period to study with my yearly data.

else is going on and that the behavioural framework may not be the best way to illustrate the way in which outcomes factor in expectations.

Following Orhangazi (2008), I divide the variables by the capital stock (K) to ward off possible heteroscedasticity problems, and estimate the panel using two-way fixed effects to account for any specific fixed firm-level and period characteristics.[85] Finally, I use the lag of investment to control for dynamic effects and also adjust investment for inflation by deflating it with a producer price index (I use the real capital stock as a denominator). The equation to be estimated is thus:

$$(C.2) \; \frac{I_{i,t}}{K_{i,t-1}} = \beta_0 + \beta_2 \left(\frac{I_{i,t-1}}{K_{i,t-2}} \right) + \beta_3 \left(\frac{D_{i,t-1}}{K_{i,t-1}} \right) + \beta_4 \left(t * \frac{D_{i,t-1}}{K_{i,t-1}} \right) + \beta_5 \left(\frac{\pi_{i,t-1}}{K_{i,t-1}} \right) + \beta_6 \left(\frac{t*\pi_{i,t-1}}{K_{i,t-1}} \right) + $$

$$\beta_7 \left(\frac{S_{i,t-1}}{K_{i,t-1}} \right) + \beta_8 \left(t * \frac{S_{i,t-1}}{K_{i,t-1}} \right) + \beta_9 \left(\frac{F_{i,t-1}}{K_{i,t-1}} \right) + \beta_{10} \left(t * \frac{F_{i,t-1}}{K_{i,t-1}} \right)$$

Where the subscript "i" identifies the firm and "t" stands for time. The estimation is conducted for the years between 1995 and 1999, both of them included, to capture the length of the expansion, which is taken to be the time between the 1994 crisis and the 199 earthquake). Furthermore, I restricted the sample to the larger firms (top 50%), as many small firms jump in and out of the statistics, with relatively large changes in one direction or the other and anyway, are often arms of larger ones in Turkey.[86] Estimation results are laid out in Table 9.

The picture that emerges from the estimation is interesting. All the coefficients are statistically significant, at least at the 10% level, and an F-test on the firm dummies supports their presence. However, while all the coefficients of the variables representing the

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[85] Estimation via random effects yields similar results. While a Breush-Pagan test revealed the existence of random effects, a Hausman test suggested that the random error component was correlated with the regressors, leading me to select the fixed effects model.
[86] Including smaller firms in the sample does not qualitatively alter the results.

behavioural channels have the predicted positive sign, all the coefficients on the original ones (sales, debt stock, profit, and financial payments0, along with the lag in investment, are negative. For one thing, this supports my contention that the impact of these variables becomes more positive as the expansion proceeds. Regarding the negative coefficients of the base variables, they are not unexpected for financial payments and total debt. The case of sales and profit is more puzzling. Given the size of the coefficient and the way the time trend was computed, the estimation results suggest that at no point of the expansion is the overall impact of these variables positive. While the results support the existence of a behavioural channel as theorised above, they also suggest that other dynamics might be at play alongside that channel.

I conduct a similar analysis with respect to net borrowing (B), here calculated as the change in total liabilities. In this case, I add the effective interest rate faced by every firm (R), which I approximate by taking the ratio of financial payments to liabilities. This effective interest rate should have a negative effect on borrowing. I also add a dummy variable taking the value of 1 if the firm is in a *Ponzi* state. With the variable, I hope to measure whether the financial health of a firm is correlated with its level of borrowing or not. The sign of the coefficient on this variable could go both ways, as being in a *Ponzi* state makes a firm desirous to borrow money, but could restrain the ardours of prospective lenders.

Since I include the interest rate, I leave out interest payments. I still include past sales, profits, and debt, but now am agnostic regarding the sign of their coefficient. Sales or profit could encourage further borrowing by sending a positive signal, but they also provide resources that decrease the need for credit. Once again, the level of debt could be a hindrance to further borrowing, but also may underline the need for outside funds or simply a propensity to have recourse to credit. I also include the product of these three variables

with a time trend as behavioural channels. Just as before, the hypothesis is that as the expansion proceeds, any given level of outcome for sales and profits is interpreted in a more positive light, so the sign of the coefficients of the product of these variables with the time trend should be positive. The exact influence of the debt level remains once more uncertain, so I don't have precise expectations regarding the coefficient of the cross-product.

Overall, the expected signs are the following:

$$B_S \lesseqgtr 0; B_\pi \lesseqgtr 0; \ B_D \lesseqgtr 0; \ B_R < 0; B_P \lesseqgtr 0; B_{ST} > 0; B_{\pi T} > 0; B_{DT} \lesseqgtr 0$$

The coefficients on the interacted variable will thus again be the results of interest, as a positive and statistically coefficient would provide support for the behavioural framework, while a negative or statistically insignificant coefficient would provide evidence against the framework.

I once again divide borrowing, sales, profits, and liabilities by the capital stock to ward off possible heteroscedasticity problems, and estimate the panel using two-way fixed effects to account for any specific fixed firm-level and period characteristics[87]. I also use the lag of borrowing to control for the dynamic effects and also adjust both borrowing variables for inflation by deflating it with a producer price index (their denominator is the real capital stock). Finally, as before, I include some time dummies to represent some of the evolution of the economy during the period studied not captured by the other variables. This yields the following equation:

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[87] As it did with the investment equation, estimation via random effects yields similar results. Once again, a Breush-Pagan test revealed the existence of random effects, but a Hausman test suggested that the random error component was correlated with the regressors. I thus selected fixed effects once again.

$$(C.3) \ \frac{B_{i,t}}{K_{i,t-1}} = \beta_0 + \beta_2\left(\frac{B_{i,t-1}}{K_{i,t-2}}\right) + \beta_3\left(\frac{D_{i,t-1}}{K_{i,t-1}}\right) + \beta_4\left(t * \frac{D_{i,t-1}}{K_{i,t-1}}\right) + \beta_5\left(\frac{\pi_{i,t-1}}{K_{i,t-1}}\right) + \beta_6\left(\frac{t*\pi_{i,t-1}}{K_{i,t-1}}\right) +$$

$$\beta_7\left(\frac{S_{i,t-1}}{K_{i,t-1}}\right) + \beta_8\left(t * \frac{S_{i,t-1}}{K_{i,t-1}}\right) + \beta_9\left(P_{i,t}\right) + \beta_{10}\left(P_{i,t-1}\right) + \beta_{11}R_{i,t}$$

Where the subscript "i" identifies the firm, "t" stands for time, "K" the capital stock, "D" the debt stock, "π" profits, "S" is total sales, "B" is borrowing, "R" the interest rate, and "P" the dummy variable taking a value of 1 if the firm is in a *Ponzi* state. Once again, the estimation is conducted for the years between 1995 and 1999, both of them included, to capture the length of the expansion, and I restricted the sample to the larger firms (top 50%).[88] Estimation results are shown in Table 10.

As was the case with investment, the coefficient on profits and debt are negative while the coefficients on their product with the time trend is positive, all four being statistically significant at the 1% level. This once again provides support for my contention that given results are viewed more positively as the expansion proceeds. Furthermore, the negative coefficient on profits is not necessarily unexpected in this case, suggesting that the resource provided by profits may be a more important effect than their impact on firms' desire and ability to borrow, even though the positive and significant coefficient on the cross-product with time certainly suggest that this latter aspect is also important. The coefficient on the interest rate is negative and statistically significant, which is to be expected, while the coefficient on past borrowing is not statistically significant at all.

The coefficients on sales and the cross-product with time are no longer statistically significant, however. This could perhaps be due to the fact that expectations are working both through profits, debt, and sales outcomes and thus that sales is somewhat crowded out.

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[88] Once again, including smaller firms does not qualitatively change the results.

To investigate this, I ran a regression without profits and debt levels (specification (2) in the result table). In this specification, the coefficient on sales and the product with time are now significant, with the same sign as in the regression on investment. This suggests that these channels may be substitutes, with the sales channel being somewhat weaker.[89] Similarly, with debt removed from the equation, the coefficient on past borrowing is now negative and statistically significant.

This may flesh out somewhat some of the channels operative in the framework described in chapter 4. If firms are ultimately looking for profits, then it is their profit expectations that matter. As I argued in chapter 6, sales were, in Turkey, a very important consideration during the years under study. Nonetheless, it is not necessarily surprising that they would take a backseat to profits themselves. Sales, in this sense, are perhaps more an indication of possible future profits to come than a spur in and of themselves.

The coefficients on the *Ponzi* dummy variable and its lag is interesting as well. The positive coefficient on the contemporaneous variable denotes a positive correlation with borrowing, which makes sense: The more a firm borrows, the more likely it is to end up in a *Ponzi* situation, while such a state itself generates demand for more loans. This tendency seems to dominate whichever borrowing constraint the firm may be experiencing as a result of the bad state of their finances. At the same time, having experienced a *Ponzi* state the year before (and lived to tell the tale) seems to be associated with less borrowing the next year, possibly because the borrowing constraint is operative in this case.

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[89] I ran various tests and it seems that the correlation between sales and profit, deflated by the capital stock as they are throughout this analysis, is both positive and strong.

This may help explain the fact that domestic borrowing did slow down as the expansion

neared its end and external shocks beset the economy, since by that point, a sizeable number

of firms found themselves in a *Ponzi* situation (Figure 30).

Leverage and Ponzi Status

Next, I look at some of the characteristics of the firms which are in a *Ponzi* state.

Using the *Ponzi* dummy variable as dependent variable, I investigate whether it is correlated

with the employment level of the firm in question or the size of its capital stock. I do so

both via the inclusion of total employment and the real capital stock, but also by dividing the

sample into four different categories for each variable: Top 1%, top 10%, bottom 10%, and

bottom 50%. In addition, I also include a time trend to capture the change in probability

through time, as well as a dummy variable taking a value of 1 if the firm increased its

leverage that year and 0 if it did not, and the lag of this variable.

The idea behind the addition of the dummy variable linked to the increase in

leverage is to see whether such an increase in the present or the past is correlated with a

change in the probability for a firm to be in a *Ponzi* state. Presumably, past increases in

leverage should be correlated with a higher probability to be in a *Ponzi* state. The

contemporaneous correlation is not so evident, however, since it is possible that firms in a

Ponzi state are actually unable to increase their leverage, while they might actually try to do

so looking for short-term relief. This also makes a link with the previous analysis, which was

concerned with the determinants of borrowing: Increases in borrowing may be reflected in

increases in leverage and, in turn, in increases in the probability of being in a *Ponzi* state.

The equation estimated is the following:

$$(C.4)\ P_{i,t} = \beta_0 + \beta_2 E_{i,t} + \beta_3 M_{i,t}^{top1} + \beta_4 M_{i,t}^{top10} + \beta_5 M_{i,t}^{bot10} + \beta_6 M_{i,t}^{bot50} + \beta_7 K_{i,t} +$$

$$\beta_8 A_{i,t}^{top1} + \beta_9 A_{i,t}^{top10} + \beta_{10} A_{i,t}^{bot10} + \beta_{11} A_{i,t}^{bot50} + \beta_{12} t + \beta_{13} L_{i,t} + \beta_{14} L_{i,t-1}$$

Where "P" is the *Ponzi* dummy variable, "E" is the level of employment, which is followed by four dummy variable representing different employment categories (M), "K" is the capital stock, also followed by four dummy variables representing different asset categories (A), "L" is a dummy variable representing an increase in leverage since the previous year, "i" identifies the firm, and "t" stands for time (and the time trend in the equation). This equation is estimated via a Logit model, using all firms, for the years 1995-2001. Estimation results can be perused in Table 11.

The general lack of statistical significance on the employment and capital stock variables seems to suggest that firms across the board were beset by these problems. There is some evidence that being in the top 1% in terms of employment was correlated with a higher probability of being in a *Ponzi* state, but none of the other employment variables have coefficients that are statistically significant. Moreover, there is some evidence that having a higher capital stock is correlated with a lower probability of being in a *Ponzi* state.[90] The coefficient on the capital stock variable is negative and statistically significant at the 5% level, while the coefficient on the dummy variable standing for the firms in the bottom 10% in terms of asset levels is positive and statistically significant at the 10% level. However, none of the other categories have statistically significant coefficients.

The time trend and the lagged leverage increase variable seem to be the most significant variables correlated with the probability of a firm being in a *Ponzi* state, both of

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[90] The results for capital stock and employment may seem contradictory at first glance, but the employment and capital stock variables actually only have a correlation coefficient of about 0.5, suggesting that while present, the association is loose. These are therefore complementary indicators of size, associated with two related but distinct aspects of the firms.

which having a positive coefficient. This is not particularly surprising in the case of the time trend, given the increase in financial fragility throughout the period under study, which was analysed in chapter 6. Similarly, it is perhaps to be expected that the lagged leverage variable be positive: If a firm increases its leverage, it incurs greater risk of ending up in a *Ponzi* state in the future. Interestingly, the coefficient on the current period leverage variable is negative and statistically significant at a 10% level, suggesting that firms that can and do actually increase their leverage may be less likely to already be in a *Ponzi* state, perhaps due to a borrowing constraint at that point.

Given the strong correlation between an increase in leverage and the subsequent probability of being in a *Ponzi* state, it may be worthwhile to study further the variables correlated with such an increase in leverage. To this end, I run two more logit regressions with "increase in leverage" as a dependent variable – one for the whole period under study and one focused on the expansion.

In the regression for the whole period, I include the lag of total sales, profits, and debts, deflated by the capital stock, the effective interest rate and its lag,[91] as well as the dummy for *Ponzi* states and its lag. I hypothesise that past sales and profit should be correlated with an increase in the probability that a firm increases its leverage, as they send a signal for future profitability. I am again agnostic with respect to the lagged debt variable, since a high level could indicate a propensity to borrow and a need for more loans, while it could also be a limitation factor if it leads to an operative debt ceiling. The interest rate, and perhaps its lag, being a proxy for the cost of borrowing, should be negatively correlated with the probability of an increase in leverage. Finally, the *Ponzi* dummy should exhibit the negative correlation that was found previously. The expected signs are thus the following:

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[91] The interest rate is constrained to lie between 0 and 1, so that extreme outliers don't drive the results.

$$L_S > 0; L_\pi > 0; L_D \lessgtr 0; L_{R_t} < 0; L_{R_{t-1}} < 0; L_{P_t} < 0; L_{P_{t-1}} < 0$$

Along with these variables, I include year dummies, which yields the following

equation:

(C.5) $L_{i,t} = \beta_0 + \beta_2 \frac{S_{i,t-1}}{K_{i,t-1}} + \beta_3 \frac{\pi_{i,t-1}}{K_{i,t-1}} + \beta_4 \frac{D_{i,t-1}}{K_{i,t-1}} + \beta_5 R_{i,t} + \beta_6 R_{i,t-1} + \beta_7 P_{i,t} + \beta_8 P_{i,t-1} +$

$\sum_{j=1996}^{j=2001} \alpha_j T_j$

Where the subscript "i" identifies the firm, the subscript "t" the time period, "L" is a

dummy taking the value of 1 if the firm increase its leverage that period, "S" the total sales,

"π" total profits, "K" the capital stock, "D" total liabilities, "R" the effective interest rate, "P"

is a dummy variable taking the value of one if the firm is in a *Ponzi* state, and "T" a series of

time dummies, using 1995 as the base year. I estimate this equation for the whole period

under study, i.e. 1995 to 2001, using every firm, via a fixed-effect logit procedure to control

for firm-specific characteristics. Estimation results are laid out in Table 12, in the first

column.

The results are both interesting and a bit puzzling. While the coefficient on sales is

not statistically significant, the coefficient on profits is both positive and statistically

significant at a 1% level. This suggest that past profits are indeed correlated with an increase

in leverage, a channel that is stronger than sales. The expected negative correlation between

the *Ponzi* dummy variable and the probability that a firm increases its leverage shows up in

the estimation, though the lag of the *Ponzi* dummy is somewhat less statistically significant.

However, the results suggest no correlation between the interest rate and an increase in leverage. This absence of influence of the interest rate is harder to explain.

For the second regression, encompassing the first economic expansion, I use all the variables from the first one, to which I add the product of a time trend with profits and sales, to see if their putatively positive effect increases as the expansion proceeds. As argued above, a positive coefficient on these variables would provide support for my contention that positive profit or sales outcomes are interpreted more optimistically in the expectation formation process as the expansion runs its course. In the same spirit, I also include a variable in which the effective interest rate is multiplied by the time trend. I would theorise that any negative effect of the interest rate should go down through time. The equation estimated is the following:

$$(C.6) \ L_{i,t} = \beta_0 + \beta_2 \frac{S_{i,t-1}}{K_{i,t-1}} + \beta_3 \frac{\pi_{i,t-1}}{K_{i,t-1}} + \beta_4 \frac{D_{i,t-1}}{K_{i,t-1}} + \beta_5 R_{i,t} + \beta_6 R_{i,t-1} + \beta_7 P_{i,t} + \beta_8 P_{i,t-1} +$$

$$\beta_9 t * \left(\frac{S_{i,t-1}}{K_{i,t-1}}\right) + \beta_{10} t * \left(\frac{\pi_{i,t-1}}{K_{i,t-1}}\right) + \beta_{11} t * R_{i,t} + \sum_{j=1996}^{j=1998} \alpha_j T_j$$

Where the subscript "i" identifies the firm, "t" the time period, "L" is a dummy taking the value of one if the firm increase its leverage that period, "S" the total sales, "K" the capital stock, "D" total liabilities, "R" the effective interest rate, "P" is a dummy variable taking the value of one if the firm is in a *Ponzi* state, and "T" a series of time dummies, using 1995 as the base year. I estimate this equation for the period spanning from 1995 to 1998, using every firm, via a fixed-effect logit procedure to control for firm-specific characteristics. Estimation results are laid out in Table 12, in the second column.

The coefficient on sales and its product with the time trend are once again not statistically significant. Interestingly, the coefficient on profits is now also statistically insignificant. Nonetheless, the coefficient on the product between profits and the time trend is positive and significant, lending some support to my behavioural expectations framework.[92] The coefficient on total debt is once again positive and statistically significant, denoting a positive correlation between accumulated debt and increase in leverage during the expansion, possibly because the size of the existing debt stock says more about a firm's tendencies and good access to credit than a putative debt ceiling. On this note, though, being in a *Ponzi* state is still negatively correlated with increasing leverage, so maybe there is a ceiling, but only when a firm reaches an unsustainable level of debt. Finally, the coefficient on the interest rate and its lag are more puzzling than before, being now positive and statistically significant. This suggests that a higher interest rate is correlated with an increase in leverage, which is surprising, beyond the fact that a higher effective interest rate could denote a greater need for credit.[93]

Taking the two regressions together, these results suggest that positive profit outcomes did lead to increases in leverage, and increasingly so as the expansion proceeded, which in turn subsequently increased the probability that a firm ended in a *Ponzi* state. This provides further support for the behavioural expectations formation framework, especially for the years during the first economics expansion, by delineating a channel whereby behavioural expectations coulod have played a role.

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[92] There is some evidence that there could be multicollinearity between the two profit variable and either of them has a statistically significant coefficient when it is included by itself.
[93]In this case as well, there is some evidence of multicollinearity between the two contemporaneous interest variables. Nevertheless, the result of a positive coefficient is relatively robust to alternative specifications.

Expectations and Investment

In addition to the probability of a firm to be in a *Ponzi* state and the correlation between different outcomes and borrowing and investment behaviour, it is also possible to study directly the correlation between investment and agent expectations. I focus on two series for investment: real quarterly private investment[94] and the percentage increase in private investment from the same quarter in the previous year. For expectations, I look at the three double difference series analysed in chapter 6 (see equation (1) in chapter 6 for details).[95]

I first test these five series for the presence of unit roots with augmented Dickey-Fuller tests. The first step of the procedure is to determine whether the series exhibit autocorrelation and if so, how many lags of the dependent variable are needed to get rid of it. Autocorrelation is present in both investment series: The error term in the percentage increase series is, perhaps unsurprisingly, correlated with the error term four lags away, while the error term in the investment series is correlated with the lags 2 and 4. Having added enough lags in the dependent variable to soak up the autocorrelation, I then test the two series for unit roots and find one in both of them. Repeating the procedure for the first difference of the variable yields a negative on the unit root test, suggesting that both series have an order of integration of 1.

I followed the same steps for the three expectations series and found neither autocorrelation nor unit roots. Since none of the expectations series has a unit root, I cannot test for cointegration, which could have allowed me to use the level of the investment variables rather than their first difference, as well as investigate the properties of the cointegration vectors. I therefore have to proceed with first-differenced investment variables

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[94] I seasonally adjusted the series prior to the estimation.
[95] Qualitatively similar results are obtained when using simple differences.

for the rest of the analysis in this section. This leads me to leave the percentage increase

series aside, as I am not sure how I would interpret the first difference of that variables in

terms of expectations.

Thus limited to an analysis of the correlation of expectations and the growth in

investment, inference is not necessarily intuitive. If investment levels are already high, for

example, it is not evident that overly optimistic expectations should necessarily bring a rise

in the growth rate of investment. Instead, that high rate could simply be maintained, say in

the face of disappointing outcomes, or be reduced a bit, though less than the situation might

warrant. Indeed, in the current case, preliminary analysis reveals a positive correlation

between expectations (all three variables) and the level of investment at the time

expectations are formed and one period before. This suggests a feedback loop between

expectations and investment, whereby a high level of investment props up expectations,

possibly via a positive influence on economic activity, and investment levels are high again

during that period of overly optimistic expectations. This is consistent with the analysis in

chapter 4. But of course, the investment series has a unit root, so the correlation could be

spurious. When the first difference is used, the correlation is dampened and reversed, now

being negative, which at first blush would invalidate the previous results.[96]

However, given that the highest disconnect happens at the end of the expansion, at a

time when output growth is slowing down, it is not necessarily surprising that there would

be a negative linkage between first-differenced investment and double difference for the

three variables. What is more, using the first difference of investment in effect puts the

negative lag of the series on the left hand side of the equation. Given the putative positive

correlation between the first lag of investment and expectations, this is liable to increase the

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[96] This is visible both through VAR analyses, with concomitant IRFs and FEVDs, or straight time series. For reasons that are detailed below, I don't show the results here.

negative correlation between expectations and the first difference of investment. But then, what should we conclude from these results, beyond the fact that investment slows down before expectations come back down? Well, maybe that is something, but it could already be seen from the graphs presented in chapter 6 themselves.

This, it turns out, may not be the main problem. Time series analysis tends to be volatile, especially when the number of degrees of freedom is low. In this case, low might be an understatement. I have 31 data points if 1994 is included and VARs or simple time series equations must be run with a few lags. The lags both eat data points and decrease the number of degrees of freedom, sending the total to the low 20s in the best of cases. With such a small sample, many of the statistical hypotheses derived from large number theory do not hold. Perhaps even more to the point, the results could be highly tributary to the presence of outliers. In this case, some manipulations reveal that the results appear largely driven by a couple of large observations in the double difference series. As can be seen in Figure 17, these series peak in late 1998 - early 1999, when investment had already slowed down for a couple of periods. This implies that the largest positive values in the expectations series are thus associated with negative values for the first difference of the investment series, itself driving the observed negative correlations. Having the results depend on a few extreme observations is not really satisfying, beyond the other problems already mentioned.

All of this leads me to discard this method of analysis. Consequently, I don't report the various results mentioned in this sub-section.

Conclusion

Both the two regressions on investment and borrowing behaviour and the sequence of logit regressions outlined some results that are congruent with the behavioural framework

outlined in Chapters 3 and 5. Focusing in the inter-crisis expansion, profits – and to a lesser extent sales – outcomes were found to have a greater positive correlation as time went on and the expansion ran its course. This is consistent with my contention that any given outcomes will be perceived differently at different moments and, in particular, increasingly positively throughout an expansion. Unfortunately, possible correlations between investment and expectations could not be studied directly for lack of workable data, but this is certainly an area that could be explored in the future.

APPENDIX D

TABLES AND FIGURES

Table 1.
Various Ratios Describing the Outstanding External Debt
(percent)
1996-2003 (Annual; end of period)

	SR/LR	SR/TOT	SR/GNP	TOT/GNP	PUB/TOT	PRI/TOT	SR/RES	RES/GNP	TOT/RES
1996	27,44	21,53	9,24	42,92	66,17	33,83	68,38	13,52	317,55
1997	26,62	21,03	9,10	43,29	60,11	39,89	65,19	13,96	310,05
1998	27,48	21,56	10,09	46,79	54,81	45,19	70,42	14,32	326,71
1999	28,63	22,26	12,21	54,87	51,83	48,17	67,91	17,98	305,10
2000	31,36	23,87	14,05	58,85	52,93	47,07	82,85	16,96	347,07
2001	16,87	14,43	11,34	78,59	62,04	37,96	54,33	20,88	376,41
2002	14,43	12,61	8,98	71,18	65,81	34,19	43,15	20,81	342,05
2003	18,81	15,83	9,65	60,96	64,66	35,34	51,19	18,86	323,28

Source: Central Bank of Turkey, except for the GNP, which was obtained from the Treasury of Turkey

Notes:
1. Acronyms: SR - Short-run; LR - Long-run; GNP - Gross National Product; PUB - Public; PRI - Private; TOT - Total;
RES - Total International Reserves
2. The number used for international reserves is for the end of the period
3. Slight revisions are made once in a while, so the percentages may not be exactly the same as current debt data numbers.

Table 2.
Proportion of Non-Performing Loans
(percent)

	BAT	O and S
1986	6,02	
1987	4,41	
1988	2,87	
1989	1,51	
1990	1,24	
1991	1,90	
1992	1,36	
1993	1,23	
1994	1,79	
1995	1,20	2,8
1996	0,77	2,2
1997	0,98	2,4
1998	4,01	7,2
1999	4,08	10,7
2000	4,27	11,6
2001	10,49	18,6

Sources: (1) Banks association of Turkey (BAT), 40th Year Book; (2) Ozatay and Sak (2003)

Notes:
1. O and S also mention values for March 2000 (9.8), June 2000 (9.7) and September 2000 (9.3).
2. O and S' 2001 value is taken in September.

Table 3.
Indicators of Currency and Credit Risk for the Commercial Banking Sector
(percent)

	1995	1996	1997	1998	1999	2000 (March)	2000 (June)	2000 (Sept.)	2000	2001 (sept.)
FX Assets / FX Liabilities	90,6	93,6	89,6	84,9	79,4	74,3	73	71,6	75,9	81
Liquid FX Assets / FX Liabilities	44,8	44,6	41	39,5	40	36,6	35,2	34,4	35,9	38,3
Liquid Assets / Total Sources	46,7	44	41,1	39,9	42,6	42,4	41	38,3	37,9	51,4
SR Assets / Liabilities	n.a.	n.a.	45,8	45,7	46,3	40,8	41,8	43,9	39,9	43,9
Share of deposits with maturity										
of 6 months or more in deposits	26,1	26,6	24,7	22,9	28,2	19,8	18,7	19,3	15,1	11,6
Repos / (Liabilities + Repos)	5,1	8,1	12,8	10,4	9,6	12	11,4	10,9	11,3	6,1

Source: Özatay, Fatih and Güven Sak (2003). «Banking Sector Fragility and Turkey's 2000-01 Financial Crisis»,
in Susan M. Collins and Dani Rodrik eds. Brookings Trade Forum: 2002, Brookings Institution Press.

Notes:
(1) Assets and Liabilities are considered short-run if they have a maturity of three months or less.
(2) FX denotes denomination in foreign currency, SR stands for "short-run"

Table 4.
Securities Markets
1988-2000 (annual)

	Securities by Sector						Securities Market Trading Volume		
	Public			Private		Total	Stock Exch.	Gov. Sec.	REPO
	Gov. Bonds	T-Bills	Total	Shares	Total		Million USD	Million USD	Million USD
	% of GDP	% of GDP	% of GDP	% of GDP	% of GDP	% of GDP			
1988	3	4	6,9	0,3	0,9	7,8			
1989	3,9	3,3	7,7	0,4	1	8,7			
1990	3,2	2,1	5,5	0,5	1	6,5			
1991	1,8	5,4	7,4	0,7	1	8,5			
1992	6,8	8,7	15,9	0,5	1,7	17,6	115		
1993	7,5	9	16,8	0,5	3,8	20,6	773		
1994	4,8	16,7	22,7	1	2,1	24,8	5 854		
1995	4,4	15,4	19,8	0,5	2,1	21,9	8 502	312	
1996	8,3	24,8	35,3	0,6	1	36,3	8 567	2 403	
1997	8	14,9	22,9	0,7	1	23,9	21 771	10 717	4 794
1998	2,5	26,9	29,4	0,8	1	30,4	23 202	8 828	23 704
1999	27,3	11,3	38,7	0,9	1,1	39,8	52 311	16 509	123 254
2000	32,3	5,2	37,5	2,4	4,6	42,1	36 698	32 736	221 405

Source: Boratav and Yeldan (2002)

Table 5.
GDP Growth
1988-2004 (Annual)

	GDP per cap.	GDP
	%	%
1988	0,34	2,12
1989	-1,48	0,25
1990	7,36	9,26
1991	-0,83	0,93
1992	4,14	5,98
1993	6,17	8,04
1994	-7,09	-5,46
1995	5,35	7,19
1996	5,19	7,01
1997	5,72	7,53
1998	1,39	3,09
1999	-6,23	-4,71
2000	5,72	7,36
2001	-8,85	-7,50
2002	6,44	7,94
2003	4,37	5,79
2004	7,50	8,93

Source: World Bank (Population data) and Turkstat (GDP data)

Table 6.
Unemployment Rate
1991-2004 (annual: Average)

	Unemployment %
1991	7,9
1992	8,1
1993	7,8
1994	8,1
1995	6,9
1996	6
1997	6,4
1998	6,3
1999	7,7
2000	6,6
2001	8,5
2002	10,3
2003	10,5
2004	10,3

Source: Turkstat

Table 7 a.
Debtors' Share of Outstanding External Debt
(percent)
1996-2003 (Annual; end of period)

| | Short-Run | | | Long-run | | | | | |
	Dresdner	Banks	Other (PRI)	gov	State ent	CBRT	Banks	NBFE	NF private
1996	5,52	49,31	44,92	58,29	4,24	18,31	3,65	1,74	11,86
1997	4,86	48,06	46,61	52,24	4,10	16,36	5,65	2,68	16,97
1998	4,32	53,72	41,93	47,17	3,79	15,97	5,65	3,45	22,22
1999	2,97	57,47	39,54	47,03	3,90	12,88	5,96	3,39	24,84
2000	2,22	59,72	34,44	47,05	3,88	14,88	5,04	3,36	23,90
2001	4,46	48,75	46,66	42,40	3,54	24,26	3,30	1,62	23,34
2002	9,99	38,63	51,30	51,98	3,13	17,88	2,65	1,38	22,11
2003	12,38	42,12	45,46	53,57	2,71	17,58	2,52	1,51	21,49

Source: Central Bank of Turkey

Notes:

1. CBRT - Central Bank of the Republic of Turkey; NBFE - Non-Bank Financial Enterprises; NF - Non-Financial; PRI – Private

2. Slight revisions are made once in a while, percentages may not be exactly the same as current debt data numbers.

Table 7 b.
Lenders' Share of Outstanding External Debt
(percent)
1996-2003 (Annual; end of period)

| | Short-Run | | Long-run | | | | | | | |
	Banks (PRI)	PRI Lender	gov	Mult	PRI Banks	NBFE	NMI	Off-Shore Banks	Dresdner	Bond Issue
1996	38,03	61,97	15,49	14,21	23,69	4,71	2,87	0,75	17,23	21,03
1997	46,13	53,87	13,46	12,12	27,67	6,76	2,82	1,04	15,45	20,66
1998	47,82	52,18	12,81	10,58	29,29	7,99	3,94	1,34	15,45	18,56
1999	50,35	49,65	11,40	9,75	30,58	8,73	4,97	1,24	12,39	20,91
2000	61,15	38,85	9,63	12,67	30,34	6,21	4,74	1,33	10,77	24,21
2001	47,40	52,60	8,81	22,65	28,29	3,47	4,05	0,75	10,23	21,66
2002	31,58	68,42	8,17	27,03	25,11	2,89	4,18	0,95	10,79	20,78
2003	35,89	64,11	7,72	27,11	23,75	2,44	3,71	1,33	11,63	22,23

Source: Central Bank of Turkey

Notes: 1. NMI - Non-Monetary Institution
        2. CBRT - Central Bank of the Republic of Turkey; NBFE - Non-Bank Financial Enterprises; NF -
        Non-Financial; PRI - Private
        3. Slight revisions are made once in a while, percentages may not be exactly the same as current debt
        data numbers.

Table 8.

Number of Instances of Different Expectations Models Within 1 Standard Deviation of Actual Expectations

	Production		Domestic Sales		New Orders	
	Optimistic	**Pessimistic**	**Optimistic**	**Pessimistic**	**Optimistic**	**Pessimistic**
3P-BLE	19/30	0/30	17/30	0/30	12/30	3/30
1P-BLE	21/32	3/32	20/32	0/32	15/32	4/32
Behavioural Exp.					23/29	26/29

Table 9.
Investment Behaviour

Dependent variable: (I_t/K_{t-1})

	(1)
(I_{t-1}/K_{t-2})	-0.034**
	(0.014)
$(S/K)_{t-1}$	-0.0035***
	(0.0013)
$(\pi/K)_{t-1}$	-2.43***
	(0.29)
$(F/K)_{t-1}$	-0.72***
	(0.27)
$(D/K)_{t-1}$	-2.38***
	(0.14)
$T*(S/K)_{t-1}$	0.00052***
	(0.00019)
$T*(\pi/K)_{t-1}$	0.12*
	(0.065)
$T*(F/K)_{t-1}$	0.17***
	(0.066)
$T*(D/K)_{t-1}$	0.094**
	(0.031)
Number of observations	2287
Number of firms	598
R-square	0.27

*Estimates are obtained using a two-way fixed effects model. The coefficients for fixed effects and for the constant term are not reported. Standard errors are in parentheses. * indicates statistical significance at 10%, ** statistical significance at 5%, and *** statistical significance at 1%.*

Table 10.
Borrowing Behaviour

Dependent variable: (B_t/K_{t-1})

	(1)	(2)
(B_{t-1}/K_{t-2})	-0.015	-0.31***
	(0.029)	(0.035)
R_t	-0.37***	-0.86***
	(0.018)	(0.083)
$(\pi/K)_{t-1}$	-3.88***	
	(0.41)	
$(S/K)_{t-1}$	0.0018	-0.0028*
	(0.0011)	(0.00154)
$(D/K)_{t-1}$	-2.93***	
	(0.18)	
$T*(S/K)_{t-1}$	-0.00027	0.00044*
	(0.00017)	(0.000227)
$T*(\pi/K)_{t-1}$	0.396***	
	(0.083)	
$T*(D/K)_{t-1}$	0.24***	
	(0.036)	
P_t	0.081***	0.062**
	(0.023)	(0.0305)
P_{t-1}	-0.16***	-0.096***
	(0.028)	(0.034)
T	-0.12***	-0.071***
	(0.016)	(0.0076)
Number of observations	1860	1860
Number of firms	575	575
R-square	0.32	0.07

Estimates are obtained using a two-way fixed effects model. The coefficients for fixed effects and for the constant term are not reported. Standard errors are in parentheses. * indicates statistical significance at 10%, ** statistical significance at 5%, and *** statistical significance at 1%.

Table 11.
Ponzi State

Dependent variable: P_t

	(1)
E_t	0.000023
	(0.00017)
$(M^{top1})_t$	1.19**
	(0.57)
$(M^{top10})_t$	-0.14
	(0.19)
$(M^{bot10})_t$	0.029
	(0.12)
$(M^{bot50})_t$	0.015
	(0.087)
K_t	-0.00056**
	(0.00022)
$(A^{top1})_t$	-0.66
	(0.63)
$(A^{top10})_t$	0.27
	(0.19)
$(A^{bot10})_t$	0.20*
	(0.12)
$(A^{bot50})_t$	-0.10
	(0.084)
L_t	-0.12*
	(0.06)
L_{t-1}	0.86***
	(0.064)
T	0.25***
	(0.016)
Number of observations	6603
Number of firms	1197

*Estimates are obtained using a logit model. The coefficients for the constant term is not reported. Standard errors are in parentheses. * indicates statistical significance at 10%, ** statistical significance at 5%, and *** statistical significance at 1%.*

Table 12.
Increase in Leverage

Dependent variable: L_t

	(1)	(2)
$(S/K)_{t-1}$	-0.00017	0.013
	(0.0014)	(0.019)
$(\pi/K)_{t-1}$	2.30***	1.89
	(0.44)	(1.83)
$(D/K)_{t-1}$	0.42***	0.43*
	(0.14)	(0.25)
R_t	0.078	2.87***
	(0.24)	(1.06)
R_{t-1}	0.39	0.61*
	(0.25)	(0.35)
$T*(S/K)_{t-1}$		-0.0019
		(0.0035)
$T*(\pi/K)_{t-1}$		1.19**
		(0.52)
$T*R_t$		-0.36
		(0.26)
P_t	-0.68***	-0.83***
	(0.089)	(0.16)
P_{t-1}	-0.17*	-0.23
	(0.103)	(0.18)
Number of observations	6217	2967
Number of firms	1024	783

*Estimates are obtained using a fixed effects logit model. The coefficients for fixed effects, for the constant term, and the time dummies are not reported. Standard errors are in parentheses. * indicates statistical significance at 10%, ** statistical significance at 5%, and *** statistical significance at 1%. Equation (1) is run from 1995 to 2001, while equation (2) is run from 1995 to 1998.*

Table 13.
List of Variables in Appendix C

	Meaning	Nature
Π	Profits (Turkish Lira)	Continuous
A	Asset Level (1 if in given group)	Dummy
B	Borrowing (Turkish Lira)	Continuous
D	Total Liabilities (Turkish Lira)	Continuous
E	Level of Employment (Number of Employees)	Continuous
F	Financial Payments (Turkish Lira)	Continuous
I	Investment (Turkish Lira)	Continuous
K	Capital Stock (Turkish Lira)	Continuous
L	Leverage (1 if var. increases)	Dummy
M	Employment Level (1 if in given group)	Dummy
P	Ponzi (1 if firm in Ponzi state)	Dummy
R	Effective Interest Rate (Ratio (F/D))	Continuious
S	Sales (Turkish Lira)	Continuous
T	Year dummies (1 for specific years)	Dummy

Source: Except for the year dummies, all the variables are from the NFC balance sheets micro dataset described in appendix B.

Figure 1
Real Exchange Rate Index (1995=100)
(Monthly: January 1989 - February 2006)

Source: Central Bank of the Republic of Turkey
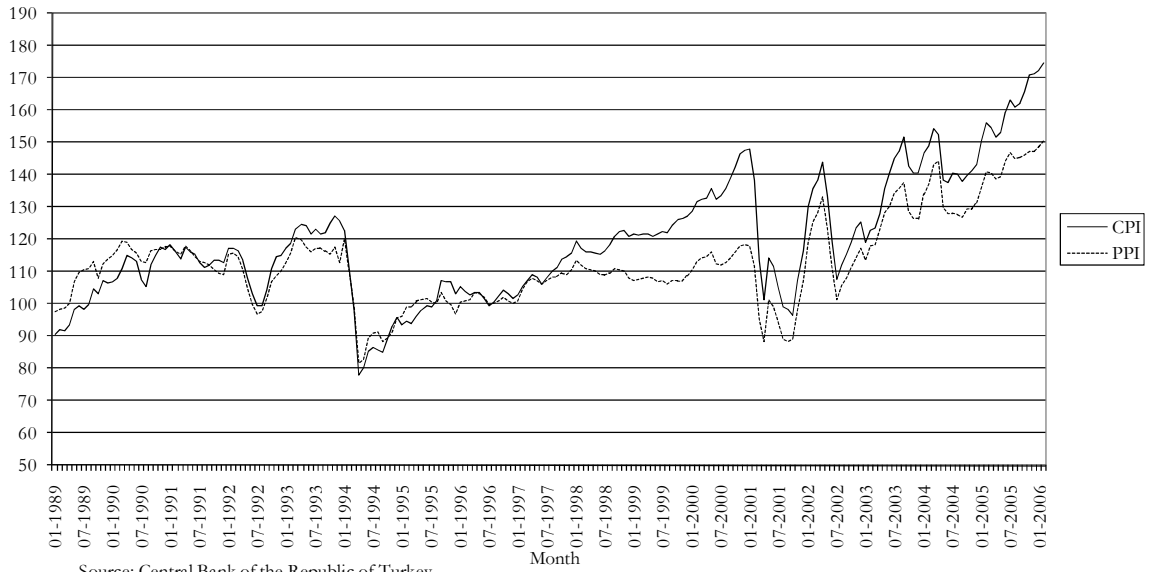
Figure 2.
Level of Short-Run Foreign Debt and Foreign Exchange Reserves in US$ Millions
(Monthly: January 1990 - December 2004)

Source: Central Bank of the Republic of Turkey   Month

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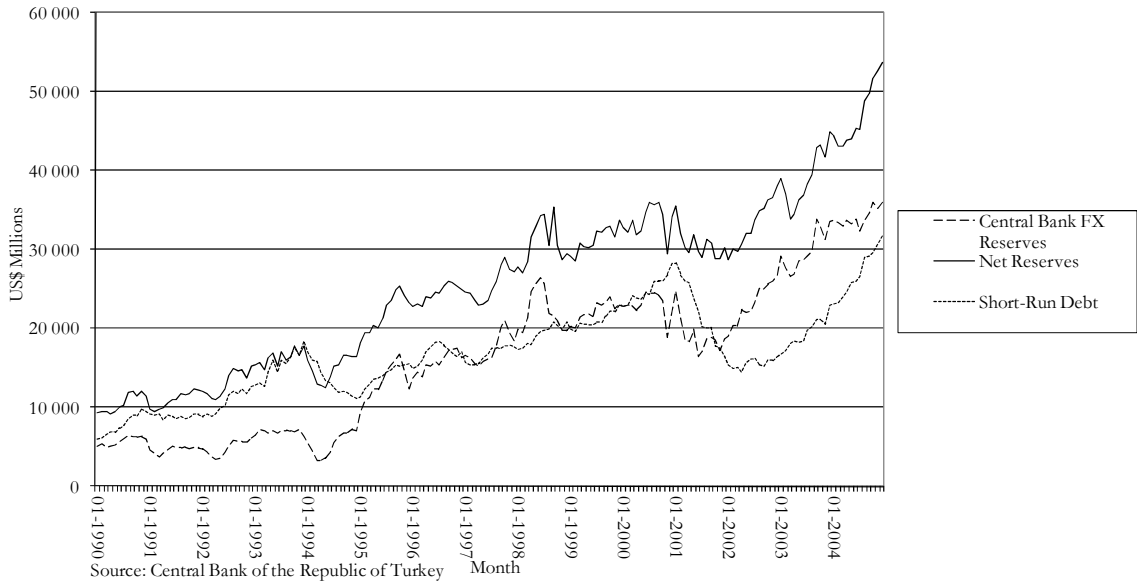
Figure 3.
Current Account Balance as a Percentage of GNP
(Yearly: 1992 - 2004)

Source: Central Bank of the Republic of Turkey
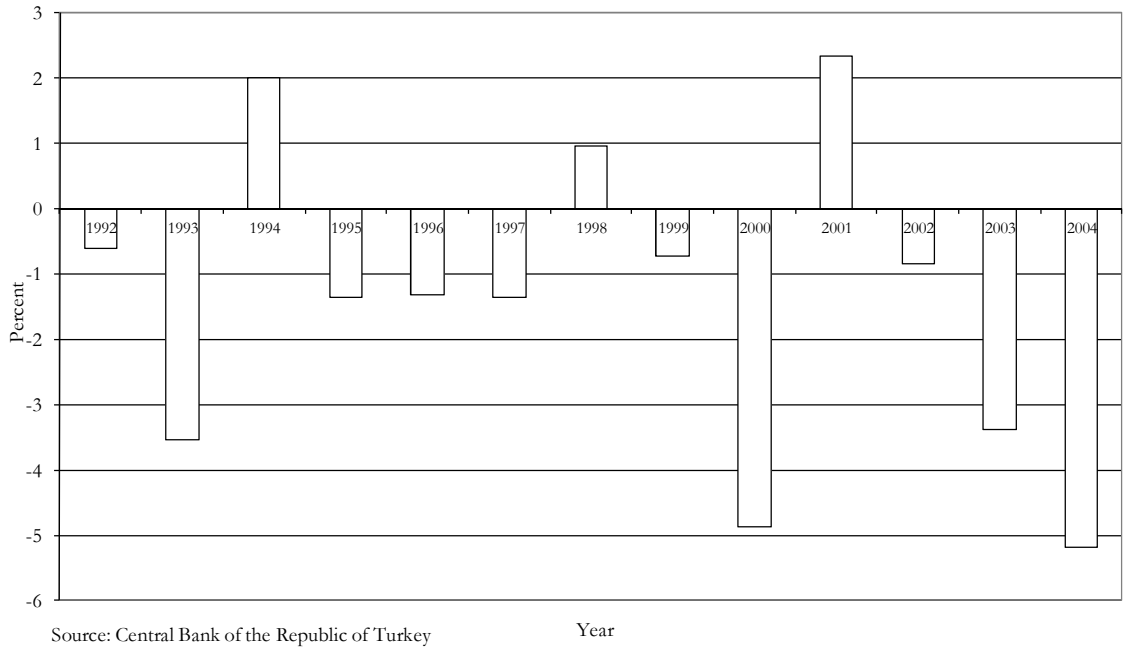
Figure 4
Comparison Between Portfolio Investment in Debt Securities and Foreign Loans Inflow
(Million $)
(Monthly: January 1999 - December 2001)

Source: Central Bank of the Republic of Turkey
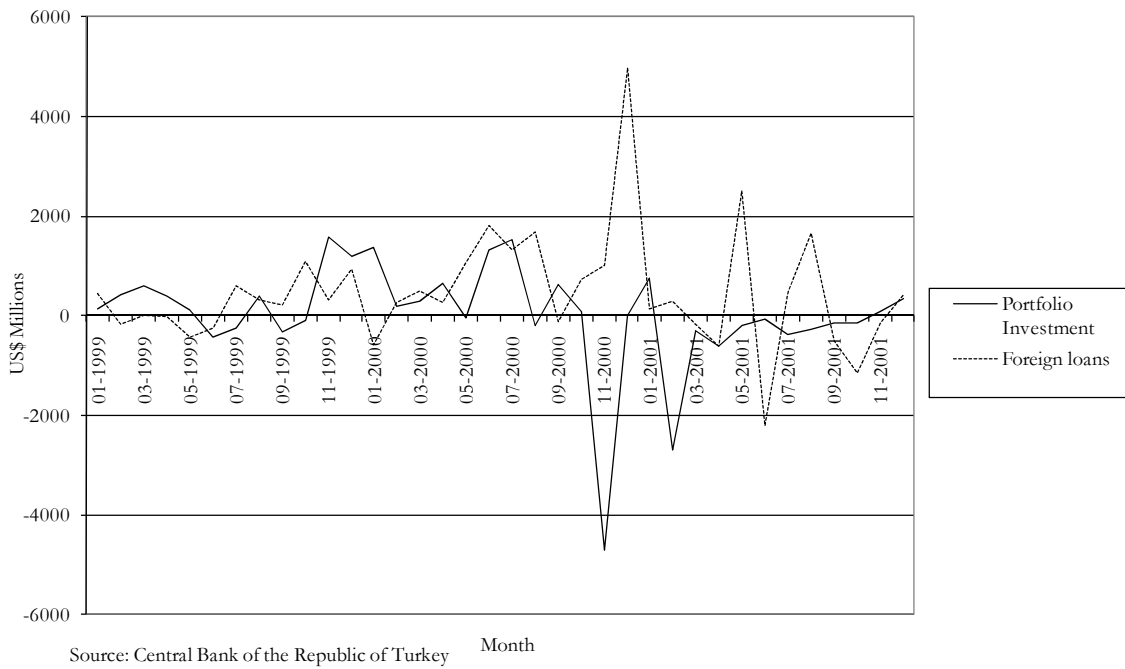
Figure 5
Portfolio Investment (Million US$),
(Monthly: January 1992 - September 2006)

Source: Central Bank of the Republic of Turkey
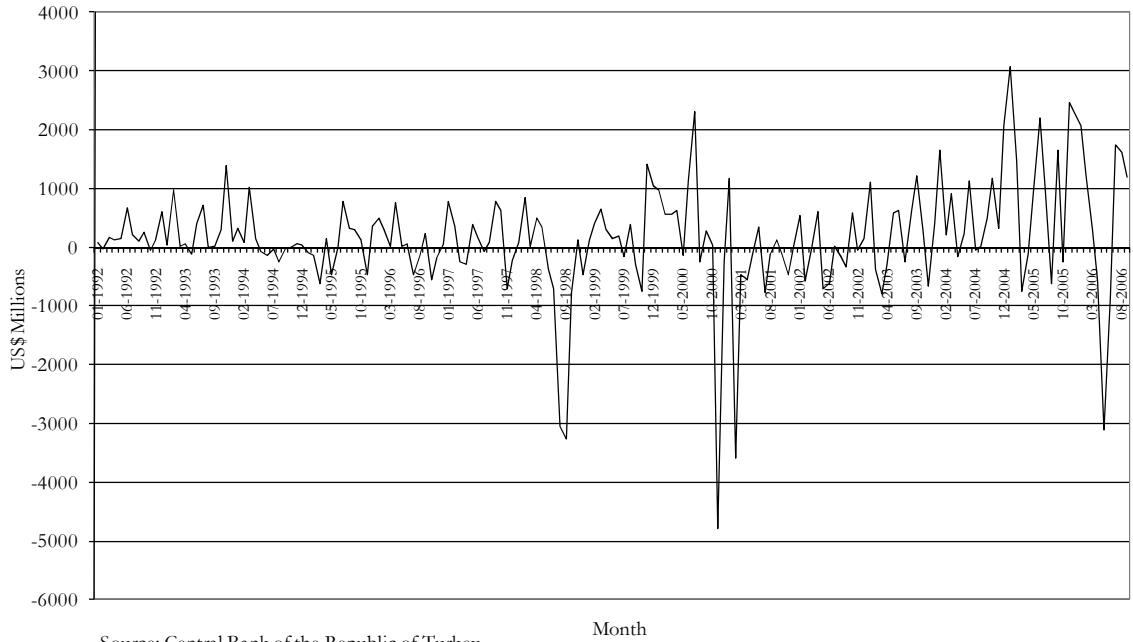
Figure 6
Domestic Credit as a Proportion of GNP
(Yearly: 1987 - 2004)

Source: Central Bank of the Republic of Turkey for loans data
and Turkish Treasury for GNP statistics.

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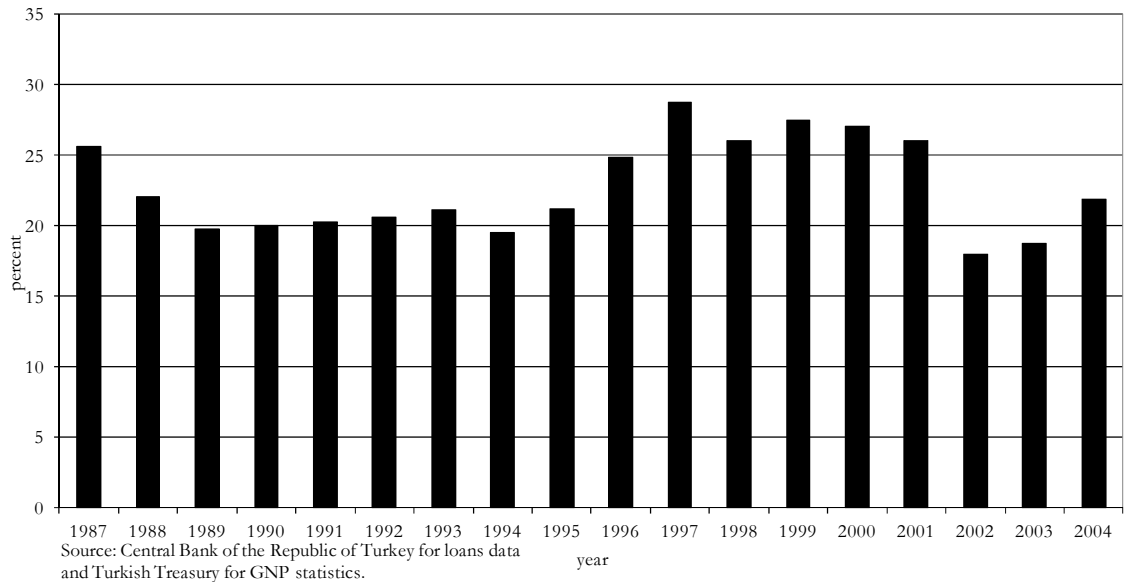
Figure 7.
Loans to Non-Financial Corporations in Turkey at 1987 prices
(Monthly: Jan 1988 - Jan 2006)

Source: Central Bank of the Republic of Turkey
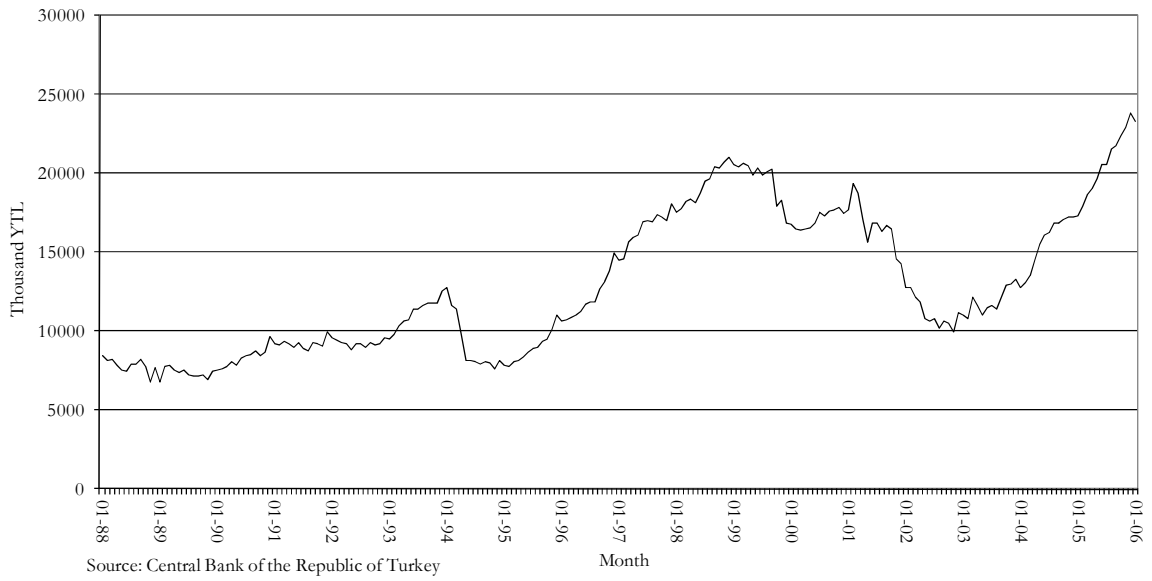
Figure 8.
Composition of Domestic Credit
(Monthly: Jan 1986 - Apr. 2006)

Source: Central Bank of the Republic of Turkey

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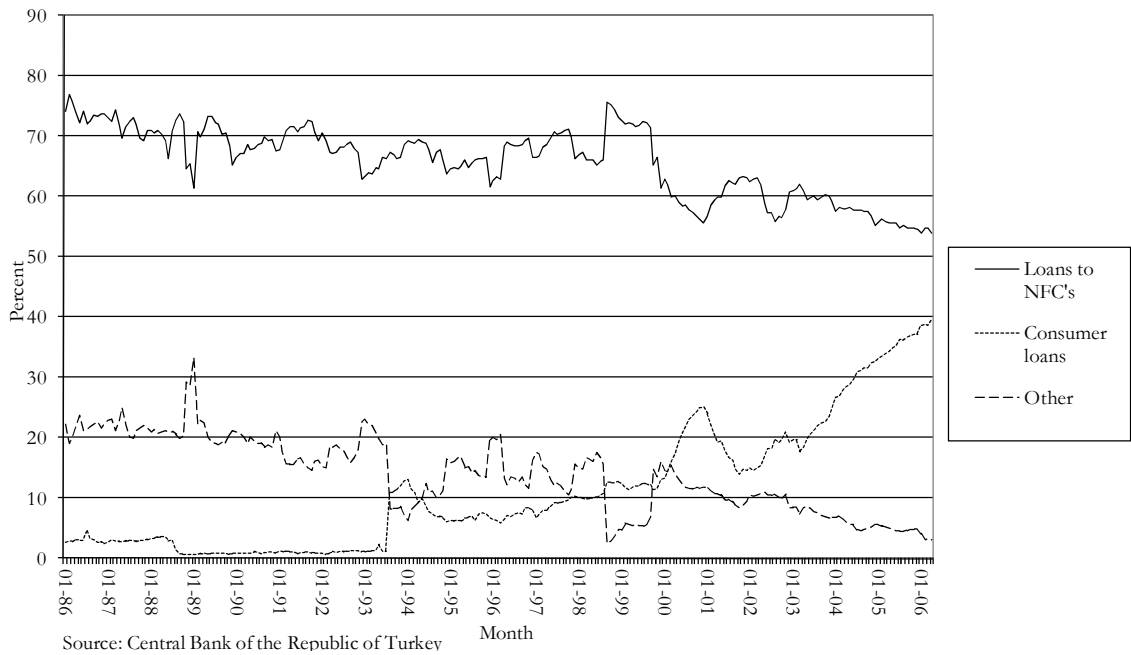
Figure 9.
Ratio of Short-Run External Debt over International Reserves
(Monthly: January 1990 - December 2004)

Source: Central Bank of the Republic of Turkey   Month
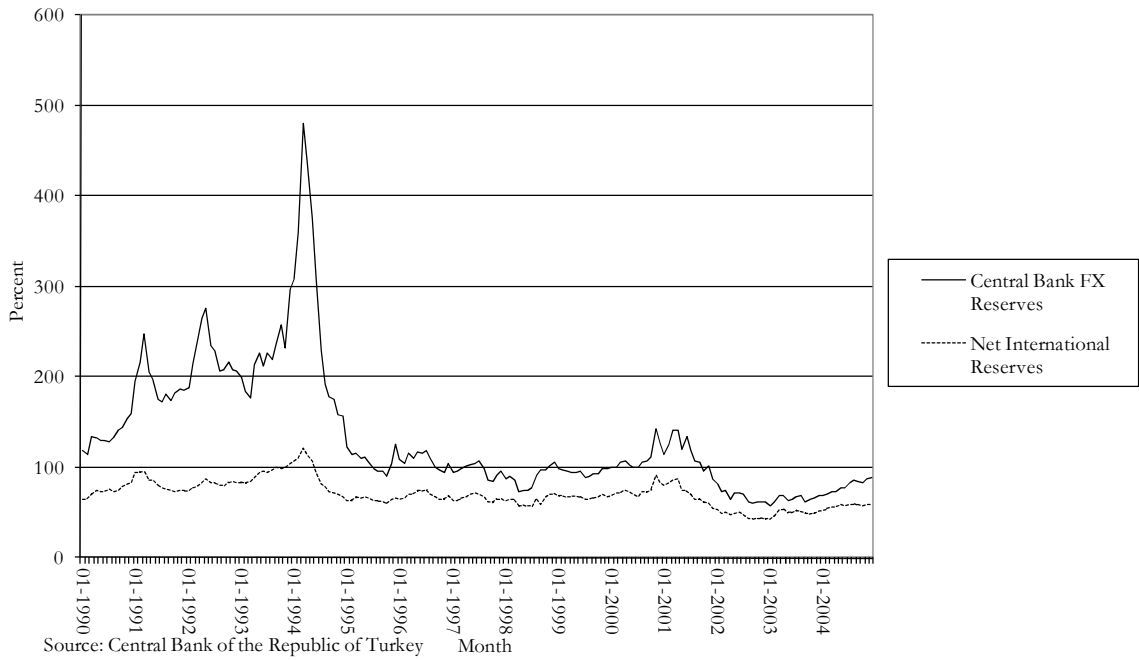
Figure 10.
Ratio of Short-Run External Debt over International Reserves - Truncated Period
(Monthly: January 1995 - December 2004)

Source: Central Bank of the Republic of Turkey

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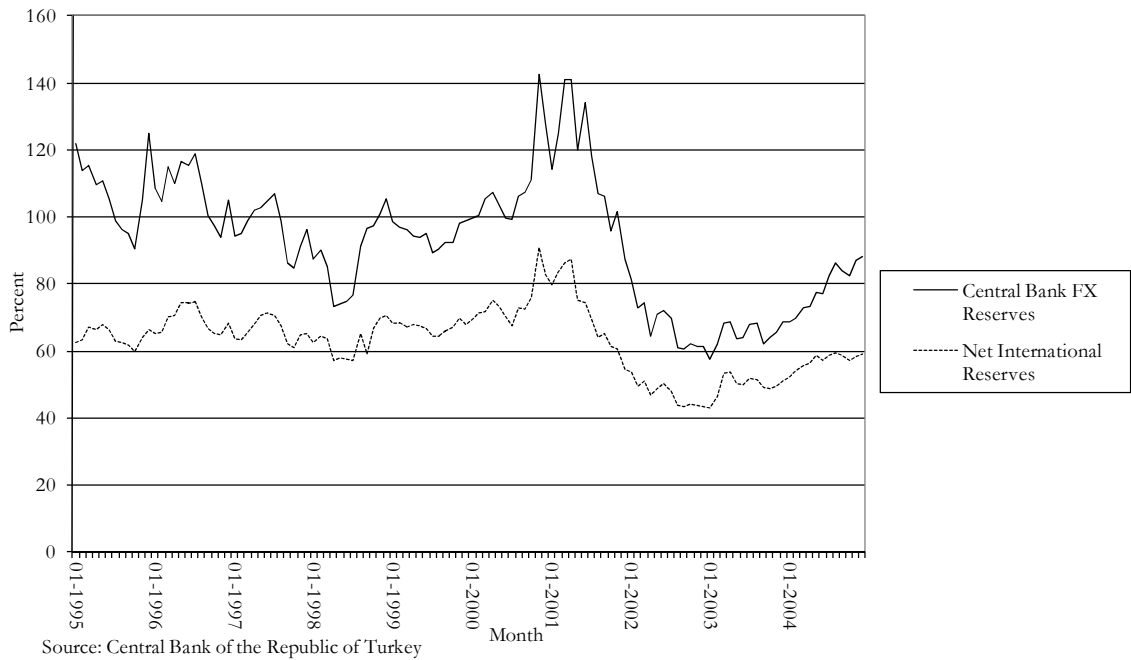
Figure 11.
Proportion of Non-Performing Loans in Total Credit
(Monthly: jan 1987 - Dec 2004)

Source: Central Bank of the Republic of Turkey
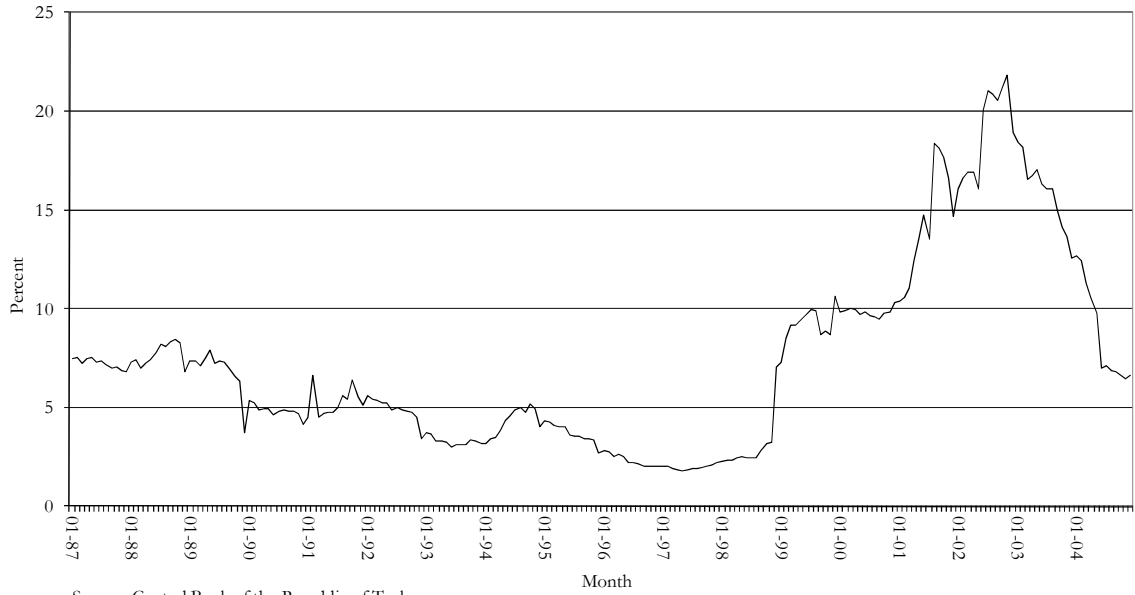
Figure 12.
Domestic Investment in Turkey at 1987 Prices
(Yearly: 1987-2004)

Source: Turkish Treasury

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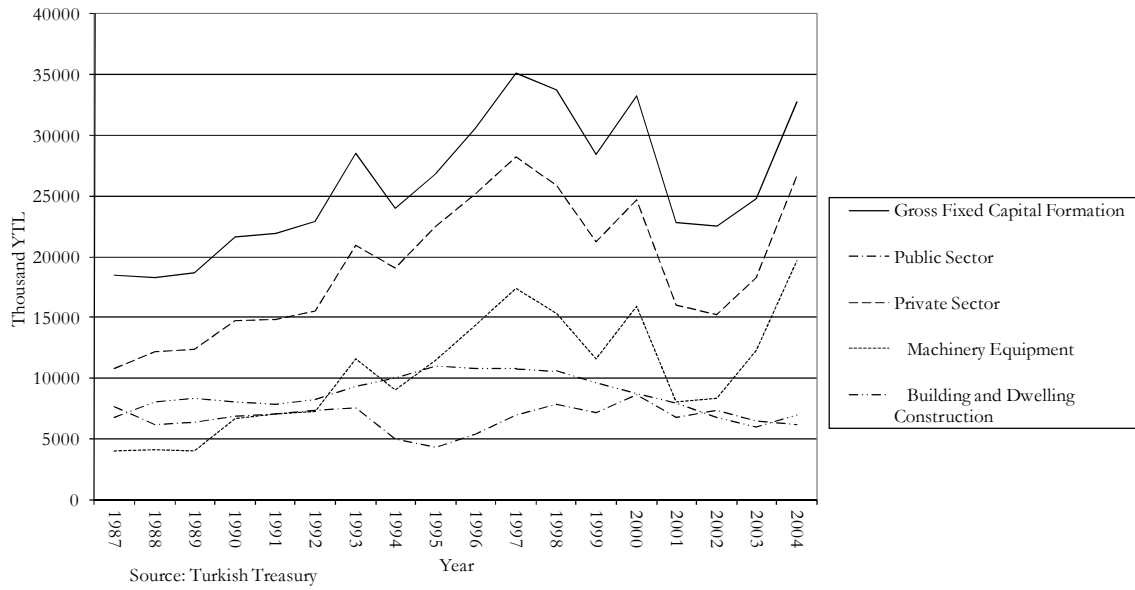
Figure 13.
Domestic Investment as a Poportion of GDP
(Yearly: 1987-2004)
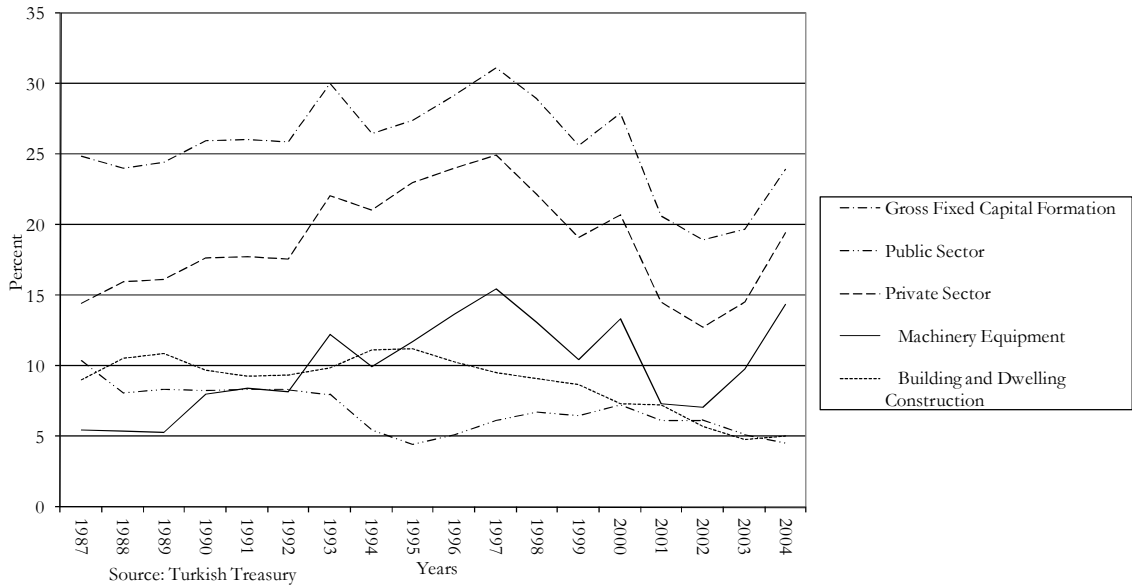
Figure 14.
Private Investment in Turkey at 1987 Prices (Seasonally Adjusted)
(Quarterly: 1987 Q1 - 2006 Q1)
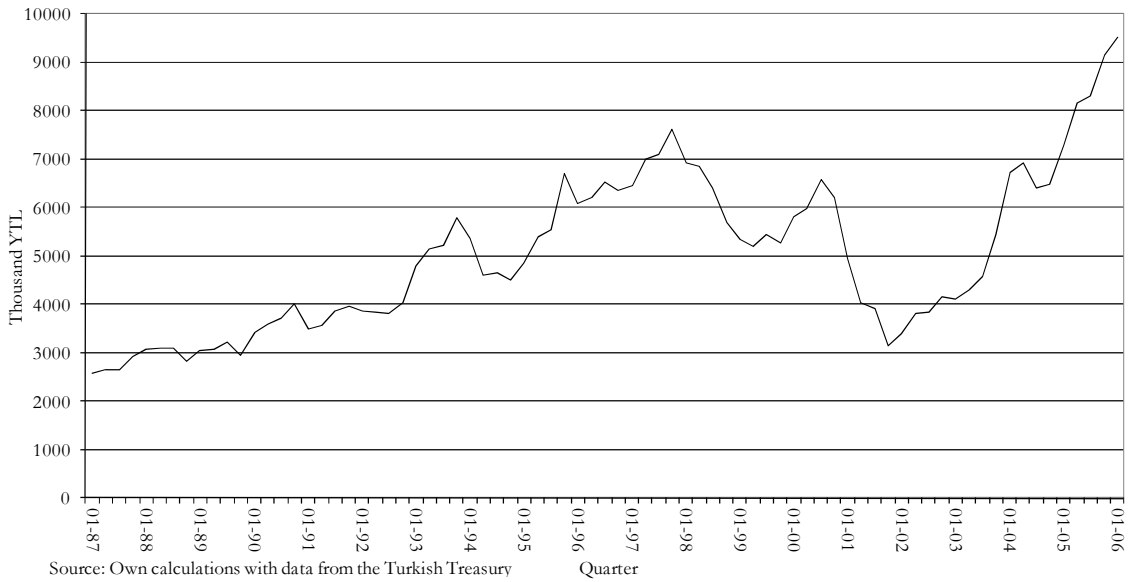
Figure 15.
Percentage of Managers of Private NFC Having Optimist Expectations (Seasonally Adj.)
(Quarterly: 1994 Q1 - 2001 Q4)

Source: Author's own calculations from Turkstat data.
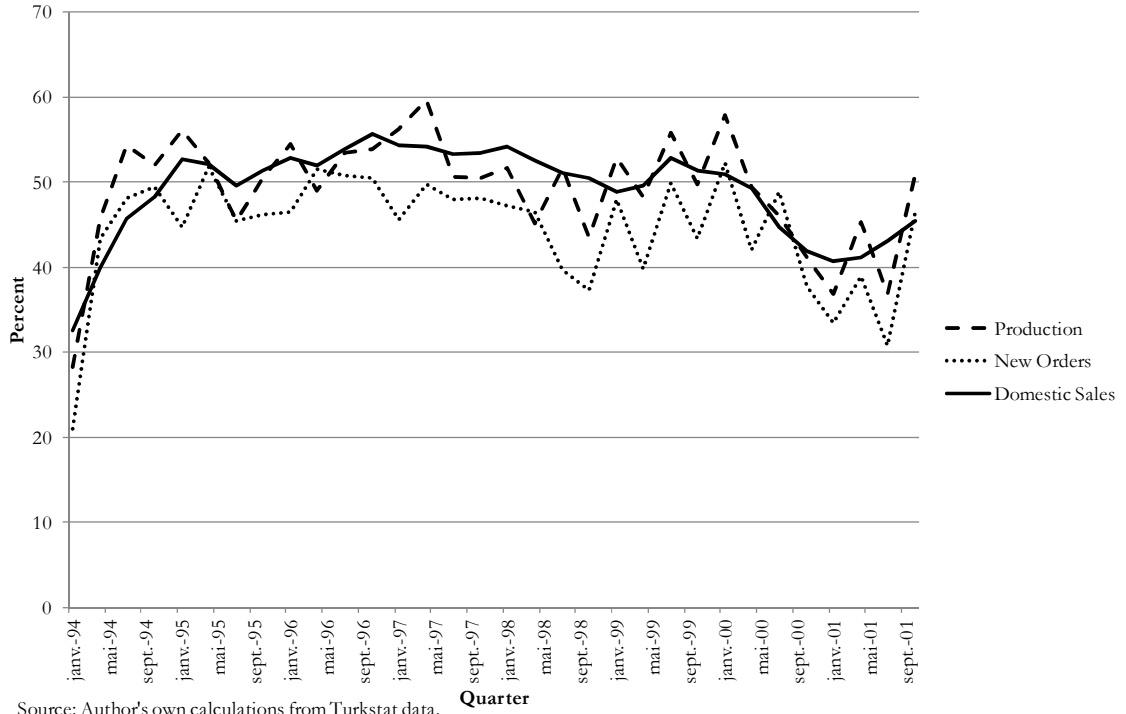
Figure 16.
Double Difference: Difference between expectations and next period outcome
for the relative proportion of firms that are optimist versus being pessimists (O-P)
(all firms) (3rd quarter of 1994 - 4th quarter of 2001)

Source: Author's calculation from Turkstat data.

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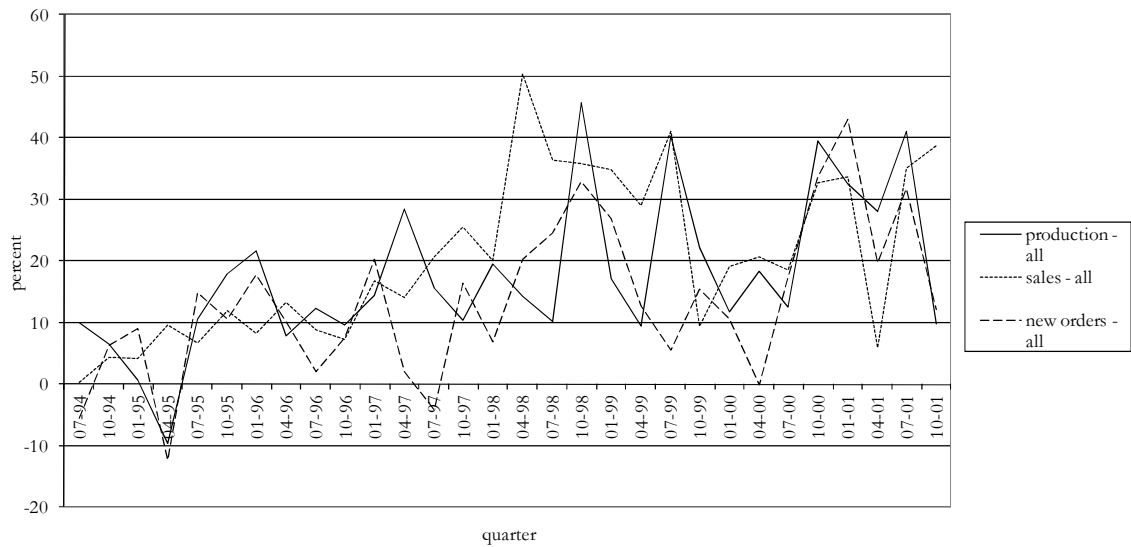
Figure 17.
Double Difference: Difference between expectations and next period outcome
for the relative proportion of firms that are optimist versus being pessimists (O-P)
(all private firms) (3rd quarter of 1994 - 4th quarter of 2001)
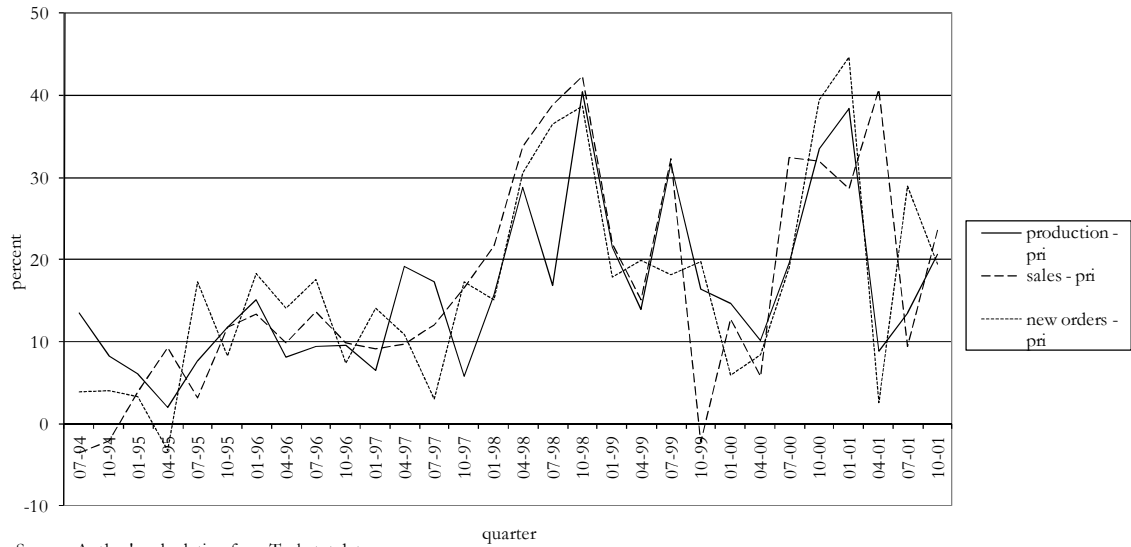
Source: Author's calculation from Turkstat data

Figure 18.
Difference between expectations and realised outcomes - Production
(Private and All Firms) (3rd quarter 1994 - 4th quarter 2001)
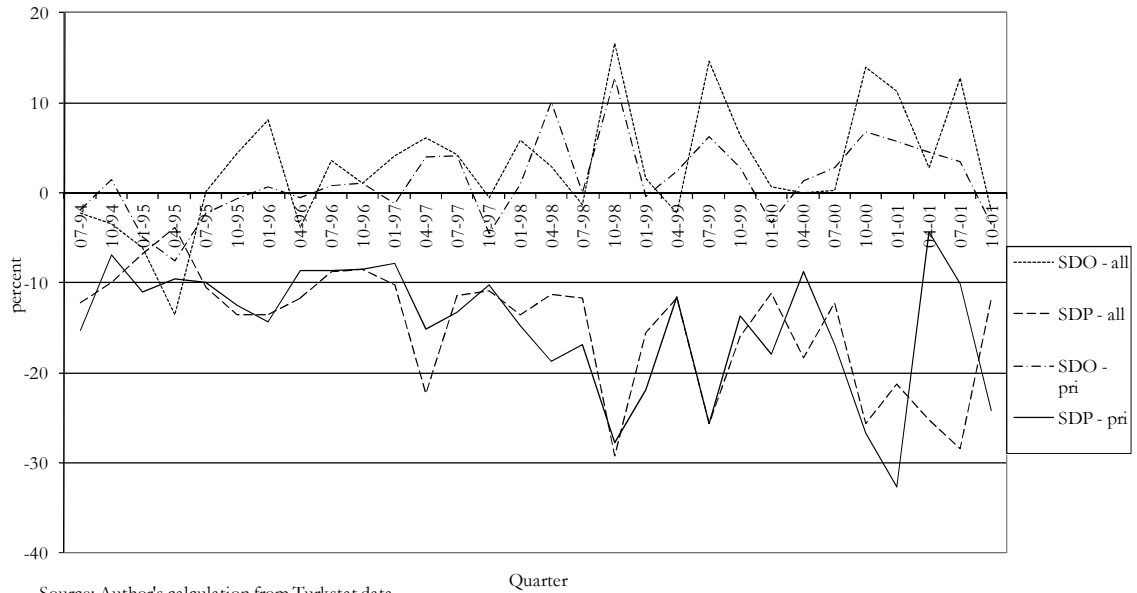
Source: Author's calculation from Turkstat data

Figure 19.
Difference between expectations and realised outcomes - Domestic Sales
(Private and All Firms) (3rd quarter 1994 - 4th quarter 2001)
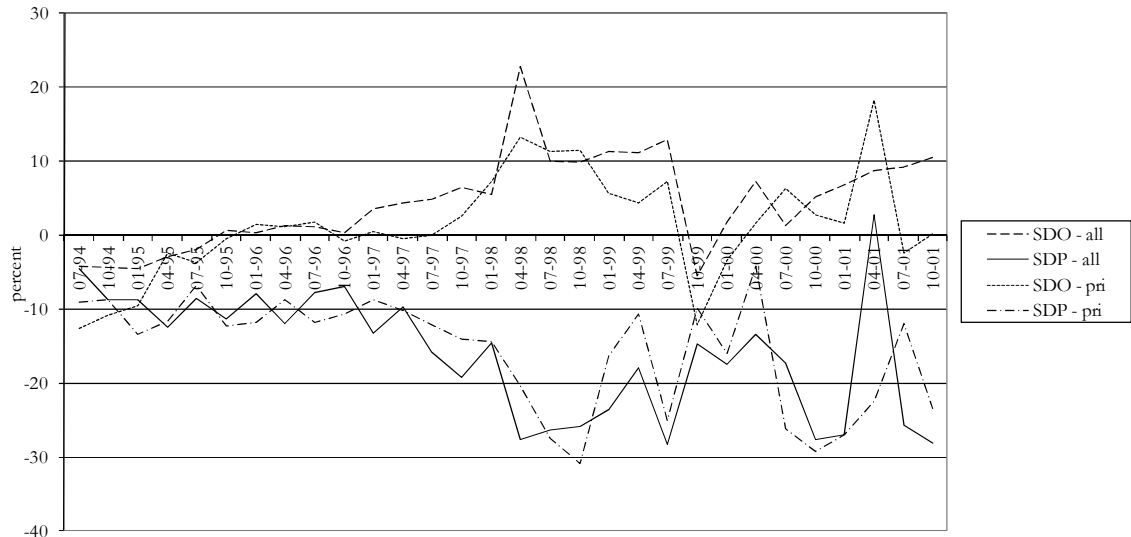
Source: Author's calculation from Turkstat data.

Figure 20.
Difference between expectations and realised outcomes - New orders
(Private and All Firms) (3rd quarter 1994 - 4th quarter 2001)
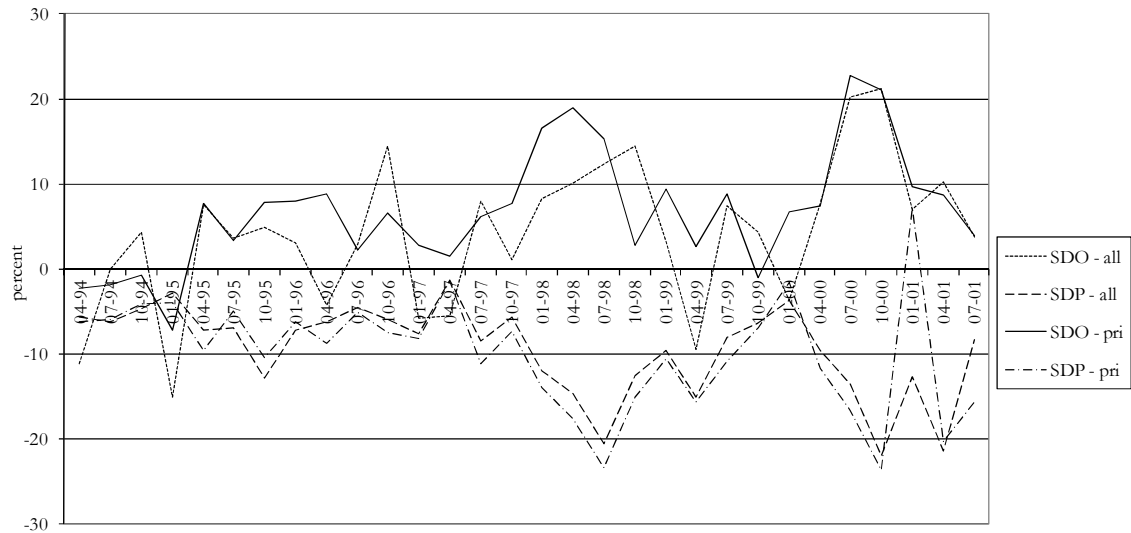
Source: Author's calculation from Turkstat data.

Figure 21.
Comparison of Rational Expectations with Single Difference for New Orders - Optimists
(Private Firms) (Quarterly: 3rd quarter 1994 - 4th quarter 2001)
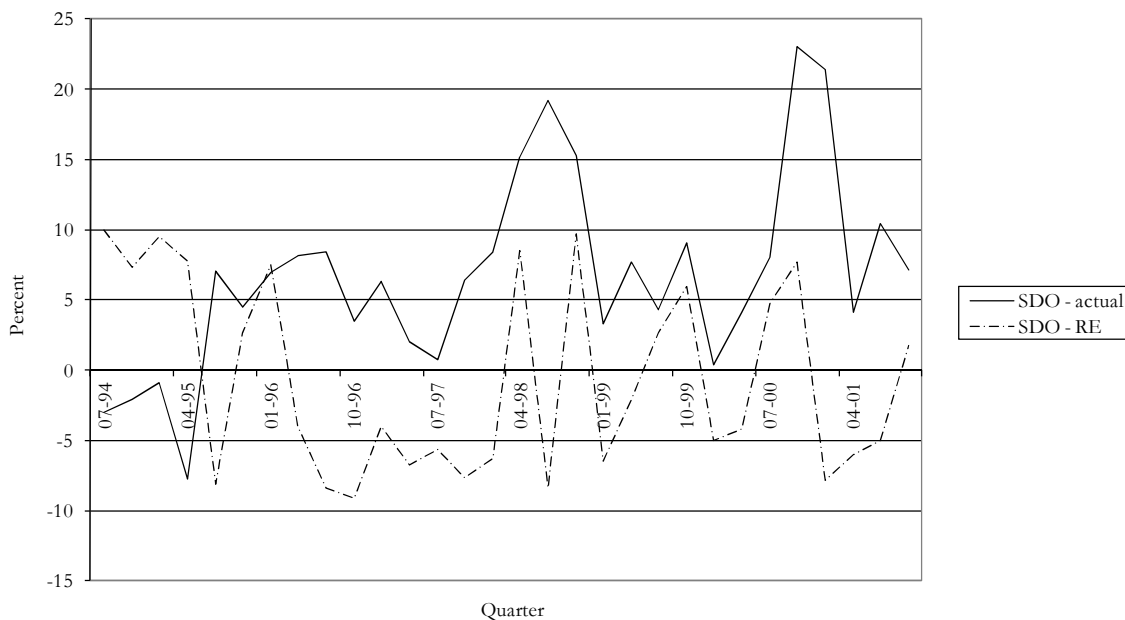
Source: Author's calculation from Turkstat data and numbers from Random.org

Figure 22.
Comparison of Rational Expectations with Single Difference for New Orders - Pessimists
(Private Firms) (Quarterly: 3rd quarter 1994 - 4th quarter 2001)
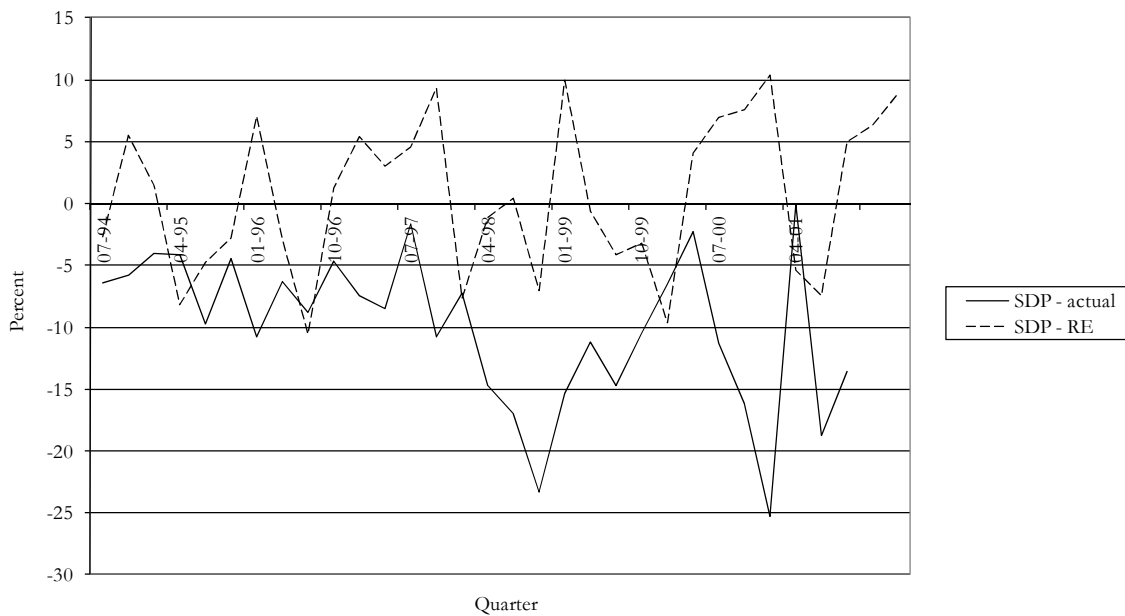
Source: Author's calculation from Turkstat data and numbers from Random.org.

Figure 23a.
Comparing Backward Looking Expectations with Actual Expectations
for New Orders - Pessimists
(Private Firms) (Quarterly: 4th quarter 1994 - 4th quarter 2001)
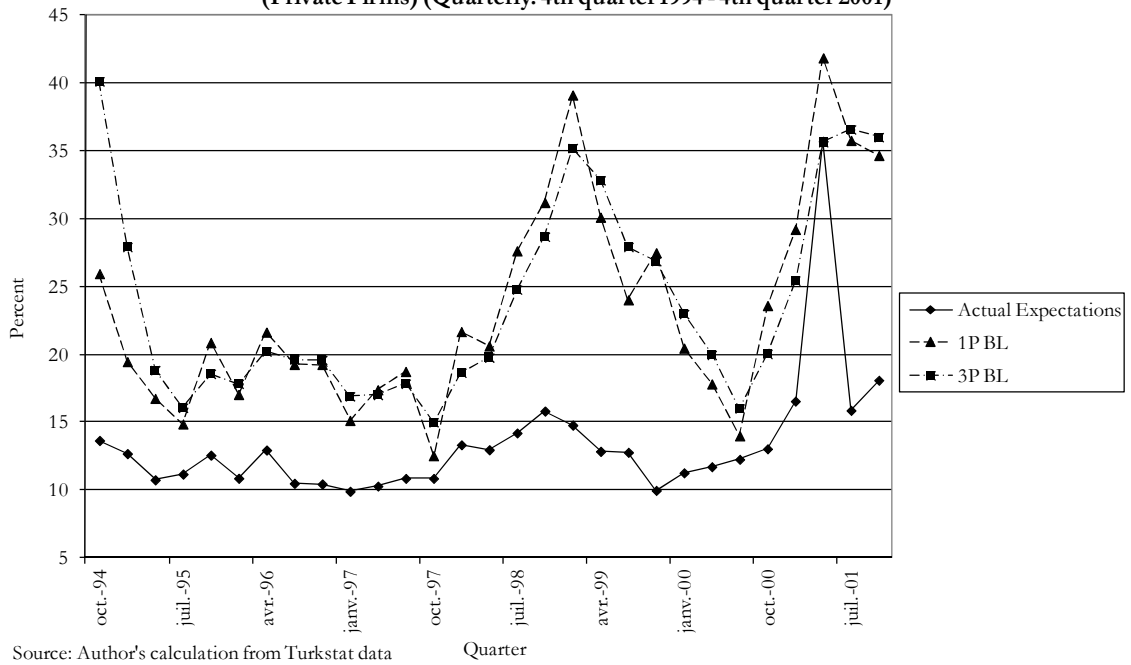
Source: Author's calculation from Turkstat data

Figure 23b.
Comparing Backward-Looking Expectations with Actual Expectations
for New Orders - Optimists
(Private Firms) (Quarterly: 4th quarter 1994 - 4th quarter 2001)
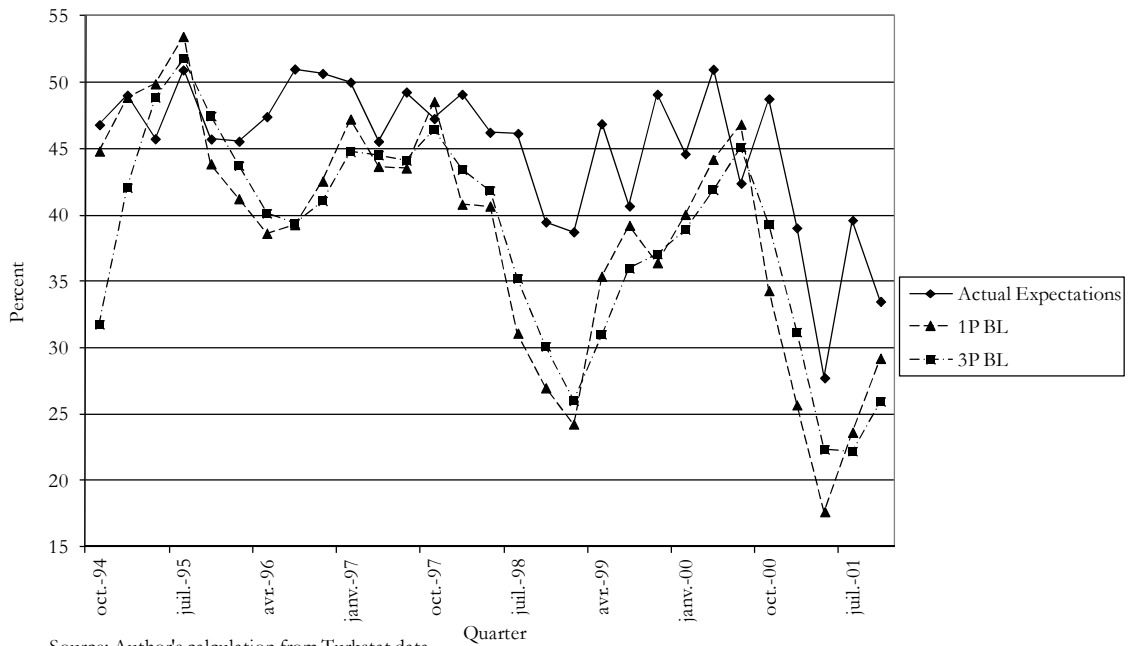
Source: Author's calculation from Turkstat data

Figure 24a.
Comparing BLE and Behavioural Expectations Models for New Orders - pessimists
(Private Firms) (Quarterly: 4th quarter 1994 - 4th quarter 2001)

Source: Author's calculation from Turkstat data
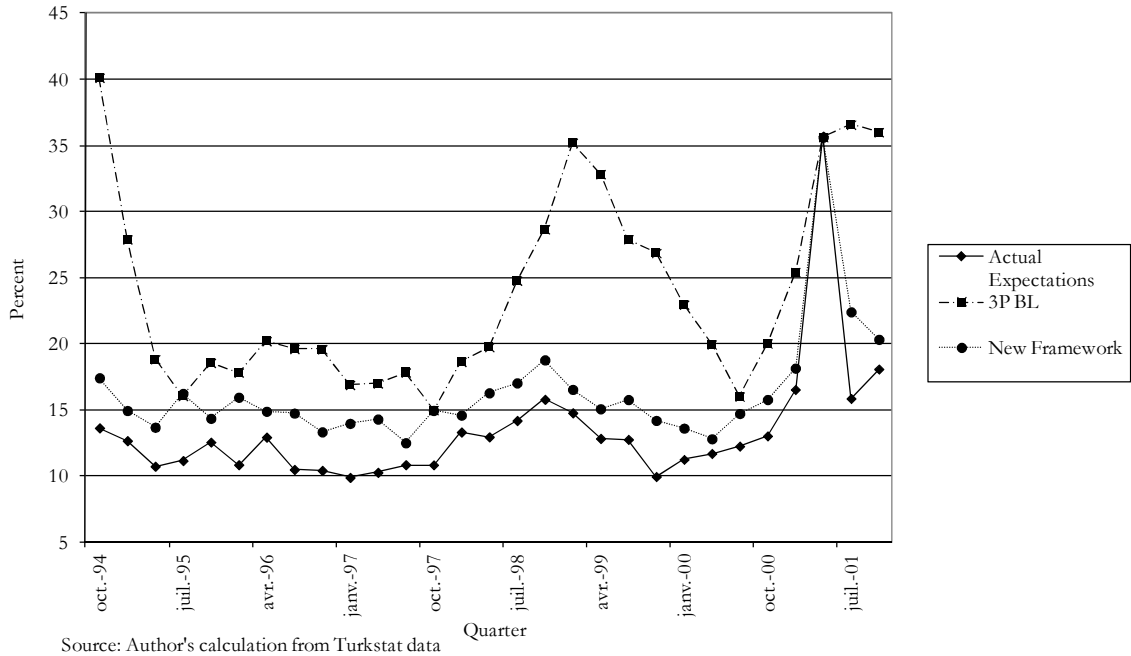
Figure 24b.
Comparing BLE and Behavioural Expectations Models for New Orders - Optimists
(Private Firms) (Quarterly: 4th quarter 1994 - 4th quarter 2001)

Source: Author's calculation from Turkstat data.
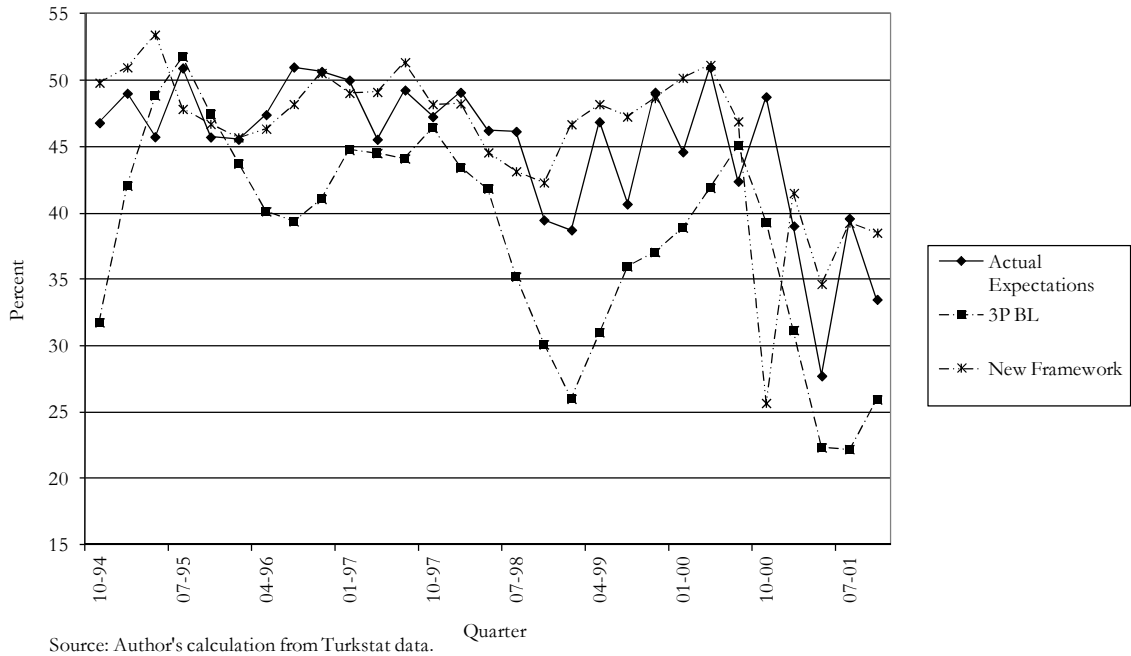
Figure 25
Factor Most Likely to Restrict Investment Over the Next Quarter,
(Monthly: January 1989 - December 2003)
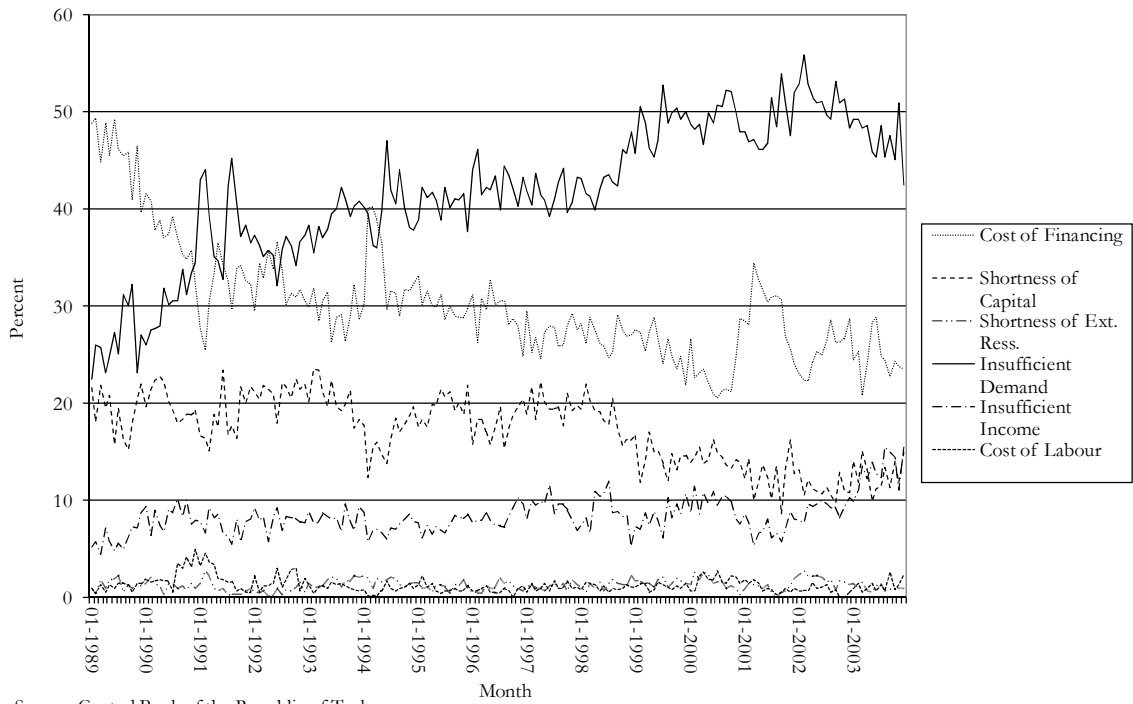
Source: Central Bank of the Republic of Turkey

Figure 26
Factor Most Likely to Restrict Production Over the Next Quarter,
December 1988 - October 2005 (Monthly)

Source: Central Bank of the Republic of Turkey

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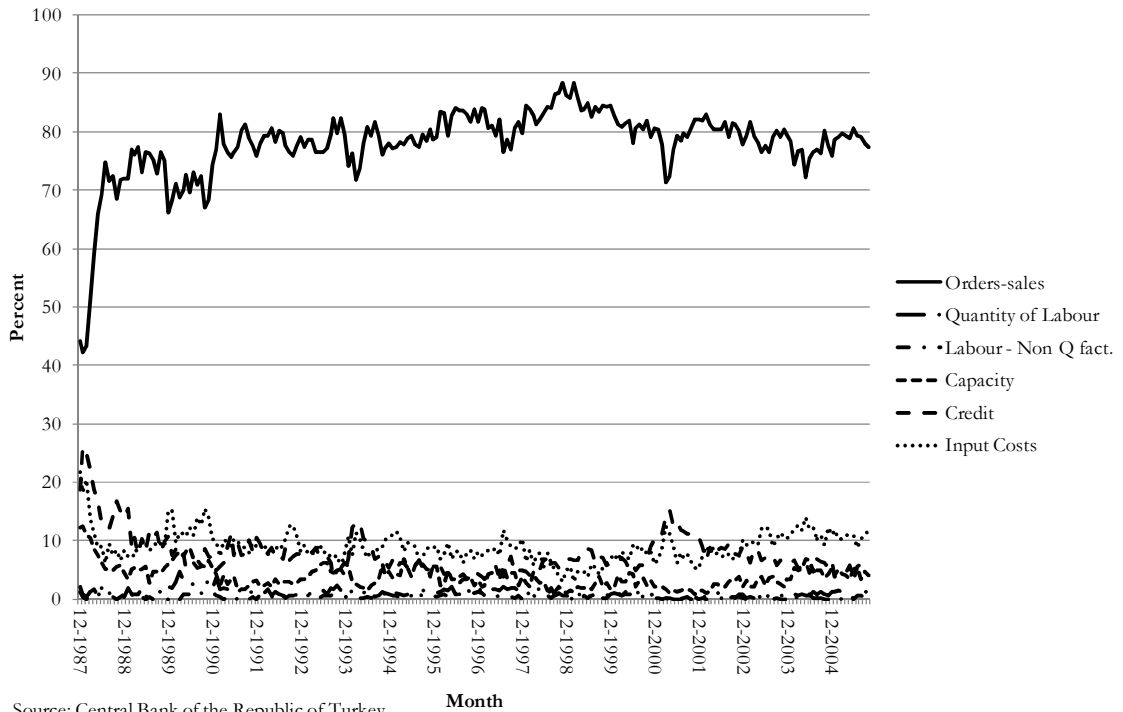
Figure 27.
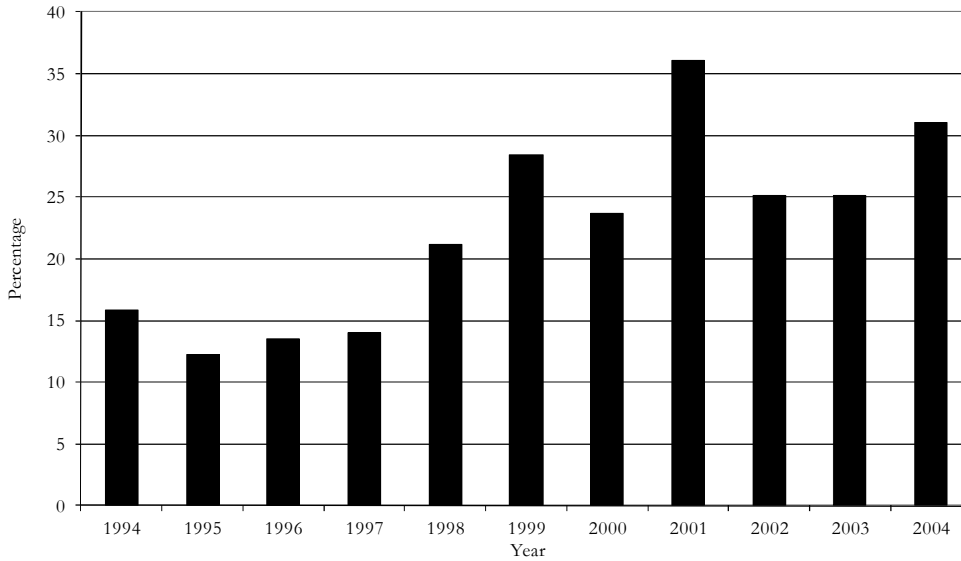**Ratio of Profit Flows to Financing Costs for Corporations**
(Yearly: 1994 - 2003)
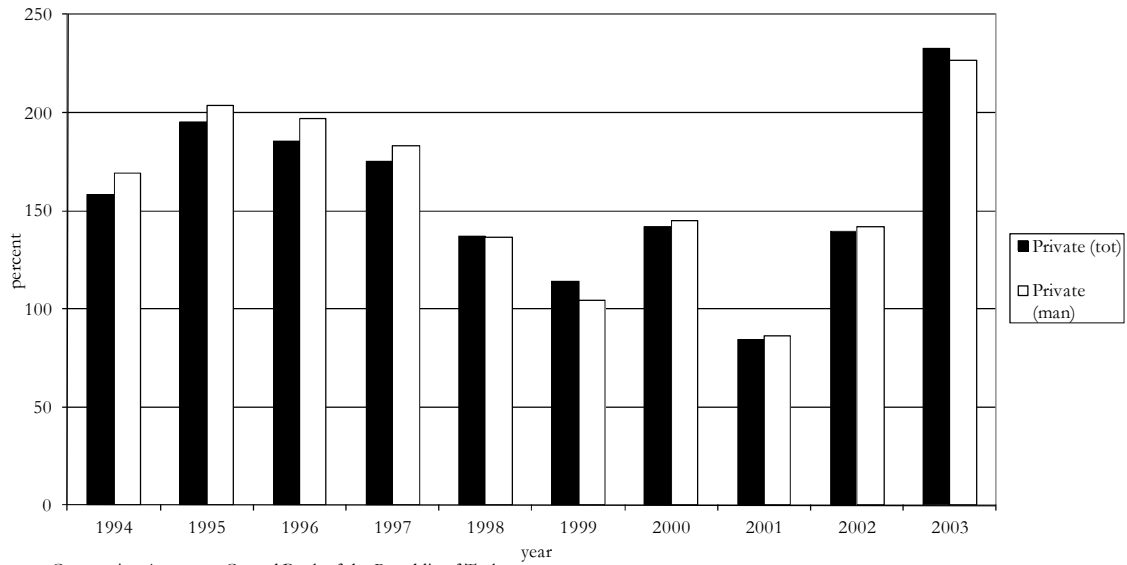
Source: Corporation Accounts, Central Bank of the Republic of Turkey.

Figure 28.
Ratio of Profit Flows to Financing Costs and Investment for Corporations
(Yearly: 1994 - 2003)
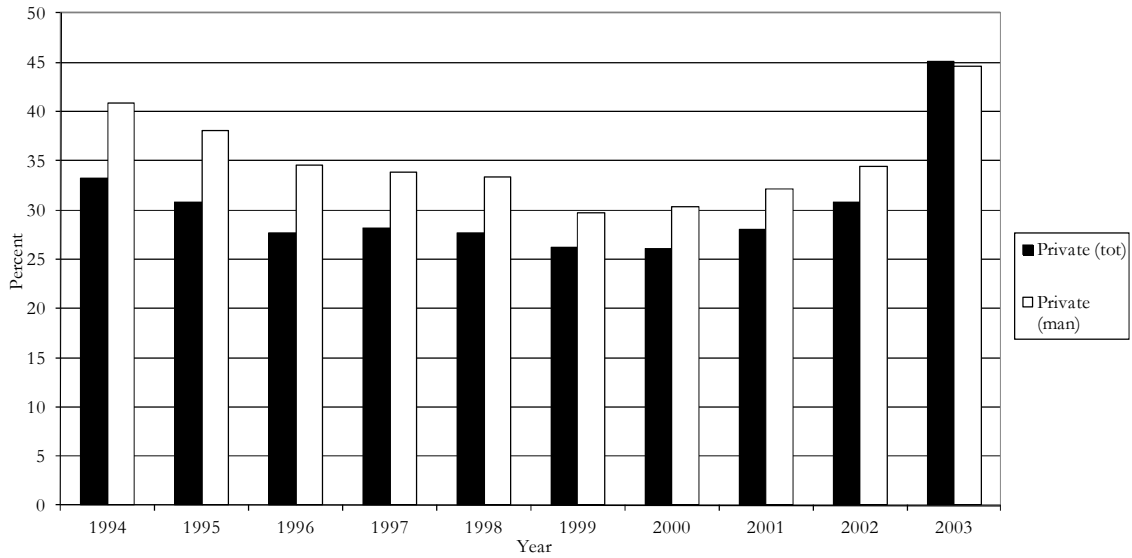
Source: Corporation Accounts, Central Bank of the Republic of Turkey.

Figure 29.
Ratio of Incremental Profit Flows to Financing Costs for Corporations
(Yearly: 1995 - 2003)
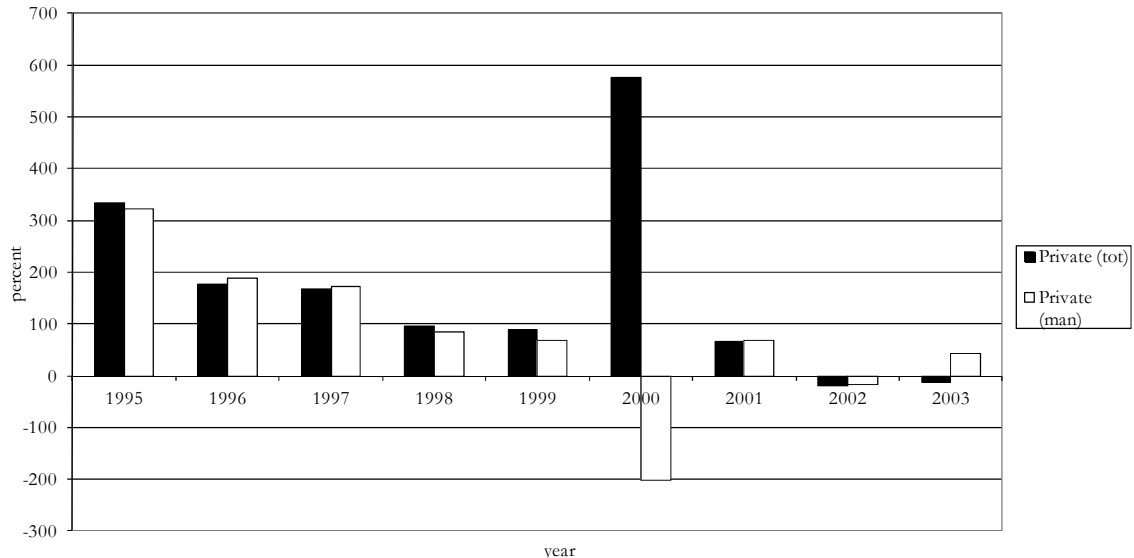
Source: Corporation Accounts, Central Bank of the Republic of Turkey.

Figure 30.
Percentage of Firms in a Ponzi State (greater interest payments than profit earnings)
**(all private firms) (Yearly: 1994-2004)**

Source: Author's Calculations with data from the Central Bank of the Republic of Turkey

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Figure 30.
Percentage of Firms in a Ponzi State (greater interest payments than profit earnings)
**(all private firms) (Yearly: 1994-2004)**
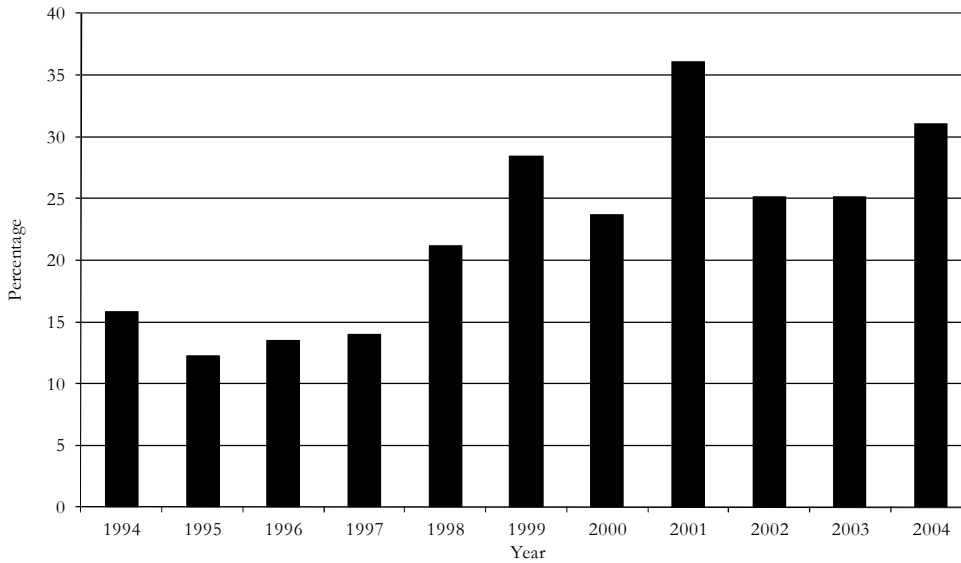
Source: Author's Calculations with data from the Central Bank of the Republic of Turkey

Figure 32.
Double Difference for Labour Needs:
Difference between expectations and next period outcome
for the relative proportion of firms that are optimist versus being pessimists (O-P)
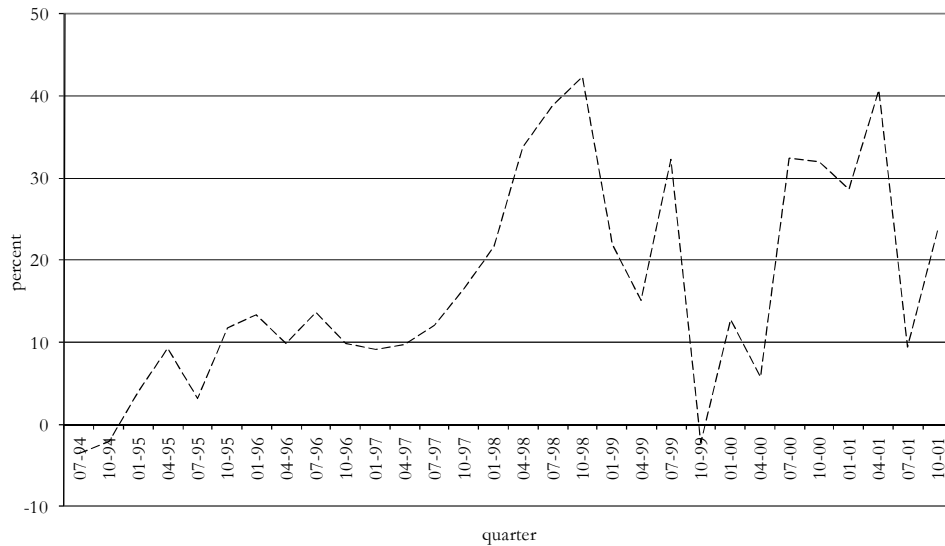**(3rd quarter of 1994 - 4th quarter of 2001)**
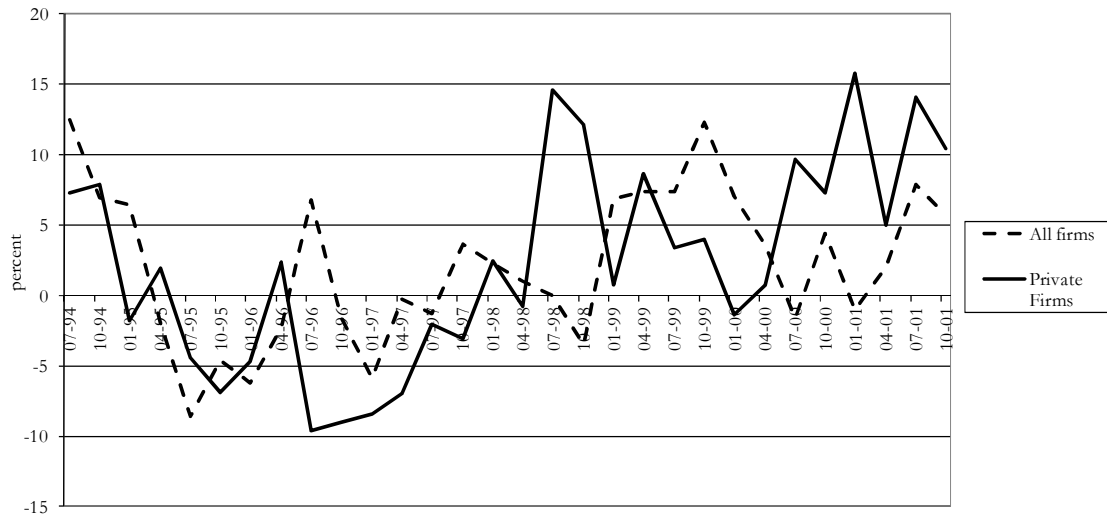
Source: Author's calculation from Turkstat data.

Figure 33a.
Double Difference for Production:
Difference between expectations and next period outcome
for the relative proportion of firms that are optimist versus being pessimists (O-P)
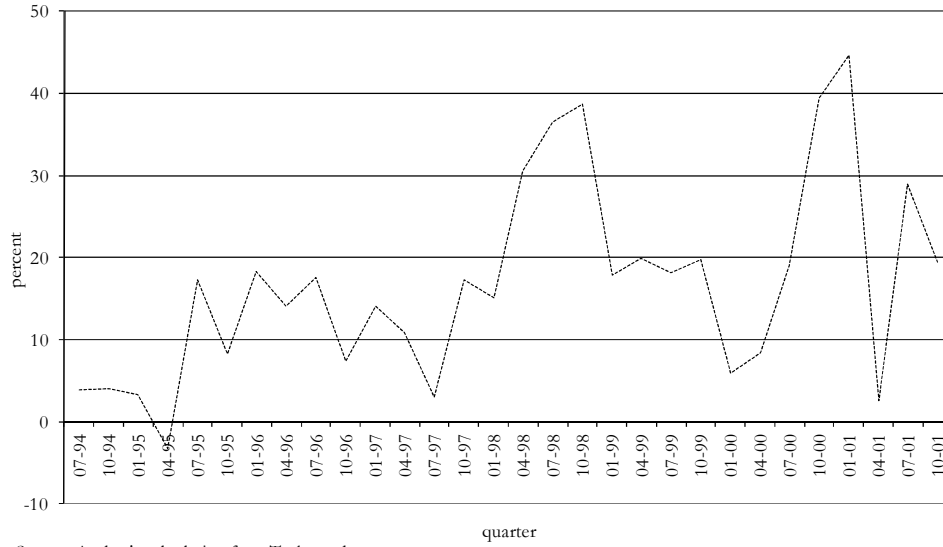**(all private firms) (3rd quarter of 1994 - 4th quarter of 2001)**
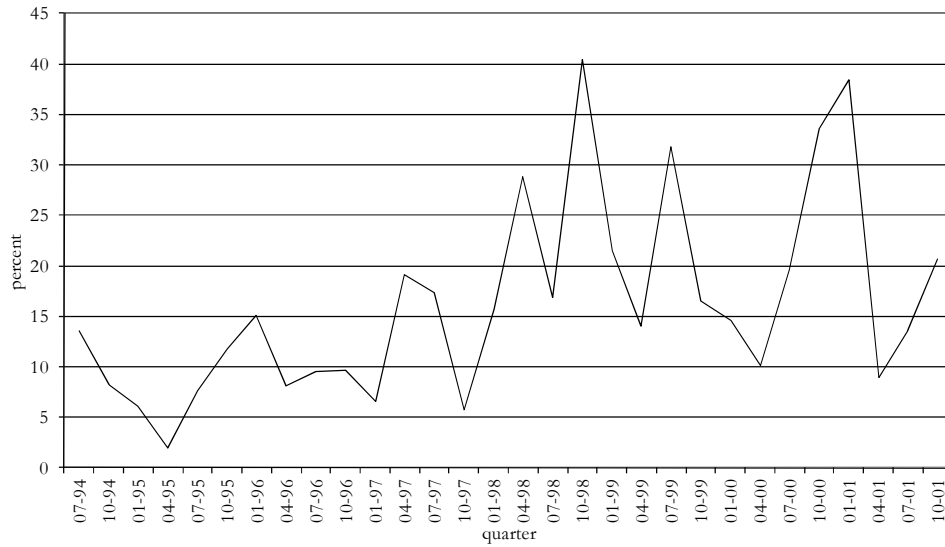
Source: Author's calculation from Turkstat data

Figure 33b.
Double Difference for Domestic Sales:
Difference between expectations and next period outcome
for the relative proportion of firms that are optimist versus being pessimists (O-P)
(all private firms) (3rd quarter of 1994 - 4th quarter of 2001)

Source: Author's calculation from Turkstat data

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Figure 33c.
Double Difference for New Orders:
Difference between expectations and next period outcome
for the relative proportion of firms that are optimist versus being pessimists (O-P)
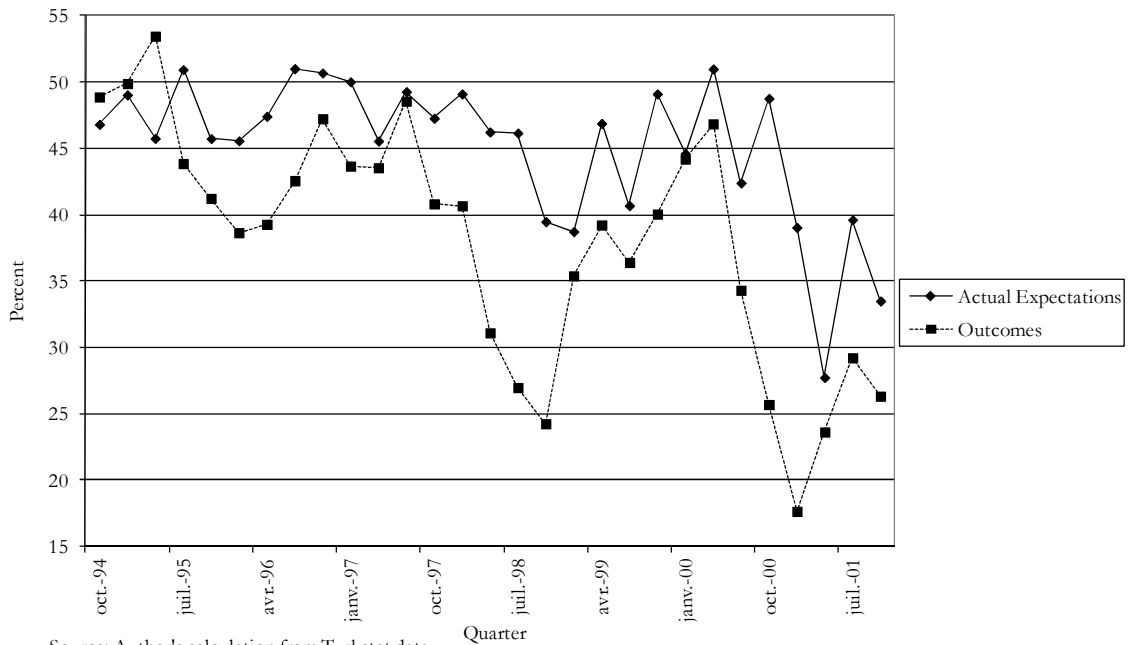**(all private firms) (3rd quarter of 1994 - 4th quarter of 2001)**

Source: Author's calculation from Turkstat data

Figure 34a.
Comparing Positive Outcomes and Optimistic Expectations for New Orders
(Private Firms) (Quarterly: 4th quarter 1994 - 4th quarter 2001)

Source: Author's calculation from Turkstat data.

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Figure 34b.
Comparing Negative Outcomes and Pessimistic Expectations for New Orders
(Private Firms) (Quarterly: 4th quarter 1994 - 4th quarter 2001)

Source: Author's calculation from Turkstat data.
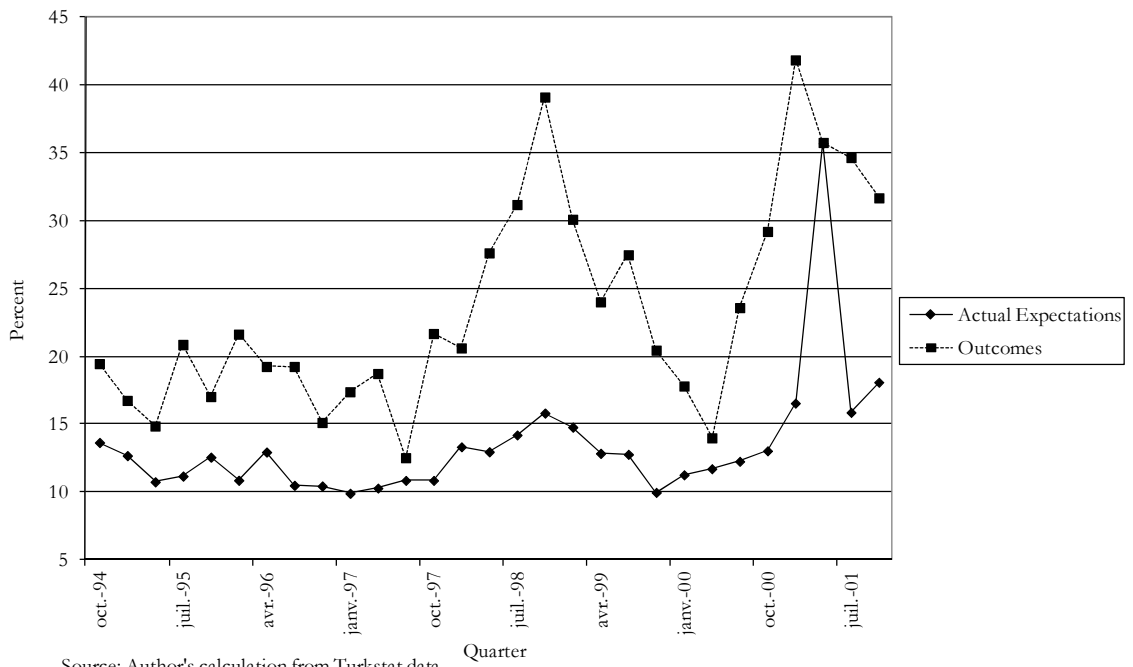
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