Part I

Theoretical and Empirical Foundations
Chapter 2

Financial Crises and Financial Instability: Definitions and Principles

2.1 A General Definition of Financial Crises

There are almost as many definitions of financial crises in the economic literature as there are theories and historical episodes of financial distress. For example, monetarists define financial crises as banking panics leading to sharp contractions in the money supply and deep downswings in real economic activity (Friedman and Schwartz 1963). Advocates of the “financial fragility” approach, having a much broader view on financial distress, define financial crises as the occurrence of one or more events as e.g. sharp declines in asset prices, bankruptcies of large financial and nonfinancial firms, being possibly associated with real economic downturns and large drops in commodity prices (Fisher 1932, 1933, Minsky 1972, Eichengreen and Portes 1987, Kindleberger 2000). Proponents of the asymmetric information view on financial markets define financial crises by particular events as e.g. banking panics, and currency crises which are caused by adverse selection and/or moral hazard (Calomiris and Gorton 1991, McKinnon and Pill 1997, Krugman 1998). By way of contrast, supporters of credit constraint and balance sheet models define financial crises as an event which causes financial constraints to bind, leading to a drying up of liquidity in financial markets, and to real contractions (Mishkin 1991, Dornbusch 1999, Velasco 2001, Caballero and Krishnamurthy 2002).

These introductory examples, which are going to be discussed in more detail in the following chapters, are only an extract from many other definitions of financial crises which can be found in the economic literature. The reason for this large variety of definitions stems from the fact that no financial crisis one can observe in reality equals another one exactly, and, perhaps more importantly, that there is no consensus view on the causes and consequences of financial crises in economic theory. This contribution aims at overcoming this existing fragmentation by providing a more general or synthetic view on financial crises which can be used to explain different forms of financial distress by common theoretical concepts. Accordingly, the present approach does not define any longer financial crises by specific and singular events as described above, but by a general multi-dimensional set of conditions or indicators as follows:
A financial crisis is a disturbance in financial markets being typically accompanied firstly, by a sudden, large, and widespread drop in financial asset prices (as e.g. declining stock and bond prices, decreasing market values of loans, or collapsing exchange rates), implying a large and sudden rise in interest rates on financial assets (as e.g. sharply increasing interest rates on bonds, loans, or money market instruments), and/or secondly, by a sudden, large, and widespread drop in real asset prices (as e.g. declining real estate prices, or dropping market prices for real capital).

This widespread drop in asset prices is caused by an actual and/or expected decline in assets’ rate of returns, which can be triggered firstly, by actual and/or expected negative real shocks (as e.g. adverse terms-of-trade shocks, large increases in input costs, or negative technology shocks), and/or secondly, by actual and/or expected negative financial shocks (as e.g. increasing real domestic or real foreign prime interest rates, exchange rate devaluations, increasing risk premia, or suspensions of government guarantees, as e.g. deposit insurance systems or bail-out guarantees).

Regarding their impact on real economic activity, financial crises can be subdivided into two categories, namely into systemic financial crises and spurious financial crises.

A systemic financial crisis is defined as a situation in which asset price drops and rising interest rates cause firstly, a widespread disruption of financial markets’ capacity to allocate financial funds into the most efficient production opportunities due to a general liquidity crunch and/or due to dysfunctions of the payment system, and secondly, real economic downturns, or even depressions and (debt-)deflation, by engendering widespread failures among financial and nonfinancial firms, and collapses in aggregate demand.¹

By way of contrast, a spurious financial crisis is defined as a situation in which asset price drops and sharply rising interest rates firstly, do not interfere with financial markets’ capacity to channel funds efficiently from savers to investors as disturbances are restricted to particular markets, sectors or agents, and secondly, do not cause real economic downturns as financial market disturbances are not transmitted into the real sector.²

In case domestic asset price disturbances spill over to foreign financial markets, as well as in case foreign financial market asset price disturbances induce domestic disturbances, they are labelled as international financial crises.

¹Financial market disturbances can also cause a failure of the government sector whose impact on the real sector differs however from widespread failures among financial and nonfinancial firms firstly, because the government sector cannot be liquidated, and secondly, as the government sector cannot be forced to give up its “production” activities. As a result, it is not clear whether a failure of the government sector can cause a systemic financial crisis. For that reason, a failure of the government sector was excluded from the general definition of systemic financial crises.

²Examples are stock market crashes, currency collapses, dropping real estate prices, or failures of financial or nonfinancial firms which do not lead to recessions, deflation, general liquidity crunches, or malfunctions of the payment system. Such events are examples of financial distress, yet they are no examples of systemic financial crises. Furthermore, spurious financial crises cannot cause a failure of the government sector.
If these internationally transmitted disturbances lead firstly, to a breakdown of financial markets' ability to allocate funds domestically and/or internationally, and cause secondly, domestic and/or international real economic downturns, they are called international systemic financial crises. If, by way of contrast, there is no disruption of financial markets' ability to allocate funds domestically and/or internationally, as well as no domestic and/or international real economic downturns, they are labelled as international spurious financial crises.

Despite the fact that this general definition of financial crises captures a great variety of possible forms of financial distress, it provides no concept explaining why some financial disturbances lead to systemic, and some to spurious financial crises. Consequently, there is no explanation of how financial market disturbances are transmitted into the real sector, and which "conditions" determine whether a given set of disturbances causes a systemic or a spurious financial crisis. Furthermore, the definition provides no explanation of the fundamental causes of real and/or financial shocks triggering financial crises, i.e. there is no explanation of whether financial crises are purely random events which are caused by exogenous shocks, or whether financial crises are endogenous phenomena resulting from inherent unstable interactions between the real and the financial sphere of modern capitalist economies.

To overcome these drawbacks, section 2.2 analyzes the interaction of asset price fluctuations and macroeconomic activity, whereas section 2.3 investigates factors determining the degree of "financial stability" or "systemic risk", i.e. overall macroeconomic conditions determining whether a given set of disturbances causes a systemic, or a spurious financial crisis. Section 2.4 sets out different theoretical views of the basic causes of financial crises, i.e. whether financial crises can be viewed as exogenous or endogenous events, or as a combination of both.

2.2 Asset Price Fluctuations and Aggregate Economic Activity

This section investigates the interaction of asset price changes and aggregate economic activity. There is broad empirical evidence that changes in asset prices generally tend to lead changes in real GDP growth. Yet, not all asset prices exhibit the characteristics of a leading indicator, depending predominantly on the depth of asset markets. Among a large number of assets, empirical studies singled out stock prices and government bond yield spreads, i.e. the difference between short-term and long-term returns on government bonds, as the best forward-looking indicators for future real output growth, whereas property and land prices were found to be more correlated with actual output growth.3

Notwithstanding the extensive empirical evidence on the leading indicator property of some asset prices, there is no general agreement on the causal linkages between asset prices and real economic activity in economic theory, stemming mainly from the fact that

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3For empirical studies of the interaction of asset prices and output growth both in industrial and emerging market countries, see e.g. Asprem (1989), Fama (1990), International Monetary Fund (2000), chapter III, and Mauro (2000).
these linkages are complex and empirically difficult to determine. One class of theories claims that under rational expectations, asset prices are “only” leading indicators reflecting future changes in output by their forward-looking nature, i.e. there exists no causal relationship between changes in asset prices and output because asset prices only provide information about future developments in the real sector without having influence on output. According to this view however, financial crises, as defined above, cannot arise. Spurious financial crises having no effect on the real sector, would only occur in case expectations about the future were wrong, which is ruled out under rational expectations. Likewise, systemic financial crises could not arise per definition since there exists no transmission mechanism from asset prices to real economic activity.

By way of contrast, according to the more traditional theoretical view, asset price changes are assumed to influence real economic activity in two ways. Firstly, asset prices are assumed to induce alterations in aggregate demand via wealth and cost of capital effects. Secondly, asset prices are assumed to influence the degree of financial stability and the state of current financial distress by determining whether existing financial constraints (net worth and liquidity constraints) are fulfilled or not, influencing on the one hand potential output by deciding upon whether an economic entity is bankrupt or not, and on the other hand aggregate demand by determining the creditworthiness of borrowers, i.e. the availability of external funds, and therewith the maximum amount of expenditures. Owing to this traditional view, both spurious and systemic financial crises, as defined above, are possible events to occur, firstly, due to the existence of various transmission mechanisms between the financial and the real sector, and secondly, due to the influence of asset prices on aggregate financial stability.

Summing up, according to the introductory general definition of financial crises in section 2.1, the present approach follows the more traditional view of the interaction of asset prices and output growth. Hence, after having discussed determinants of asset prices in section 2.2.1, section 2.2.2 analyzes how asset prices influence financial constraints and therewith creditworthiness and the availability of external funds, whereas section 2.2.3 studies the influence of asset prices on aggregate demand. The results of sections 2.2.2 and 2.2.3 are employed to develop a qualitative approach in section 2.2.4 to the emergence of cumulative upward and downward processes, i.e. to economic dynamics which are characterized by self-sustaining or endogenous interdependencies between the real and the financial sector of an economy, leading either to steady increasing asset prices and increasing GDP growth, or to steady falling asset prices and steady declining, or even negative GDP growth, giving rise to systemic financial crises. The qualitative results of section 2.2.4, in combination with factors determining financial stability being discussed in section 2.3, serve as qualitative a basis for the quantitative approach in part II of the book.

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4 For this class of theories, see e.g. Morck, Schleifer and Vishny (1990).
5 In case there are no shocks to the real sector leaving all “fundamentals” unchanged, which is the case during a spurious financial crisis, then, under the assumption of rational expectations, asset prices cannot change since there is no change in “fundamentals”. Thus, a downward revision of expectations without a change in fundamentals indicates an expectation error which is excluded under the rational expectations hypothesis.
2.2.1 Determinants of Asset Prices

There are various theories and models of asset pricing in economics, as e.g. portfolio theory being based on the capital asset pricing model (CAPM), consumption based asset pricing theory being grounded on the consumption based capital asset pricing model (CCAMP), or production based asset pricing theory having evolved from stochastic growth and real business cycle theory. Albeit these theories differ with respect to assumptions, model structures, etc., they all have in common that the price of an asset is generally determined by the present value approach, stating that the price of an asset is determined by the sum of its discounted expected earnings or cash flows.

Expected cash flows are the asset's expected rents, cash or imputed, net of costs of operation, maintenance, taxes, etc. Interest costs, i.e. rates of return which the investor must pay to borrow funds to hold the asset, or opportunity costs, i.e. rates of return the investor must sacrifice by holding smaller amounts of other assets, are represented by the discount factor which is a risk-adjusted reference "interest" rate investors demand for holding the asset, being powerfully influenced by monetary policies, i.e. by short-term interest rates. It is important to note that interest or opportunity costs associated with the asset, are not subtracted from expected cash flows since expected cash flows represent the asset's "natural returns", which are independent of financing issues. Likewise, it must be emphasized that the discount factor is not a market interest rate on a specific kind of reference asset which investors could alternatively invest in, but a rate appropriate for the valuation of streams of future returns with the time patterns, uncertainties, and covariances of the asset's cash flows. That is, the discount factor can be interpreted as "mixed" rate, consisting of the return of a risk-free reference asset, plus an asset-specific risk premium reflecting all uncertainties and risks associated with the asset's cash flows.

Formally, the nominal market value, or the market price of an asset, \( P_A \), being subject to an infinite income stream is given at time \( t \) in discrete form by

\[
P_{A,t} = \sum_{s=t}^{\infty} (1 + (i_{RF} + rp - \hat{p}^e))^{-(s-t)} CF_e^e = \sum_{s=t}^{\infty} (1 + (i_{RF} + rp - \hat{p}^e))^{-(s-t)} CF_{r,s}^e P_e^e, \quad (2.1)
\]

and in continuous form by

\[
P_A(t) = \int_t^{\infty} e^{-(i_{RF} + rp - \hat{p}^e)(s-t)} CF_e^e(s) ds = \int_t^{\infty} e^{-(i_{RF} + rp - \hat{p}^e)(s-t)} CF_r^e(s) P_e^e(s) ds, \quad (2.2)
\]

where \( CF_e^e \) denotes real expected cash flows or expected real earnings, \( P_e^e \) the expected price level, \( CF_e^e = CF_r^e \) \( P_e^e \) nominal expected cash flows, \( i_{RF} \) the nominal risk-free interest rate of a risk-free reference asset (e.g. nominal interest rate on long-term government bonds being crucially dependent on monetary policies), \( rp \) the risk premium in nominal terms representing the asset's risk of default, \( \hat{p}^e \) the price level's expected growth rate being defined in discrete time as \( \hat{p}^e_s = (P_e^e_{s+1} - P_e^e_s)/P_e^e_s \) and in continuous time as

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\( ^6 \)For example, regarding equities, the discount factor is not represented by the interest rate on long-term government bonds, or by the interest rate on long-term corporate bonds, but e.g. by the interest rate on long-term government bonds, representing the risk-free reference asset, plus an equity-specific risk premium reflecting all uncertainties and risks associated with the equity's cash flows.
\[ \hat{p}^e(s) = \hat{P}^e(s)/P(s), \text{ and } i_{RF} + rp - \hat{p}^e \text{ the risk-adjusted real expected reference interest rate.} \]

In case the expected price level \( P^e \) and expected real earnings \( CF^e \) are constant over time, implying constant nominal earnings \( CF^e \), the asset price at time \( t \) is given, both in discrete and in continuous form, by

\[ PA = \frac{CF^e}{i_{RF} + rp - \hat{p}^e} = \frac{CF^e P^e}{i_{RF} + rp - \hat{p}^e}. \] (2.3)

According to the present value approach, asset prices decline/rise ceteris paribus, in case there is a fall/rise in expected real cash flows \( CF^e \), a rise/fall in the nominal risk-free interest rate \( i_{RF} \), a rise/fall in the risk premium in nominal terms \( rp \), and a fall/rise in the expected price level \( P^e \) implying also a fall/rise in the price level’s expected growth rate \( \hat{p}^e \). Consequently, regarding financial crises, drops in asset prices can be caused by deteriorating “objective” fundamental data (fall in actual earnings\(^8\), rise in current nominal risk-free interest rates), as well as by worsening “subjective” expectations as to future earnings, the expected price level and default risk.

Prominent applications of the present value approach are e.g. the “Gordon equation” (Gordon 1962), determining equity prices in a consumption based capital asset pricing model, Tobin’s \( q \) theory of investment discussed in appendix A, and textbook illustrations of the determination of bond prices. Regarding the determination of exchange rates, it must be noted that the present value approach cannot be applied since exchange rates are no income generating assets whose return can be compared to another asset. Rather,

\(^7\)Unlike most representations of nominal discounted present values which are generally stated in nominal terms, i.e. nominal expected cash flows are generally discounted by a nominal reference interest rate, equations 2.1 and 2.2 define nominal present values as a stream of future expected nominal earnings being discounted by an expected real reference interest rate since this kind of description allows for a better consideration of the impact of (expected) inflation. The definition of nominal discounted present values in equations 2.1 and 2.2 can be derived in four steps. Regarding the discrete time case in equation 2.1, the first step is to define the real market value, or the real discounted present value of an asset at time \( t \), \( PA, t \), reading as \( PA, t = PA, t / P_t = \sum_{s=t}^{\infty} (1 + z_r)^{(s-t)} CF^e, s, t \), where \( z_r \) denotes the real risk-adjusted reference interest rate. In the second step, real expected cash flows \( CF^e, s, t \) are replaced by nominal expected cash flows \( CF^e \), which are deflated by the current price level \( P_t \), leading to \( PA, t = PA, t / P_t = \sum_{s=t}^{\infty} (1 + z_r)^{(s-t)} (CF^e, s, t / P_t) P_t / P_t \). In the third step, the real discounted present value is transformed into a nominal discounted present value via multiplication by the current price level at time \( t \), \( P_t \), resulting in \( PA, t = PA, t / P_t = \sum_{s=t}^{\infty} (1 + z_r)^{(s-t)} (CF^e, s, t / P_t) P_t / P_t \). In the fourth step, the term \( (1 + z_r)^{(s-t)} \) is replaced according to the multi-period Fisher relation, reading for \( s \geq t \) as \( (1 + z_r)^{(s-t)} = (1 + i_{RF} + rp)^{(s-t)} / (1 + \hat{p}^e)^{(s-t)} \), which results in \( PA, t = PA, t + P_t = \sum_{s=t}^{\infty} (1 + i_{RF} + rp)^{(s-t)} / (1 + \hat{p}^e)^{(s-t)} CF^e \), approximating the Fisher relation by the result that \( z_r \approx i_{RF} + rp - \hat{p}^e \), the nominal discounted present value is given by \( PA, t = PA, t + P_t = \sum_{s=t}^{\infty} (1 + (i_{RF} + rp - \hat{p}^e))^{(s-t)} CF^e \), which corresponds exactly to equation 2.1. The derivation of the continuous case in equation 2.2 is described analogously to the discrete time case in four steps. Following step one above, the real market value of an asset at time \( t \) is given by \( PA, t = PA, t / P_t = \int_{-\infty}^{t} e^{-z_r(s-t)} CF^e(s) ds \). According to step two, real expected cash flows are replaced by nominal expected cash flows, leading to \( PA, t = PA, t / P_t = \int_{-\infty}^{t} e^{-z_r(s-t)} (CF^e(s) / P^e(s)) (P^e(s) / P(t)) ds \). Transforming the real discounted present value into the nominal discounted present value according to the step three via multiplication by the current price level \( P(t) \) yields \( PA, t = PA, t / P_t = \int_{-\infty}^{t} e^{-z_r(s-t)} CF^e(s) ds \). As to step four, the multi-period Fisher relation, reading in continuous time for \( s \geq t \) as \( e^{z_r(s-t)} = e^{(i_{RF} + rp)(s-t)/\hat{p}^e(s-t)} \), or after having eliminated \( (s-t) \) as \( z_r = i_{RF} + rp - \hat{p}^e \), is used to replace \( z_r \), which results in \( PA, t = PA, t / P_t = \int_{-\infty}^{t} e^{-z_r(s-t)} (CF^e(s) / P^e(s)) (P^e(s) / P(t)) ds \), corresponding exactly to equation 2.2.

\(^8\)Note that at time \( t \), it holds that \( CF^e_t = CF^e_t \) according to equation 2.1, and \( CF^e(t) = CF(t) \) according to equation 2.2.
exchange rates’ “market price” is determined by international transactions in services, goods and financial assets, which demands different approaches to price determination, as e.g. purchasing power theory (PPP), uncovered interest parity theory (UIP), or asset market approaches to the exchange rate.

2.2.2 Asset Prices and Financial Constraints

Asset prices have a decisive influence on real economic activity by their impact on financial constraints, determining a business unit’s creditworthiness, the available amount of external finance and thereby the maximum amount of aggregate expenditures, as well as whether a business unit is bankrupt or not. As a result, the strength of the transmission from the financial into the real sphere of an economy, as well as the question of whether a financial crisis is spurious or systemic, depends on whether constraints are binding or not binding, and on whether constraints can be fulfilled at all.

There are two broad classes of financial constraints in economic theory whose explicit form depends on how financial markets are assumed to work. The theory of perfect capital markets, being outlined in section 2.2.2.1, is based on intertemporal Walrasian equilibrium theory and assumes that there are no frictions in financial markets, and that economic agents are only subject to an intertemporal solvency constraint. By way of contrast, the theory of imperfect capital markets, being reviewed in section 2.2.2.2, assumes that there are strong information asymmetries in financial markets leading to borrowing constraints which depend on agents’ net worth. As there are strong differences between both perspectives, section 2.2.2.3 compares both theories with real world financial constraints and develops a synthetic view on the impact of financial constraints on real economic activity. This perspective is employed as a basis for section 2.2.4, analyzing the emergence of cumulative processes, and for the quantitative approach to financial crises being developed in part II of the book.

2.2.2.1 Perfect Capital Market Theory

The Existence of Intertemporal Solvency Constraints. Theoretical models as well as empirical studies of borrowing and lending have been often based on perfect capital market theory combined with general intertemporal Walrasian equilibrium theory.\(^9\) As a result, financial constraints on borrowing and lending in perfect capital markets in a multi-period competitive environment are generally formulated as intertemporal conditions referring to the entire time span of the planning period, and not as static requirements which have to be fulfilled at a certain moment in time. As a thorough discussion of financial constraints under intertemporal decisions of agents would require a formal treatment, the following qualitative description is supplemented by a quantitative example in appendix B.

According to intertemporal maximization models, economic agents are generally subject to two financial constraints which determine whether an economic entity is bankrupt or not. The first condition to be fulfilled is the so-called no-Ponzi-game condition\(^{10}\), being

\(^9\)See e.g. Blanchard and Fischer (1989), and Obstfeld and Rogoff (1999).

\(^{10}\)The no-Ponzi-game condition is named after Boston swindler C. Ponzi who promised very high returns to investors in the 1920s which he paid, at least for a certain time, by money from new investors. After
labelled in mathematical terms as the transversality condition. The no-Ponzi-game condition requires that the present value of debt/wealth of a representative agent at the end of the planning period has to be zero, i.e. the agent is not allowed to leave the scene without having repaid debt/without having consumed entire wealth. The second condition to be fulfilled is an intertemporal budget constraint, stating that the positive/negative present value of future net income, i.e. the positive/negative present value of output less private consumption (in a closed economy without investment and government expenditures), must not exceed the present value of initial debt plus interest payments/fall short of the present value of initial wealth, where debt/wealth has been generated by past consumption which has been higher/lower than income. In case the intertemporal budget constraint is not fulfilled, implying also a violation of the no-Ponzi-game condition, the economic unit is bankrupt or intertemporally insolvent, whereas in case the intertemporal budget constraint and the no-Ponzi-game condition are fulfilled, the economic unit is intertemporally solvent.

The Absence of Temporary Borrowing Constraints. The existence of the intertemporal solvency constraint combined with the no-Ponzi-game condition, guaranteeing the non-explosiveness of debt, implies that agents’ spending can be temporarily higher than their income, and, much more importantly, that agents can borrow temporarily against future income without any borrowing constraint. Accordingly, as long as agents remain intertemporally solvent, there arises no bankruptcy at a specific moment in time since all due payment commitments can be met by borrowing temporarily without any restrictions.

The Irrelevance of the Financial Structure. The irrelevance of the financial structure for borrowing and lending in perfect capital markets has been highlighted by the Modigliani-Miller theorem (Modigliani and Miller 1958) whose results can be summarized in two propositions. Firstly, the capital structure, the debt-equity ratio, or corporate leverage is irrelevant for the present value of the firm, implying that optimal investment is independent of capital markets. This independence implies that the value of assets cannot be changed by altering the claims. It means that in perfect capital markets a firm cannot increase its market value simply by recombining debts against its assets and offering them in different forms. This result is based on the assumption that the value of a business firm depends solely on investment opportunities available to it, and that finance for investment is always available and not restricted by borrowing constraints. Secondly, as a consequence of the irrelevance of the capital structure, the cost of capital of a business firm is independent of the type of securities used to finance the project or the capital structure of the firm, i.e. there exist no differences between the costs of different financing instruments.

2.2.2.2 Imperfect Capital Market Theory

The Existence of Asymmetric Information and Credit Rationing. In sharp contrast to the theory of perfect capital markets, imperfect market capital theory, which has a long tradition in macroeconomics beginning with I. Fisher (1933) and J.M. Keynes
(1936) if not earlier authors, postulates that both the financial structure and capital markets in general have a decisive influence on aggregate economy activity by determining the strength of borrowing constraints and the costs of finance. The claim that goods and financial markets are mutually dependent is built on the basic assumption that capital markets are subject to asymmetric information, being an obstacle for a frictionless functioning of financial markets.

Asymmetric information in financial markets is defined as a situation in which one agent of a financial contract is much better informed than the other one. That is, borrowers who take loans have much better information about the prospective returns and risks associated with the investment project than lenders. This basic information asymmetry causes two forms of frictions in information flows, namely adverse selection and moral hazard, leading on the one hand to credit rationing and on the other hand to the existence of borrowing constraints.

Adverse selection occurs before a transaction has taken place and comes into being by the fact that the worst borrowers with highest credit risk have the most difficulties in receiving funds, and therefore are going to offer the highest interest rates since they are likely not to repay the loan. An adverse selection problem comes into being in case lenders grant loans only to those borrowers with highest interest rate offers, implying huge losses for lenders since borrowers with highest credit risk are most likely to be selected. Accordingly, since lenders cannot use the interest rate as a reliable indicator to distinguish "good" from "bad" borrowers, lenders may decide on granting no loans at all, even if there are good borrowers in the market. Thus, adverse selection may lead to credit rationing which is defined as a situation in which at a given interest rate, demand for credit is higher than credit supply.

Moral hazard occurs after the transaction has taken place and comes into being in case the borrower earns profits in case the investment project succeeds, and bears no losses in case the project fails, since losses are paid by the lender or by the tax payer. This distortion in incentives leads to actions by the borrower which are immoral from the lender’s point of view, as e.g. “overinvestment” in projects with very high risk, or an inefficient use of loans for personal (consumption) purposes of the borrower. In order to avoid such immoral actions by borrowers, lenders may engage in screening and monitoring, which however, can also cause credit rationing since lenders cannot assess whether a potential borrower is going to engage in immoral actions.

The Existence of Borrowing Constraints. Apart from credit rationing, adverse selection and moral hazard also lead to the emergence of borrowing constraints since potential losses for lenders can be reduced or avoided, either by imposing borrowing ceilings which prevent borrowers from borrowing an unlimited amount of credit, or by demanding risk-dependent interest rates, leading to an upward sloping supply schedule for credit.

Respecting the existence of borrowing ceilings, it is generally assumed that borrowers’ assets are used as collateral, and that debt ceilings are formulated as a fraction of borrowers’ net worth, where net worth is generally defined as the market, or discounted

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11 For an overview on the theory of imperfect capital markets, see Gertler (1988) and Trautwein (2000).
12 For a detailed discussion on credit rationing in markets with asymmetric information, see Stiglitz and Weiss (1981, 1992), and Jaffee and Stiglitz (1990).
present value of assets less the market, or discounted present value of debt. All net worth concepts are grounded on the principle that the status of solvency or insolvency, as well as the influence of net worth on the availability of financial funds, and thereby on aggregate expenditures, are determined by the sign of net worth which can be positive, zero, or negative. In case net worth is negative, an economic unit is defined as being bankrupt or insolvent, and receives no financial funds. If, by way of contrast, net worth is equal to or greater than zero, an economic unit is defined as being solvent, where the amount of available finance, and thereby the amount of aggregate expenditure, is a positive function of borrowers’ net worth, i.e. the higher net worth is, the more funds are available due to a lower credit risk, and the higher aggregate expenditures are.

Regarding the existence of risk-dependent interest rates, borrowing is constrained by the fact that “market” interest rates are assumed to consist of a risk-free rate and a risk premium, where the risk premium is either a convex function of agents’ debt, or depends positively on agents’ net worth serving as collateral. Thus, decreasing net worth, or increasing debt, lead to increasing financing costs which pose an upper limit on the amount of debt finance since the higher interest rate costs, the lower is the present value of an investment project.

The Existence of a “Financial Hierarchy”. The existence of asymmetric information also causes a difference between costs of internal finance by retained earnings, and costs of external finance by debt or equity finance. Since internal finance, unlike external finance, requires no financial contract, there arise no information asymmetries, and thereby no “agency costs of lending”, i.e. no external finance premium depending negatively on borrowers’ net worth, or positively on borrowers’ debt stock. Regarding external finance, there exists also a cost difference between debt and equity finance, where equity finance is more expensive than debt finance due to higher information asymmetries, because providing financial funds as a shareholder is associated with higher risk than as a traditional lender due to insecure earnings and a higher losses in case of default. Accordingly, a varying degree of information asymmetries depending on the form of the financial contract implies a financial hierarchy of finance costs, where internal finance by retained earnings is the cheapest finance form, followed by external debt finance bearing additionally an external finance premium, and external equity finance being the most expensive form of finance.13

The “Financial Accelerator” Effect. A further consequence of asymmetric information in financial markets is the emergence of the financial accelerator effect, stating that the financial sector of an economy accelerates both the upturn and the downturn of the business cycle. The financial accelerator effect arises from the fact that the costs of (investment) finance, and especially the external finance premium, are inversely related to borrowers’ net worth position. As a result, aggregate investment is positively dependent on borrowers’ net worth and negatively dependent on the the costs of capital. In case there is a sudden decrease in borrowers’ net worth, which can be induced by a fall in asset prices, a reduction in cash flow and liquidity, a rise in foreign debt by devaluations, the

external finance premium rises inducing a reduction of investment expenditures. By way of contrast, in case there is a rise in borrowers’ net worth, the external finance premium decreases and induces a rise in investment expenditures.\footnote{14}

The Existence of Banks and the Necessity of Financial Market Regulation. The dominant role of banks in the financial structure of capitalist economies can be explained as well by the existence of asymmetric information, since banks can be considered as producers of relevant information regarding the assessment of credit risk, which reduces existing asymmetries and allows for a much higher availability of funds. This argument can also be brought forward to explain the empirical fact that economic growth is positively correlated with the state of development of the domestic financial system. Furthermore, the existence of asymmetric information justifies the existence of financial market supervision and regulation by domestic and international regulation authorities to reduce existing asymmetries by screening and monitoring. In order to avoid financial distress, business firms and banks have to be obliged to disclose publicly relevant information about their financial liquidity and solvency status, as well as to adhere to common accounting standards. Accordingly, fast financial market liberalization being accompanied by lax supervision and regulation, limited screening and monitoring of financial institutions, weak accounting and disclosure rules, and by the absence of a security net for financial institutions, can lead very quickly to financial distress and financial crises due to an increase in information asymmetries.\footnote{15}

2.2.2.3 A Comparison with Real World Financial Constraints

Real World Financial Constraints. In reality, each economic unit is subject to a liquidity constraint and to a solvency constraint which are both employed to determine the status of bankruptcy, as well as the degree of creditworthiness, and thereby the amount of available debt finance and the amount of aggregate expenditures. Though bankruptcy law differs among countries, the real world status of bankruptcy is generally defined by two facts, namely by illiquidity and by insolvency. Regarding illiquidity, an economic unit is bankrupt in case due payment commitments cannot be fulfilled. This situation emerges in case current cash flow from “normal” operation is negative, and if there is no possibility to receive liquid funds, e.g. by new borrowing, or by selling assets to meet payment commitments, so that overall cash flow remains negative. Regarding insolvency, an economic unit is bankrupt in case its current net worth, i.e. the difference between assets and debts in its balance sheet, is negative. To become bankrupt, only one of the two conditions must be fulfilled, so not to be bankrupt requires both liquidity and solvency of an economic unit.

\footnote{14}{For details on the financial accelerator effect, see Bernanke (1983), Greenwald, Stiglitz and Weiss (1984), Greenwald and Stiglitz (1993), Bernanke, Gertler and Gilchrist (1996, 1998), Kiyotaki and Moore (1997), and Miller and Stiglitz (1999).}

\footnote{15}{For further theoretical literature on credit rationing, borrowing constraints, the effects of balance sheet positions, the financial hierarchy, and the financial accelerator, see Bernanke (1983), Bernanke and Gertler (1989, 1990, 1994, 1995, 2000), Bernanke and Lown (1992), Gertler (1992), Gertler and Gilchrist (1993, 1994), and Bernanke, Gertler and Gilchrist (1998, 1999). For empirical studies of the effects of credit constraints on aggregate economic activity, see e.g. Bacchetta and Gerlach (1997) studying the impacts on consumption, and Fazzari, Hubbard and Petersen (1988) analyzing the impacts on investment.}
Though there arise situations in which economic units are illiquid but solvent, or insolvent but liquid, in most cases the violation of one financial constraint induces the violation of the other one, since liquidity and solvency are interdependent. For example, in case one economic unit is illiquid and tries to fulfill due payment commitments by selling assets, the sale of assets can cause a large drop in asset prices thereby generating possibly insolvency. By way of contrast, in case an economic unit is insolvent, creditors may want to withdraw their funds quickly in order to reduce losses which may cause illiquidity of the debtor. Summing up, the real world bankruptcy status of an economic unit, and thereby its creditworthiness and the available amount of external finance, are determined by both the liquidity and the solvency status which are interdependent.

A Comparison with Perfect Capital Market Theory. Regarding the correspondences of perfect capital market theory with the stylized facts of real world financial constraints, there arises only one similarity, namely that bankruptcy is defined by cash flow positions. Regarding the differences, there are three issues to be mentioned. Firstly, regarding the definition of bankruptcy, perfect capital market theory neglects balance sheet positions, and refers to an intertemporal cash flow constraint. Secondly, according to perfect capital market theory, there are no temporary borrowing constraints, so that there is no influence of actual cash flow and net worth position on creditworthiness and real economic activity. Thirdly, due to the neglect of balance sheet effects, there arise no interdependencies between cash flow and balance sheet positions, i.e. between the liquidity and the solvency status.

A Comparison with Imperfect Capital Market Theory. Respecting the common grounds, imperfect capital market theory emphasizes in accordance with the stylized facts of real world financial constraints that net worth positions are a crucial determinant of creditworthiness and real economic activity due to the existence of borrowing ceilings and risk-dependent interest rates. Regarding the differences, imperfect capital market theory lacks a well-formulated theoretical link between the interaction of liquidity and balance sheet positions.

An Assessment. The comparison has shown that imperfect capital market theory provides useful tools to explain the stylized facts regarding the transmission of financial sector shocks into the real sphere of an economy. However, to be applicable to the explanation of financial crises, imperfect capital market theory has to be supplemented by three important elements. Firstly, according to bankruptcy law, liquidity and solvency have to be well-defined and distinguished from each other. Secondly, the interaction between solvency and liquidity constraints has to be elaborated, and thirdly, the connection between cash flows, profits, net worth and changes in the financial structure, i.e. changes in the composition of assets and debts, have to be clarified. These supplements are going to be taken into consideration in section 2.2.4, which, in combination with the ensuing section 2.2.3, provides a qualitative framework for the emergence of cumulative or endogenous processes, serving as a theoretical basis for the models being developed in part II of the book.
2.2.3 Asset Prices and Aggregate Demand

The influence of asset prices on aggregate demand is generally studied by the theory of monetary transmission mechanisms.\textsuperscript{16} This section is not going to provide a general overview of monetary transmission mechanisms, but highlights the most important effects of asset price changes on aggregate demand, where stock prices and real property prices have been found empirically to be most influential.\textsuperscript{17}

Asset Prices and Consumption. There are three effects according to which consumption is influenced by the level of asset prices. Firstly, consumption is generally assumed to depend at least partly on expected wage income. As increasing/decreasing asset prices affect such expectations by signalling faster/slower growth of future real income, there exists a positive correlation between the level of asset prices and current consumption.\textsuperscript{18} Secondly, according to life cycle and/or permanent income models, consumption is positively dependent on households’ lifetime financial resources, i.e. rising/falling asset prices increase/decrease lifetime resources and lead to an increase/decrease in current consumption.\textsuperscript{19} Thirdly, as to imperfect capital market theory, information asymmetries prevent households from borrowing solely on the basis of future expected income to satisfy their consumption needs, as borrowing is constrained by households’ net worth which is positively dependent on the level of asset prices. Accordingly, current consumption is a positive function of current disposable income and of the availability of external finance. In case there is a rise/fall in asset prices, households’ net worth increases/decreases, leading to an increase/decrease in the available amount of borrowing and therethrough to an increase/decrease in current consumption.

Asset Prices and Investment. Asset prices influence investment via three main channels. Firstly, the credit channel of monetary policy, consisting of the bank lending and balance sheet channel, states that increasing/decreasing asset prices lead to increasing/decreasing net worth positions, as well as to increasing/decreasing cash flow positions, which increase/decrease the available amount external finance and lower/increase the agency cost of lending, thereby leading to an increase/decrease in aggregate investment. Secondly, according to the theory of the “flexible accelerator”, investment is predominantly dependent on expected future output growth. Accordingly, rising/declining asset prices indicating faster/slower GDP growth in the future lead to an increase/decrease in aggregate investment.\textsuperscript{20} Thirdly, Tobin’s $q$ theory of investment, being reviewed in appendix A, states that an increase/decrease in asset prices lowers/increases the cost of buying new capital goods relative to the costs of buying existing capital goods, e.g. at the stock exchange. Accordingly, if there is a rise/fall in Tobin’s $q$, i.e. in the ratio of the

\textsuperscript{16}For a review of monetary transmission mechanisms, see e.g. Hubbard (1995), and Mishkin (1995).

\textsuperscript{17}For empirical studies of the impacts of asset prices on aggregate demand in industrialized countries, see e.g. Bank for International Settlements (1998).

\textsuperscript{18}See e.g. Poterba and Sanwick (1995).

\textsuperscript{19}See e.g. Deaton (1992).

\textsuperscript{20}See e.g. Jorgensen (1963). For empirical evidence on flexible accelerator models, see e.g. Mullins and Wadhwani (1989).
market valuation of existing capital goods to the costs of acquiring new capital, investment increases/decreases.\textsuperscript{21}

**The Influence of Exchange Rates.** Though the exchange rate has not been classified as a typical financial asset, its impact on real economic activity has to be studied since revaluations or devaluations influence real economic activity via three main channels.

Firstly, according to standard textbook models, there exists a positive relationship between the real exchange rate and net exports, i.e. an increase/decrease in the real exchange rate by an appreciation/depreciation of the nominal exchange rate stimulates/dampens aggregate demand via increasing/decreasing net export. This mechanism is built on the assumption that the values of import and export elasticities fulfill the Robinson and/or the Marshall-Lerner-condition. In case these conditions are not fulfilled, net exports are a negative function of the real exchange rate giving rise e.g. to short-run J-curve effects.

Secondly, in case balance sheet positions are characterized by large unhedged positions in foreign currency, changes in nominal exchange rates alter net worth and cash flow positions, and thereby aggregate consumption and investment via changes in the available amount of finance, and in the agency cost of lending. For example, if balance sheets are characterized by large amounts of foreign debt denominated in foreign currency which are not hedged by foreign assets to the same amount, there exists an inverse relationship between the nominal exchange rate and consumption and investment expenditures since an increase/decrease in the exchange rate increases/decreases the nominal amount of debt in domestic currency, which reduces/increases net worth, causing a decrease/increase in the available amount of external funds and therethrough a decrease/increase in consumption and investment expenditures. By way of contrast, in case balance sheets are characterized by unhedged positions of foreign assets denominated in foreign currency, there is a positive relationship between the nominal exchange rate and consumption and investment.

Thirdly, there exists an inverse relationship between the nominal exchange rate and the costs of imported inputs having both an influence on aggregate demand and on aggregate supply. For example, if there is an increase in the nominal exchange rate, costs for imported inputs rise, implying on the one hand a negative supply shock shifting the aggregate supply schedule upwards, and on the other hand a reduction in investment demand via a reduction in profits leading to declines in asset prices. Fourthly, there exists an inverse relationship between the nominal exchange rate and consumption via price effects of imported consumption goods changing real wages. For example, if there is an increase in the nominal exchange rate, prices for imported consumption goods rise, causing a rise in the aggregate domestic price level which reduces real wages and therethrough consumption. Summing up, contrary to the standard assumption that there is a positive correlation between (nominal and real) exchange rates and aggregate demand via the net export effect, there are various factors which can reverse this relationship, being labelled in the economic literature as “contractionary devaluation”, stating that a devaluation of the home currency does not lead to a domestic real expansion, but to a real macroeconomic contraction.\textsuperscript{22}

\textsuperscript{21}For empirical evidence on the impact of stock prices and Tobin’s \textit{q} on investment in the United States and Canada, see Barro (1990).

\textsuperscript{22}For a detailed discussion of possible effects causing contractionary devaluations, see Krugman and Taylor (1978), Taylor (1983), and van Wijnbergen (1983a, 1983b).
2.2.4 Asset Prices, Liquidity, Solvency and the Emergence of Cumulative Processes

After having reviewed standard approaches to the influence of asset prices on real economic activity, this section develops a new framework regarding the interdependencies of financial sector disturbances and the real sphere of an economy by the introduction of a new concept in section 2.2.4.1 as to the interaction of the liquidity and the solvency status of economic units. This new concept allows for the determination of a wide range of causes for bankruptcy being analyzed in section 2.2.4.2, where the state of bankruptcy is defined, as opposed to standard models, according to real world bankruptcy law, having been already outlined in section 2.2.2.3. Furthermore, this basic framework of the determinants of bankruptcy, or of the determinants of systemic financial crises, is enlarged by the results of sections 2.2.1 to 2.2.3, resulting in an aggregate qualitative model of various transmission mechanisms being relevant for the propagation mechanisms of systemic financial crises. These various interdependencies of asset prices, liquidity, solvency, financial constraints, and real economic activity, having been neglected so far by standard approaches on financial crises, give rise to cumulative and self-sustaining upward and downward processes in macroeconomic activity, and in aggregate financial “health” via the influence of macroeconomic conditions on the (macroeconomic) determinants of bankruptcy and vice versa. This new framework discussed in section 2.2.4.3 implies, partly in accordance with the “financial accelerator” theory, that financial sector disturbances, no matter whether they are positive or negative, are generally amplified by various interdependencies between the financial and the real sector of an economy, and can lead either to long-lasting boom or bust periods, where macroeconomic contractions are associated with systemic financial crises. Though this section uses some formal expressions, the analysis is qualitative in nature, serving as a theoretical basis for the quantitative analysis in part II of the book.

2.2.4.1 Liquidity, Solvency, and Profits: Definitions and Interdependencies

To elaborate the interdependencies between liquidity, solvency, and profits, the analysis starts with a stylized balance sheet in figure 2.1 which is to portray the financial structure of a representative economic sector, as e.g. the firm or the banking sector. Figure 2.1 could be alternatively interpreted as a stylized balance sheet of a single economic unit. This microeconomic perspective however, is not able to study the sector-internal dynamics leading to self-sustaining expansions as well as contractions, because, for example, asset prices or risk-dependent interest rates cannot be influenced by a single economic unit’s earnings, cash flows, or profits. By way of contrast, an entire economic sector as a whole determines its own market valuation by aggregate earnings, cash flows, and profits giving rise to endogenous expansions and contractions. Furthermore, a microeconomic perspective would neglect the fact that the analysis of (systemic) financial crises refers to widespread failures of a large fraction of business units in the firm and in the financial sector, and not to defaults of single economic entities.

All balance sheet positions in figure 2.1, being assumed to be function of time $t$, are priced at their current market or discounted present values. There are three types of assets. Asset type one are domestic productive assets being used as an input factor whose market value amounts to $P_A(t) A(t)$, where $A(t)$ denotes the real stock of domestic assets, and $P_A(t)$ the market price per real unit in domestic currency. The real stock of assets $A(t)$
Figure 2.1: Stylized Financial Structure of a Representative Economic Sector

priced at $P_A(t)$ can be interpreted as a weighted average of a large variety of domestic real and financial assets valued at their market prices. Asset type two are foreign productive assets, being also used as input factors, whose market value in domestic currency amount to $P_A(t) A^*(t) s(t)$, where $A^*(t)$ denotes the real stock of foreign assets, $P_A(t)$ the market price per real unit in foreign currency, and $s(t)$ the nominal exchange rate, expressing the price of one unit foreign currency in domestic currency. The real stock of foreign assets $A^*(t)$ valued at $P_A(t)$ can also be interpreted as a weighted average of a large variety of foreign real and financial assets valued at their market prices. Domestic and foreign productive assets $A(t)$ and $A^*(t)$ are assumed to be subject to depreciation. Asset type three are non-interest bearing liquid monetary assets $LMA(t)$ which are not used as an input factor, but to fulfill payment commitments; $LMA(t)$ can be interpreted e.g. as deposits with banks which can be liquidated instantly.

On the debt side, there are two types of liabilities. Firstly, (nominal) domestic debt $DB(t)$ in domestic currency, and secondly, foreign debt in domestic currency $s(t) DB^*(t)$, where $DB^*(t)$ denotes the nominal value of foreign debt in foreign currency. Net worth $NW(t)$ is the difference between assets and debts and can take a positive, zero, or negative sign. The debt-asset ratio, being defined as the ratio of the sum of debts to the sum of assets, i.e. $(DB(t) + s(t) DB^*(t))/(P_A(t) A(t) + s(t) P_A(t) A^*(t) + LMA(t))$, is an indirect indicator of the level of net worth as an increasing/decreasing debt-asset ratio indicates a decreasing/increasing level of net worth $NW(t)$. The net foreign position, being defined as foreign assets less foreign debt, i.e. formally as $P_A^*(t) A^*(t) - DB^*(t)$, provides information about the use of foreign debt on the asset side of the balance sheet, i.e. whether foreign debt is used to invest in domestic assets which are denominated in domestic currency, or in foreign assets which are denominated in foreign currency. In case foreign debt is used to invest in foreign assets, then the balance sheet exhibits a foreign neutral or a foreign net creditor position. In terms of the stylized balance sheet in figure 2.1, a foreign neutral or foreign net creditor position is characterized formally by $DB^*(t) \leq P_A^* A^*$, i.e. by foreign assets being equal or larger than foreign debt. If, by way of contrast, foreign debt is used partly or entirely to invest in domestic assets, then the balance sheet exhibits a foreign net debtor position which, in terms of figure 2.1 is characterized formally by $DB^*(t) > P_A^* A^*$, i.e. by foreign debt being larger than foreign assets.
In case figure 2.1 is interpreted as the stylized balance sheet of the business firm sector, the stock of domestic assets \( A(t) \) valued at its market price \( P_A(t) \) represents the capital stock valued at the stock exchange by aggregate equity prices, and other domestic financial assets, as e.g. domestic equities or bonds valued at their market prices. The nominal stock of foreign assets \( P_A^*(t)A^*(t) \) can be interpreted as foreign direct investment in the form of real capital valued e.g. at replacement costs, and as foreign financial assets, as e.g. foreign bonds or equities valued at their market prices. Liquid monetary assets \( LMA(t) \) represent deposits with banks. Domestic and foreign debt, i.e. \( DB(t) \) and \( DB^*(t) \), represent domestic and foreign bank loans. By way of contrast, if figure 2.1 is to represent the banking sector, the nominal stock of domestic assets \( P_A(t)A(t) \) represents the stock of loans priced at its “quality”, i.e. at its expected discounted present value, and other domestic financial assets valued at their market prices. The nominal stock of foreign assets \( P_A(t)A^*(t) \) represents loans in foreign currency to foreigners, and other foreign financial assets valued at their market prices. Liquid monetary assets \( LMA(t) \) represent central bank reserves which are a fraction of domestic and foreign deposits in foreign currency, being represented by \( DB(t) \) and \( DB^*(t) \), i.e it holds that \( DB(t) + s(t)DB^*(t) = m LMA(t) \) where \( m \) denotes the money multiplier being the inverse of the required reserve ratio.

It has been assumed that the balance sheet in figure 2.1 consists only of on-balance sheet assets and debts though the use of off-balance sheet assets and debts, representing contingent assets and liabilities which are placed generally below the balance sheet, by financial and non-financial firms in industrial and in emerging market economies has increased steadily during the last two decades owing to the worldwide process of domestic and international financial market liberalization. Off-balance sheet positions can be subdivided in traditional ones, as e.g. guarantees, and in “newer” ones, as e.g. options, swaps, futures or forwards, being also called derivatives, or financial innovations. Contingent assets and claims can have adverse effects on aggregate financial stability as they are not used to hedge against risk, but to take risk deliberately. Furthermore, most financial innovations, so-called “Over The Counter” products, are not subject to common standards of financial market regulation as they are not traded at official future and option exchanges, facilitating excessive and uncontrolled risk taking. As a thorough discussion of the impacts of off-balance sheet positions on aggregate liquidity, solvency, and real economic activity would require a far larger and more detailed discussion than this contribution can manage, the potential impacts of off-balance sheet transactions on aggregate financial stability are described briefly in appendix C by a simple example, whereas the following discussion is going to be restricted to the analysis of on-balance sheet positions.

The liquidity or cash flow status of the representative economic sector is determined by money inflows less money outflows, stemming on the one hand from operating profits, and on the other hand from changes in asset and debt stocks. Operating profits \( OP(t) \) are formally given by

\[
OP(t) = EA(t) - i_{DB}(t)DB(t) - s(t)i_{DB}^*(t)DB^*(t),
\]

where \( EA(t) \) denotes nominal earnings in domestic currency, \( i_{DB}(t) \) the interest rate on domestic debt, and \( i_{DB}^*(t) \) the interest rate on foreign debt. Hence, operating profits are determined by nominal earnings \( EA(t) \) less interest rate costs on domestic debt \( i_{DB}(t)DB(t) \), and less interest rate costs on foreign debt, where nominal earnings \( EA(t) \)
are defined by

\[ EA(t) = P(t) Y(Y^d(t), Y^s(t)), \quad \text{(2.5)} \]

i.e. by the product of the domestic price level \( P(t) \) and the sector’s real aggregate output \( Y(Y^d(t), Y^s(t)) \), being positively dependent on demand conditions \( Y^d(t) \) and supply conditions \( Y^s(t) \) to be determined below.\(^{23}\) Adding changes in asset and debt stocks to operating profits \( OP(t) \) by equation 2.4 results in the cash flow or liquidity status at time \( t \), \( CF(t) \), which is formally given by

\[ CF(t) = OP(t) - P_A(t) \dot{A}(t) - s(t) P_A^*(t) \dot{A}^*(t) - LMA(t) + DB(t) + s(t) DB^*(t), \quad \text{(2.6)} \]

where \( \ddot{x}(t) = dx/dt \) denotes the time derivative of variable \( x(t) \), i.e. the change of variable \( x(t) \) at time \( t \). Thus, the cash flow position is determined by operating profits less changes in assets \( -P_A(t) \dot{A}(t) - s(t) P_A^*(t) \dot{A}^*(t) - LMA(t) \), plus changes in debt \( DB(t) + s(t) DB^*(t) \).\(^{24}\)

It has to be emphasized that cash flow position 2.6, resulting from normal operation and balance sheet transactions, may not be mixed up with actual or expected cash flows being used for asset price determination as outlined in equation 2.3, because cash flow by equation 2.6 refers to the overall liquidity status including financing costs and shifts in balance sheet items, whereas expected cash flows in equation 2.3 do only refer to net money inflows exclusive of interest rate or opportunity costs.

**Nominal profits** of the representative sector at time \( t \), \( PR(t) \), are determined by operating profits \( OP(t) \), and by capital gains or losses resulting from changes in domestic asset prices \( P_A \), foreign asset prices \( P_A^* \), and in the exchange rate \( s(t) \). Formally, nominal profits \( PR(t) \) are given by

\[ PR(t) = OP(t) + P_A(t) A(t) + s(t) P_A^*(t) A^*(t) + s(t) P_A^*(t) A^*(t) - s(t) DB^*(t). \quad \text{(2.7)} \]

The **solvency status or net worth** at time \( t \), \( NW(t) \), is a backward looking variable\(^{25}\), being determined by initial net worth at time \( t = 0 \), \( NW(0) \), i.e. by the difference between the initial asset and debt stock at time \( t = 0 \), and by past accumulated and actual profits/losses. Formally, net worth is given by

\[ NW(t) = NW(0) + \int_{s=0}^{t} PR(s) \, ds. \quad \text{(2.8)} \]

This definition of net worth excludes cash calls and/or write-downs which would cause changes in net worth by extraordinary alterations in assets and/or debts being not associated with “normal operation”.\(^{26}\)

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\(^{23}\)For reasons of simplicity, equation 2.5 assumes that there are no nominal earnings in foreign currency. However, this simplifying assumption is going to be given up later in section 2.2.4.3.

\(^{24}\)Note that, for example, a sale of domestic asset \( A \), i.e. \( \dot{A}(t) < 0 \), at price \( P_A(t) \), leads to a money inflow to the amount of \( -P_A(t) \dot{A}(t) > 0 \), whereas a reduction of foreign debt \( DB^* \), i.e. \( DB^*(t) < 0 \), at the exchange rate \( s(t) \), leads to a money outflow to the amount of \( s(t) DB^*(t) < 0 \).

\(^{25}\)For the distinction between backward and forward looking variables, as well as their influence on solutions of general dynamic rational expectations models, see appendix D.

\(^{26}\)To illustrate the interdependencies between cash flows, profits, and net worth consider the following
2.2.4.2 Determinants of Bankruptcy

This paragraph analyzes possible causes of bankruptcy, where the state of bankruptcy is defined according to real world bankruptcy rules. Thus, an economic unit, or an economic sector, is defined to be bankrupt firstly, if it is illiquid, or secondly, if it is insolvent, or thirdly, if it is both illiquid and insolvent, where illiquidity is defined by a negative cash flow position according to equation 2.6, i.e. by $CF(t) < 0$, and insolvency by a negative net worth position according to equation 2.8, i.e. by $NW(t) < 0$. The following analysis provides only a short enumeration of possible determinants of illiquidity and insolvency, without considering explicitly both the interdependencies between different determinants and between illiquidity and insolvency, as these interdependencies give rise to cumulative processes which are going to be analyzed in the next paragraph.

Insolvency, or negative net worth $NW(t)$, can be caused according to equation 2.8 by past accumulated and/or actual losses which are greater than initial net worth. Negative profits, or losses can be caused according to equations 2.4 and 2.7 ceteris paribus firstly, by a drop in nominal earnings $EA(t)$, which can be caused by a fall in the domestic price level $P(t)$, i.e. by (debt-) deflation, and/or by a drop in real output $Y(Y^d(t), Y^s(t))$ caused by deteriorating demand and supply conditions, secondly, by a rise in the domestic interest rate on debt $i_{DB}(t)$, thirdly, by a rise in the foreign interest rate on debt $i_{DB}^*(t)$, fourthly, by a drop in domestic asset prices $P_A(t)$, fifthly, by a drop in foreign asset prices $P_A^*(t)$, and sixthly, by a rise in the exchange rate $s(t)$ in case the nominal value of foreign assets is smaller than the nominal value of foreign debt, i.e. in case the sector is not hedged against currency risk. It has to be emphasized, that changes in asset and debt stocks are not responsible for a deterioration of the solvency status, since changes in asset and debt stocks are the result from past changes in profits.

Illiquidity, or a negative cash flow $CF(t)$, can be caused according to equations 2.4 and 2.6 ceteris paribus firstly, by a drop in nominal earnings $EA(t)$, which can stem from a drop in the domestic price level $P(t)$ and/or from a drop in output $Y(Y^d(t), Y^s(t))$, secondly, by a rise in the domestic interest rate on debt $i_{DB}(t)$, and thirdly, by a rise in the foreign interest rate on debt $i_{DB}^*(t)$. The same factors can lead to insolvency as they determine the state of operating profits by equation 2.4, being both an ingredient example. The balance sheet positions according to figure 2.1 are assumed to have the following initial numerical values in $t = 0$: $P_A(0) = 1$, $A(0) = 5$, $P_A^*(0) = 0$, $A^*(0) = 0$, $LMA(0) = 3$, $DB(0) = 0$, $s(0) = 0$, $DB^*(0) = 0$ resulting in $NW(0) = 8$. Operating profit in $t = 1$ is $OP(1) = -4$, being assumed to be paid by a reduction in $LMA$. However, as the stock of $LMA$ does not suffice to meet due payment obligations, the sector would become illiquid if there were no money inflows. Consider that the sector increases domestic debt by one unit, i.e. $DB(1) = 1$, to obtain liquid financial means leading to increase in $LMA$ by one unit, which is however spent immediately to meet the sector’s payment obligations, i.e. the change in $LMA$ amounts to $LMA(1) = -3 + 1 - 1 = -3$. Accordingly, the operating loss of 4 units is financed by liquidating the initial stock of $LMA$ by 3 units, and by taking a loan of 1 unit, generating a cash flow according to equation 2.6 in $t = 1$ which amount to $CF(1) = OP(1) - LMA(1) + DB(1) = -4 - (-3) + 1 = 0$. Furthermore, consider that the price of domestic assets in $t = 1$ drops to $P_A(1) = 0.8$, i.e. $P_A(1) = -0.2$, resulting in a total loss according to equation 2.7 of $PR(1) = OP(1) + P_A(1)A(1) = -4 + (-0.2) \cdot 5 = -5$, as $A(1) = A(0) = 5$. Hence, net worth in $t = 1$, owing to equation 2.8, is given by $NW(1) = NW(0) + PR(1) = 8 - 5 = 3$, which can be alternatively obtained from new asset and debt stocks in $t = 1$ which amount to $P_A(1) = 0.8$, $A(1) = 5$, $P_A^*(1) = 0$, $A^*(1) = 0$, $LMA(1) = 0$, $DB(1) = 1$, $s(1) = 0$, $DB^*(1) = 0$, resulting in $NW(1) = 3$ as well.

Insolvency implies a debt-asset ratio value of greater than one, indicating that the sum of debts is larger than the sum of assets.

27 Insolvency implies a debt-asset ratio value of greater than one, indicating that the sum of debts is larger than the sum of assets.
of the liquidity status 2.6 and of nominal profits 2.7. Accordingly, liquidity and solvency are interdependent, i.e. illiquidity can cause insolvency and vice versa. Further causes for illiquidity according to equation 2.6 are changes in assets and debts leading to money outflows which overcompensate money inflows. Among various possibilities, there is one case which is of special empirical relevance, arising if demanded repayment of debt (money outflow) is larger than operating profits or losses plus returns from selling assets, i.e. if it holds that

\[-DB(t) - s(t)DB^*(t) > EA(t) - i_DB(t)DB(t) - s(t)\dot{i}_{DB}(t)DB^*(t) \]
\[-PA(t)A(t) - s(t)P_{A}(t)A^*(t) - LMA(t),\]

(2.9)

where \(DB(t), DB^*(t) < 0\).

The banking sector, or single banks, are faced with condition 2.9 in case of a bank run, i.e. in case most domestic and/or foreign depositors withdraw their short-term funds \(DB(t)\) and \(s(t)DB^*(t)\). Banks however, never can meet an almost complete and sudden withdrawal of deposits as liquid monetary assets \(LMA(t)\) (central bank reserves) are only a fraction of deposits, and operating profits \(OP(t)\) are likely to be not able to cover all money outflows. Likewise, a liquidation of assets which would be necessary to prevent illiquidity is not possible firstly, as a considerable part of assets are long-term debt contracts, as e.g. mortgage loans or long-term business loans, which cannot be liquidated, and secondly, as a sudden and widespread withdrawal of short-term debt contracts, as e.g. roll-over business loans which could be theoretically liquidated instantly, is likely to cause illiquidity by firms according to condition 2.9, which increases the share of non-performing loans with banks and reduces banks’ profits and net worth. As the banking sector cannot meet all payment commitments in case of a bank run, the only remaining possibility to prevent illiquidity is a massive lender of last resort intervention by the central bank, i.e. a large and extraordinary increase in liquid monetary assets \(LMA(t)\) (central bank reserves) which are used to pay depositors. However, in case a large part of deposits are denominated in foreign currency, a central bank intervention cannot prevent illiquidity in case of a bank run; in that case, only a short-run liquidity support by international financial markets could avert bankruptcy by domestic banks, which is however an unrealistic scenario, as a bank run by foreigners indicates that domestic banks are faced with a credit crunch in international financial markets.

Illiquidity in the business firm sector according to condition 2.9 is, like a bank run, caused by a sudden and widespread withdrawal of short-term debt which can be induced, as aforementioned, by a bank run when banks try to meet payment commitments by calling roll-over loans. As business firms’ operating profits in most cases do not suffice to meet a widespread liquidation of short-term debt, there arise two options to prevent illiquidity. Firstly, business firms can try to sell a widespread part of their assets, being labelled as a “fire-sale” of assets. However, in case an entire economic sector sells its assets, asset prices \(P_A(t)\) and \(P_{A}(t)\) are going to drop, reducing money inflows and causing additionally insolvency problems. Secondly, business firms can try to borrow new funds to repay existing debt. However, in case there is a widespread withdrawal of short-term business loans by banks, business firms are unlikely to receive new funds due to an overall credit crunch in domestic financial markets. As opposed to lender of last
resort interventions which are able to prevent widespread illiquidity by banks, widespread illiquidity of business firms in most cases cannot be prevented by a "concerted action" of the banking sector due to coordination failures.

2.2.4.3 Cumulative Expansions and Contractions

Hitherto, the analysis concentrated on definitions as well as on interdependencies of liquidity, profits and solvency. However, to study the propagation mechanisms of systemic financial crises, the analysis has to be enlarged firstly, by the interdependencies of financial constraints, asset prices and real economic activity according to sections 2.2.1 to 2.2.3, and secondly, by the interdependencies of economic units' financial status and macroeconomic activity. Both kinds of interdependencies give rise to cumulative upward and downward processes, where macroeconomic contractions are associated with systemic financial crises. The following analysis distinguishes three main effects causing cumulative processes, where the first effect considers the emergence of demand-side cumulative processes, the second effect the emergence of financial-accelerator induced cumulative process, and the third effect the emergence of supply-side induced cumulative processes. As the following discussion refers to changes in aggregate economic activity, and not to changes in income of a certain sector, the definitions of liquidity, solvency, and profits according to section 2.2.4.1, refer in the following to the aggregate liquidity and solvency status, as well as to aggregate profits.

The Emergence of Demand-Side Cumulative Processes. Including the effects of varying real economic activity, or varying nominal earnings \( P(t) \cdot Y(Yd(t), Y^s(t)) \) according to equation 2.5, requires that both the demand and the supply conditions \( Yd(t) \) and \( Y^s(t) \) are endogenized. Demand conditions \( Yd(t) \) are assumed to be positively dependent on the market value of domestic and foreign assets according to the results of section 2.2.3, i.e. formally it holds that

\[
Y^d(t) = Y^d(P_A(t)A(t), s(t)P_A^*(t)A^*(t)).
\] (2.10)

By way of contrast, supply conditions \( Y^s(t) \), i.e. potential output, are assumed to be positively dependent on the real stocks of domestic and foreign assets like output resulting from a production function. Formally it holds that

\[
Y^s(t) = Y^s(A(t), A^*(t)).
\] (2.11)

The influence of asset prices is included by assuming that domestic asset prices \( P_A(t) \) are determined according to equation 2.3 by discounting nominal earnings \( EA(t) \), where the discount factor is a weighted average of domestic and foreign interest rate costs as the stock of domestic assets \( A(t) \) is financed both by domestic and by foreign debt. Formally, domestic asset prices are given by

\[
P_A(t) = \frac{P(t) Y(Y^d(t), Y^s(t))}{\gamma i_{DB}(t) + (1 - \gamma)(i_{DB}^*(t) + \ddot{s}(t))}, \quad 0 < \gamma < 1,
\] (2.12)

where \( \ddot{s}(t) = \dot{s}(t)/s(t) \) denotes the exchange rate's growth rate, \( i_{DB}(t) + \ddot{s}(t) \) foreign interest rate costs in domestic currency terms, and \( \gamma \) the weighting factor whose value
depends on the percentage share of domestic debt finance of asset $A(t)$. For reasons of simplicity, foreign asset prices $P_A^*(t)$ are assumed to be negatively dependent on the foreign interest rate on debt $i_{DB}^*(t)$, i.e. formally it holds that

$$P_A^*(t) = P_A^*(i_{DB}^*(t)).$$

(2.13)

One important implication of endogenizing both asset prices and nominal earnings by equations 2.10 to 2.13, is the emergence of demand-side cumulative upward and downward processes by a self-sustaining interaction between domestic asset prices and real economic activity (nominal earnings). A drop/rise in nominal earnings according to equation 2.5 leads to a decline/rise in domestic asset prices according to equation 2.12, whereas the decline/rise in domestic asset prices causes a further drop/rise in nominal earnings by deteriorating/improving demand conditions according to equation 2.10, inducing a further decline/rise in domestic asset prices, and so on. Accordingly, once there is a decline/rise in asset prices or in real economic activity, an endogenous process is going to cause a further decline/rise in asset prices and real economic activity. Furthermore, an endogenous decline/rise in asset prices and real economic activity causes a self-sustaining decline/rise in cash flows, profits, and net worth according to equations 2.6, 2.7, and 2.8.

It must be emphasized however, that these demand-side cumulative upward and downward processes cannot start by themselves, but have to be “triggered” by an exogenous event. The main triggers according to equation 2.12, are changes in domestic and foreign interest rates $i_{DB}(t)$ and $i_{DB}^*(t)$, and changes in the exchange rate $s(t)$. For example, a rise in the domestic interest rate on debt causes a fall in asset prices and in aggregate earnings via deteriorating demand conditions, leading to reductions in cash flow, profits, net worth, whereas the drop in nominal earnings causes a further decline in asset prices, cash flow, profits, net worth, leading to a further decline in demand conditions, nominal earnings, asset prices, cash flow, profits, net worth, and so on. By way of contrast a drop in the domestic interest rate on debt causes a cumulative improvement in cash flow, profits, net worth, and asset prices, and engenders an overall macroeconomic expansion.

Though not explicitly considered by the model equations above, terms-of-trade shocks and technology shocks can also give rise to demand-side cumulative processes as both shocks lead to a change in nominal earnings. A rise/drop in the real exchange rate, caused either by exchange rate or inflation alterations, leads to a rise/fall in net exports and thereby in nominal earnings, causing an upward/downward cumulative process being associated with increasing/decreasing asset prices, nominal earnings, liquidity, profits, and net worth. Though technology shocks develop from the supply-side, they can give rise to demand-side cumulative processes as a positive/negative technology shock leads to improving/deteriorating supply conditions according to equation 2.11 by an increase/decrease in potential output at given stocks of real domestic and foreign assets, leading to a rise/fall in nominal earnings, asset prices, liquidity, profits, and net worth.28

28 Technology shocks could be taken into consideration formally by the introduction of a technological efficiency parameter $J(t)$ in the supply conditions equation 2.11, reading in its modified form as

$$Y^*(t) = Y^*(A(t), A^*(t), J(t)),$$

and stating that potential output is positively dependent on the efficiency of production technology $J(t)$. A positive/negative technology shock leads to an increase/decrease in production efficiency, i.e. to

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The Emergence of Financial-Accelerator Induced Cumulative Processes. Hitherto, cumulative upward and downward processes have been explained solely by the demand-side interaction of asset prices and real economic activity, where the influence of financial constraints, i.e. the influence of liquidity constraint $CF(t) \geq 0$, derived from equation 2.6, and the solvency constraint $NW(t) \geq 0$, derived from equation 2.8, have been neglected so far. However, the liquidity and the solvency constraint have an “accelerating” effect on the cumulative upward and downward process via alterations in financing conditions according to the “financial accelerator principle” which has been outlined in section 2.2.2.2. Including financial-accelerator induced cumulative processes in the model requires that financing conditions, i.e. the domestic and the foreign interest rate on debt $i_{DB}(t)$ and $i^*_{DB}$, as well as the available amount of debt finance $DB(t)$ and $DB^*(t)$, have to be endogenized. Following imperfect capital market theory, both the domestic and the foreign interest rate on debt $i_{DB}(t)$ and $i^*_{DB}$ are assumed to be negatively dependent both on the cash flow $CF(t)$ and the net worth position $NW(t)$, i.e. formally it holds that

$$i_{DB}(t) = i_{DB}(CF(t), NW(t))$$
$$i^*_{DB}(t) = i^*_{DB}(CF(t), NW(t)),$$

(stating that an increase/decrease in cash flow and/or net worth reduces/increases default risk leading to relaxing/tightening financing conditions by declining/rising interest rates. Regarding the availability of debt finance, it is assumed that the stocks of available domestic and foreign debt, $DB(t)$ and $DB^*(t)$, are positively dependent on the cash flow and the net worth position, i.e. formally it holds that

$$DB(t) = DB(CF(t), NW(t)) + DB^*(CF(t), NW(t)),$$

$$DB^*(t) = DB^*(CF(t), NW(t)),$$

(stating that declining/rising default risk by increasing/decreasing cash flow and/or net worth leads to relaxing/tightening financing conditions by increasing/decreasing the amount of available debt.\textsuperscript{29}

The impact of the financial accelerator effect on the exchange rate $s(t)$ in case of flexible exchange rate systems, and on foreign exchange reserves $Z(t)$ in case of fixed exchange rate systems, depends on whether changes in the foreign debt stock $DB^*(t)$ cause transactions in the foreign exchange market or not. Generally, the existence of transactions in the foreign exchange market is determined by the cash flow position in foreign currency $CF^*(t)$, being formally defined, following the balance sheet structure in figure 2.1, and equations 2.4 and 2.6, as

$$CF^*(t) = EA^*(t) - i^*(t)DB^*(t) - P^*_A(t)\dot{A}^*(t) + DB^*(t),$$

that is, by nominal earnings in foreign currency $EA^*(t)$, which have been neglected so far for reasons of simplicity, less foreign interest costs, less changes in foreign assets rise/fall in $J(t)$, and thereby to an increase/decrease in potential output $Y^*(t)$.

\textsuperscript{29}It has to emphasized that the solvency status in equations 2.14 to 2.17, i.e. the net worth position $NW(t)$, could have been alternatively represented by the inverse of the debt-asset ratio.
$P_A(t)\hat{A}(t)$, plus changes in the foreign debt stock $DB^*(t)$. If the foreign cash flow position is zero, i.e. if it holds that $CF^*(t) = 0$, there arise no transactions in the foreign exchange market, as money outflows in foreign currency can be “paid” completely by money inflows in foreign currency, implying that there is no need to exchange cash flows in domestic currency into foreign currency. By way of contrast, in case the foreign cash flow position is positive or negative, i.e. if it holds that $CF^*(t) \neq 0$, there arise transactions in the foreign exchange market as excess/lacking cash flow in foreign currency is sold/bought at the foreign exchange market, leading to an increase/decrease in the cash flow position in domestic currency $CF^D(t)$, being formally defined, following also the balance sheet structure in figure 2.1, by

$$CF^D(t) = EA(t) - i(t)DB(t) - P_A(t)\hat{A}(t) - LMA(t) + DB(t), \quad (2.19)$$

that is, by nominal earnings in domestic currency $EA(t)$, less interest payments on domestic debt $i(t)DB(t)$, less changes in domestic assets $P_A(t)\hat{A}(t)$ and in liquid monetary assets $LMA(t)$, plus changes in domestic debt $DB(t)$. 30

Consequently, if there are variations in the foreign debt stock, i.e. if it holds that $DB^*(t) \neq 0$, there arise no changes in the exchange rate $s(t)$, and in foreign exchange reserves $Z(t)$, if the foreign cash flow position remains zero, implying that changes in foreign debt are compensated by other components in the foreign cash flow position 2.18. For example, if an increase in foreign debt is used to finance an increase in foreign assets to the same amount, i.e. if it holds that $DB^*(t) = -P_A(t)\hat{A}(t)$ where $\hat{A}(t) > 0$, there arise no transactions in the foreign exchange market, leaving the exchange rate and foreign exchange reserves unchanged. By way of contrast, there arise changes in the exchange rate and in foreign exchange reserves, in case variations in the debt stock are not completely compensated by other components of the foreign cash flow position 2.18, leading to changes in the domestic cash flow position 2.19.

Empirical evidence on episodes of financial crises shows firstly, that countries with large amounts of foreign debt, i.e. emerging market countries (as e.g. Thailand, Mexico, Argentina) but also industrial countries (as e.g. Norway, Sweden, Finland), are subject to large variations in the foreign debt stock, and secondly, that these variations cause either large swings in exchange rates or in foreign exchange reserves, implying that the foreign cash flow position is generally different from zero. The most important reason for a nonzero foreign cash flow position in case of variations in the foreign debt stock is the empirical fact that foreign debt is generally used for investment in domestic assets, generating income streams predominantly in domestic currency. Summing up, it is reasonable to assume that changes in the foreign debt stock $DB^*(t)$ generally lead to transactions in the foreign exchange market which lead to variations in the exchange rate $s(t)$ and in foreign exchange reserves $Z(t)$.

Consequently, in case of flexible exchange rate systems, a reduction/increase in foreign debt $DB^*(t)$ by foreign lenders leads to an increasing demand for/supply of foreign currency by domestic agents, causing a rise/fall of the exchange rate $s(t)$, as paying back/receiving foreign debt requires that domestic/foreign currency has to be exchanged

30 The sum of the domestic cash flow position 2.19 and the foreign cash flow position 2.18 expressed in domestic currency, i.e. multiplied by the exchange rate $s(t)$, equals the overall cash flow position defined in equation 2.6 plus nominal earnings in foreign currency in domestic currency $s(t)EA^*(t)$ which have been neglected for reasons of simplicity in the previous analysis.
into foreign/domestic currency. Thus, it holds formally that

$$s(t) = s(DB^*(t)),$$

stating that a decrease/increase in foreign debt causes an increased demand/supply for foreign currency leading to a rise/fall of the exchange rate. Accordingly, capital outflows/inflows generally lead to a depreciation/appreciation of the home currency.

In case of fixed exchange rate systems, it seems reasonable to assume that a reduction/increase in foreign debt $DB^*(t)$ by foreign lenders leads to an increasing demand for/supply of foreign currency by domestic agents, causing a reduction/increase in foreign exchange reserves $Z(t)$. Ergo, the stock of foreign exchange reserves $Z(t)$ is formally given by

$$Z(t) = Z(DB^*(t)),$$

stating that a decrease/increase in foreign debt causes an increased demand/supply for foreign currency leading to a reduction/increase in the stock of foreign reserves. Consequently, capital outflows/inflows generally lead to a decline/rise of foreign exchange reserves. Foreign exchange reserves $Z(t)$ generally have an inverse effect on domestic interest rates $i(t)$ as a rising/declining stock of foreign exchange reserves increases/decreases the amount of high powered money, leading to a decrease/increase in domestic interest rates, i.e. formally it holds that

$$i(t) = i(Z(t)).$$

The inclusion of the influence of financial constraints on asset prices, real economic activity, liquidity, profits, and solvency generates cumulative upward and downward processes which are much larger in amplitude than demand-side cumulative processes, as they are reinforced by the financial accelerator effect via improving or deteriorating cash flow and net worth positions. A drop/rise in nominal earnings giving rise to a demand-side cumulative downward/upward process, being associated with declining/rising asset prices, cash flows, profits, net worth and deteriorating/improving demand conditions, is amplified firstly, by an increase/decrease in the domestic and in the foreign interest rates on debt $i_{DB}(t)$ and $i_{DB}^*(t)$ by equations 2.14 and 2.15, secondly, by a reduction/increase of available domestic and foreign debt finance $DB(t)$ and $DB^*(t)$ by equations 2.16 and 2.17, thirdly, in case of flexible exchange rate systems by a rise/fall in the exchange rate by equation 2.20, and fourthly, in case of fixed exchange rate systems, by a decrease/increase in the stock of foreign exchange reserves by equation 2.21 inducing an additional rise/fall in domestic interest rates by equation 2.22, leading to a further drop/rose in asset prices, to a further deterioration/improvement in demand conditions, to a further macroeconomic contraction/expansion, to further deteriorations/improvements in cash flow, profits and net worth, to further interest rate increases/decreases, to further revaluations/devaluations of the exchange rate, and to a further decrease/increase in the stock of foreign exchange reserves.

It is important to note that the inclusion of financial constraint effects does not longer require that cumulative processes are triggered by exogenous events, because interest rates and exchange rates (and foreign exchange reserves) are endogenous variables as well. Accordingly, there arises the possibility that cumulative processes are purely endogenous.
in nature, implying that macroeconomic expansions as well as contractions, which are possibly associated with systemic financial crises, are an inherent characteristic of modern economies, being discussed in detail in part II of the book.

The Emergence of Supply-Side Induced Cumulative Processes. A further effect, which has been neglected so far, but giving rise to further accelerations of demand-side and financial-accelerator induced cumulative processes, is the impact of supply-side induced cumulative processes through changes in supply conditions \( Y'(t) \), being induced by alterations in domestic and real asset stocks, \( A(t) \) and \( A^*(t) \), according to equation 2.11. It is reasonable to assume that the stocks of domestic and foreign assets \( A(t) \) and \( A^*(t) \), and thereby supply conditions \( Y'(t) \), are positively dependent on financing conditions, and on the availability of debt finance, since the acquisition of assets generally requires external funds. Hence, formally it holds that

\[
A(t) = A(i_{DB}(t), i^*_DB(t), DB(t), DB^*(t)) \\
A^*(t) = A^*(i_{DB}(t), i^*_DB(t), DB(t), DB^*(t)),
\]

stating that investment in domestic and foreign assets is negatively dependent on domestic and foreign interest rates, and positively dependent on the availability of domestic and foreign debt. Equations 2.23 and 2.24 imply that an overall macroeconomic contraction/expansion, being associated with falling/rising asset prices, nominal earnings, cash flow, profits, net worth, domestic and foreign debt stocks, and increasing/decreasing domestic interest rates, foreign interest rates, and exchange rates, is further dampened/accelerated by a decrease/increase in potential output, leading to a further reduction/increase in nominal earnings according to equation 2.5, and thereby to a further acceleration of the cumulative downward/upward process.

Changing supply conditions, i.e. changing asset stocks, have an additional accelerating effect on cumulative upward and downward processes by influencing asset prices. This effect is not captured by equations 2.12 and 2.13 as they do not determine asset prices by supply and demand conditions. However, during macroeconomic contractions/expansions, decreasing/increasing asset stocks lead to an additional decrease/increase in domestic and foreign asset prices by an increasing supply/demand of domestic and foreign assets. One important effect arises especially in times of financial distress, being labelled as distress selling or fire-sale of assets, when a large number of economic units is forced to sell large amounts of their asset stocks at the same time to meet payment obligations, as it has been for example described by condition 2.9, resulting in a collapse of asset prices causing further solvency and liquidity problems.

An Assessment. Summing up, there exist various transmission mechanisms causing endogenous upward and downward processes in overall macroeconomic activity, where expansions are associated with “financial health”, and contractions with “financial distress”. Furthermore, it has been emphasized that contractions, as well as expansions can be purely endogenous phenomena which are not caused by exogenous shocks. However, notwithstanding the fact, that the analysis can provide a deep understanding of cumulative processes, it does not provide an explanation why a process is expansionary
or contractionary, i.e. there is no explanation why an expansionary process, being associated with strong liquidity and solvency positions, can suddenly turn into a systemic financial crisis which leads to a deep depression. Furthermore, the analysis also assumes that all liquidity and solvency disturbances are transmitted into the real sector, which would imply that any little disturbance in the liquidity and solvency status would lead either to a dynamically unstable never-ending expansion, or to a dynamically unstable never-ending contraction being associated with systemic financial crises; that is, regarding the analysis of financial crises, the framework does not distinguish between systemic and spurious financial crises. These drawbacks are going to be considered in the following section which studies the determinants of financial stability and allows for a distinction between spurious and systemic financial crises, or why some disturbances lead to the above mentioned cumulative processes and others not. Both the analysis of cumulative processes and financial stability are the necessary ingredients for the theoretical models in part II of the book.

2.3 Determinants of Financial Instability

After having discussed the interdependencies of asset prices, bankruptcy, and real economic activity, giving rise to systemic financial crises in case of adverse financial market disturbances, this section analyzes factors determining whether a given set of financial market disturbances causes either a spurious, or a systemic financial crisis, depending on the overall state of financial instability. Section 2.3.1 starts with a general definition of financial instability, being followed by the analysis of four important determinants of financial instability, where section 2.3.2 discusses the distribution of robust and fragile cash flow positions within an economy, section 2.3.3 the adequacy of refinancing positions, section 2.3.4 the volatility of asset prices and their use in the financial system, and section 2.3.5 the influence of monetary instability.

2.3.1 A General Definition of Financial Instability

Following the general definition of financial crises in section 2.1, spurious and systemic financial crises are subject to the same adverse shocks and drops in asset prices, but differ significantly with respect to their impact on real economic activity. In case of systemic financial crises, asset price drops cause, according to the results of section 2.2.4, widespread illiquidity and insolvency among agents, liquidity crunches, dysfunctions of the payment system, and collapses in aggregate economic activity. By way of contrast, spurious financial crises are characterized by the absence of widespread disruptions in financial market activity, as well as by the absence of collapses in real economic activity. Ergo, whether a given set of adverse disturbances in financial markets causes a disruption of financial markets' capacity to allocate funds efficiently and induces a strong contractive transmission into the real sector or not, is dependent firstly, on factors determining the robustness of aggregate cash flow and solvency positions to remain positive, secondly, on factors determining the robustness of real economic activity and financial market activity not to develop into a cumulative downward spiral. To put it differently, whether a given set of financial market disturbances causes a spurious or a systemic financial crisis depends
on factors determining the degree of aggregate financial instability\textsuperscript{31}, being defined as follows:

\textit{The degree of aggregate \textbf{financial instability} of an economy is the level of probability that a given set of asset price disturbances, being triggered by actual and/or expected real and/or financial shocks, causes widespread illiquidity and insolvency among economic units, as well as a collapse of real economic activity. If, for a given set of disturbances, the probability of widespread failures and real economic downturns is high, then the economy is designated as being financially unstable. If, for the same given set of disturbances, the probability of widespread failures and drops in real economic activity is low, then the economy is called financially stable.}

This general definition implies that in case of financially unstable economies, even very small shocks and financial market disturbances suffice to cause a systemic financial crisis, whereas in case of financially stable economies, only huge shocks associated with very large drops in asset prices give rise to systemic financial crises.

\section*{2.3.2 Cash Flow Positions and Present Values}

The first determinant of financial instability is the aggregate proneness to illiquidity and insolvency in case of adverse real and/or financial shocks. Determining the aggregate level of proneness to bankruptcy requires that the economy is disaggregated into single economic units, or into groups or sectors with similar determinants of the liquidity and solvency status in order to obtain a distribution of crisis-prone and financially robust economic entities which allows for the determination of the aggregate level of financial instability.

Assessing the overall financial stability of an economy according to the distribution of robust and fragile cash flow positions goes back on H. P. Minsky's analysis of financial fragility which is going to be set out in sections 2.3.2.1 and 2.3.2.2.\textsuperscript{32} As Minsky's original concept is restricted to the analysis of financial fragility in closed economies, sections 2.3.2.3 and 2.3.2.4 enlarge Minsky's theory of financial stability to open economies.

\subsection*{2.3.2.1 Hedge, Speculative and Ponzi-Finance}

In order to get a measure of potential aggregate illiquidity and insolvency in case of adverse shocks, the first step is to classify economic units on a microeconomic level according to their risk to become illiquid and insolvent, where Minsky defines three different states of risk, namely \textit{hedge}, \textit{speculative} and "Ponzi" finance. To distinguish between these different types of economic units, some definitions and theoretical concepts have to be introduced firstly.

\textsuperscript{31}In the economic literature, financial instability is often labelled synonymously as financial fragility, financial vulnerability, or systemic risk.

\textsuperscript{32}Sections 2.3.2.1 and 2.3.2.2 are based on Minsky (1972, 1975, 1977, 1978, 1980a, 1980b, 1982a, 1982b, 1986).
Basic Concepts. Consider a single business unit existing for some periods $t = 1, \ldots, n$, which faces a series of contractual cash payment commitments on debts $PC_t$, and a series of expected quasi rents, or expected gross nominal profits $GPR_t^e$, where both expected gross profits and payment commitments are separated into an income (interest) and into a return of principal components, like in a fully amortized contract. Accordingly, today’s payment commitments $PC_t$, resulting from the current liability structure are defined as

$$PC_t = PC_t(y) + PC_t(a),$$

(2.25)

that is, by interest (income) payments on current debt $PC_t(y)$, plus repayment of the principal $PC_t(a)$. Expected gross nominal profits $GPR_t^e$ are defined as

$$GPR_t^e = GPR_t^e(y) + GPR_t^e(a),$$

(2.26)

that is, as the expected net income part of cash flow $GPR_t^e(y)$ representing the “yield” of investment over replacement or acquisition costs, plus wastage or consumption of capital $GPR_t^e(a)$.

For a business unit to be viable, it is necessary that it holds that

$$\sum_{t=1}^{n} GPR_t^e > 0$$

(2.27)

$$\sum_{t=1}^{n} GPR_t^e > \sum_{t=1}^{n} PC_t,$$

(2.28)

that is, that the sum of expected gross profits has to be greater than zero, and that the sum of expected gross profits has to be greater than the sum of payment commitments over the entire economic lifetime.\(^{33}\)

The value, or capitalized net worth of a business unit, $E$, is defined by the discounted present value of expected gross profits less payment commitments, formally as

$$E = \sum_{t=1}^{n} k_t(GPR_t^e - PC_t),$$

(2.29)

where $k_t$ represents the discount factor, reflecting financial market conditions which depend on market interest rates, and on general general risk conditions.\(^{34}\) A tighten-
ing/relaxation in financial market conditions is reflected by a fall/rise in \( k_t \), indicating an increase/fall in market interest rates and in risk premia.

**Hedge Finance.** A hedge finance unit is characterized by the condition

\[
GPR_t^* > PC_t
\]  

(2.30)

for all periods \( t = 1, \ldots, n \), stating that in every period \( t \), expected gross profits exceed payment commitments. According to equation 2.29, the present value, or the net worth of a hedge-finance unit \( E \) is independent of financial market conditions, i.e. a change in interest rates or in overall risk conditions, being reflected in a change of \( k_t \), does not lead to changes in \( E \). Thus, a tightening in financial markets cannot lead to bankruptcy, i.e. to a negative present value \( E \), or to illiquidity by a sudden increase in \( PC_t \). Hedge financing is only possibly in case the balance sheet’s debt side contains only equities or long-term debt with maturity date \( t = n \), and with fixed interest rates. However, negative net worth or illiquidity can arise in case actual cash flows fall short of anticipated cash flows and of the amount of payment commitments, which can be caused e.g. by unexpected increases in labour and material costs, or by unexpected drops in aggregate demand. To avoid such adverse events, hedge-finance units generally are going to hold money and marketable (short-term) financial assets which are not needed for normal operation and which serve only as an insurance against illiquidity and insolvency. Summing up, a hedge-finance unit is not dependent on the “normal” functioning of financial market, but on the “normal” functioning of product and factor markets.

Given that expectations are fulfilled and realized gross profits \( GPR_t \) exceed payment commitments in each period, i.e. if it holds that \( GPR_t^* = GPR_t > PC_t \) for all \( t \), a hedge finance unit receives net money inflows in each period. Furthermore, if the income portion of realized gross profits exceeds the income portion of payment commitments (interest rate costs), i.e. if \( GPR_t(y) > PC_t(y) \), then net worth is going to increase in each period. The increase in net worth and in money holdings can be used to finance the acquisition of capital assets without changing the debt-asset ratio, or, in case capital assets are additionally financed by an increase in external debt, financing conditions are not going to deteriorate. Likewise, if net worth consists of equity shares, the fulfillment of expectations of hedge-finance units leads to an increase in share prices and to an increase in the wealth of stock holders.

**Speculative Finance.** For a speculative finance unit, it holds that

\[
GPR_t^* < PC_t \\
GPR_t^* > PC_t
\]  

(2.31)

\[(2.32)\]

stating that near-term payment commitments (periods 1 to \( m \)) exceed near term expected gross profits, but that in the longer run (periods \( m + 1 \) to \( n \)), expected gross profits exceed payment commitments. Furthermore, for a speculative finance unit, it holds that

\[
\sum_{i=1}^{m} GPR_i^*(y) > \sum_{i=1}^{m} PC_i(y),
\]

(2.33)
that is, though total payment commitments exceed total expected gross profits over the first $m$ periods, the net income part of cash flow $GPR_t^e(y)$ exceeds interest rate costs $PC_t(y)$ in periods 1 to $m$. Hence, a speculative finance unit has a share of its principal on debt which falls due in the near term, but whose repayment exceeds the near term debt-repayment funds the unit’s assets generate. To meet near-term payment obligations the speculative unit can either run down its money or liquid assets, or, if liquid assets do not suffice, the unit needs to place new debt or to roll over debt, i.e. speculative financing involves a short-term financing of long-term positions. Thus, a prerequisite for speculative finance is that borrowers as well as lenders believe that there exists a market in which cash, being used to bridge liquidity gaps in early periods, can be obtained frictionlessly at required dates. Moreover, liquidity to fulfill payment commitments in early periods is assumed to be available at “normal” financing terms which do not detrimentally affect the probability that future obligations can be fulfilled.

A speculative finance unit’s expected net worth or solvency position $E$ depends crucially on the level of market interest rates and risk premia, determining the level of the discount rate $k_t$. For a set of “low” interest rates and risk premia, implying a “high” value of $k_t$, the expected discounted present value $E$ is positive. By way of contrast, a tightening in financial market conditions, being associated with “high” market interest rates and risk premia, connoting a “low” value of $k_t$, can possibly cause a present value reversal, i.e. $E < 0$, implying insolvency of the business unit. Furthermore, in case the speculative finance unit operates under floating debt interest rates, a present value reversal is accelerated by an increase in payment commitments $PC_t$ in case of financial market tightening. Accordingly, speculative finance is built on the assumption that interest rates will not move outside some acceptable range. Furthermore, a speculative finance unit can become insolvent, as a hedge finance unit, in case actual gross profits fall short of expected gross profits and of the amount of payment commitments. Summing up, a speculative finance unit is dependent on the “normal” functioning of product and factor markets like a hedge finance unit, but is additionally dependent on the “normal” functioning of financial markets. Thus, a speculative finance unit is exposed to higher risk of illiquidity and insolvency than a hedge finance unit.

Despite the fact that a speculative finance unit has to increase its stock of short-term debt and to decrease its liquid assets in early periods to bridge liquidity gaps, a speculative unit is able to decrease its short-term debt and to increase liquidity in the long-run, and thereby to increase its equity relative to its liabilities in case profit expectations are fulfilled, i.e. if $GPR_t^e = GPR_t$, as the income portion of gross profits exceeds the income portion of payment commitments (interest payments) in every period, i.e. because it holds that $GPR_t(y) > PC_t(y)$ for all $t$. Consequently, it is possible to increase net worth for speculative units even if debt is refinanced. However, in case the business unit is financed at least partly by equities, this statement is only valid if payment commitments include conventional payments of dividends, because in this case, the business unit has positive retained earnings. If, on the contrary, dividends are not included in payment commitments, it is possible that the income portion of payment commitments exceeds the income portion of gross profits, i.e. it is possible that $GPR_t(y) < PC_t(y)$, implying

\[35\] A third possibility is the fire-sale of assets if liquid assets do not suffice, and placing new debt or rolling over debt is not possible. However, this credit or liquidity crunch scenario emerges only if a financial crisis is already in place and is therefore neglected in the further analysis.
that dividends are paid out of current cash flow which reduces the future earning capacity of a business unit and increases the speculative nature of the unit. This kind of dividend policy can mirror unjustifiable optimistic expectations, as well as measures to preserve or to increase the market value of equities.

Banks, other financial institutions, treasuries with floating debt, and business firms rolling-over bank debt or commercial paper, are typical speculative finance units firstly, as they borrow short-term and invest in long-term projects, and secondly, as they deal very often with floating debt, making them vulnerable to interest rate changes since a business unit that borrows at floating interest rates is engaged in a form of speculative finance even though at current interest rates the unit is classified as a hedge finance unit.

"Ponzi" Finance. For a Ponzi finance unit, it holds that

\[ GPR_t^C < PC_t \quad (t = 1, \ldots, n - 1) \]  
(2.34)

\[ GPR_t^C \gg PC_t \quad (t = n) \]  
(2.35)

and

\[ GPR_t^C(y) < PC_t(y) \quad (t = 1, \ldots, n - 1) \]  
(2.36)

\[ GPR_t^C(y) \gg PC_t(y) \quad (t = n), \]  
(2.37)

stating that in all periods, except in the final period \( t = n \), expected gross profits are lower than payment commitments, and interest rate costs exceed the net income part of cash flows. Consequently, in order to meet payment commitments in periods \( t = 1 \) to \( t = n - 1 \), a Ponzi finance unit has to increase its debt stock and to decrease liquidity steadily. Hence, a Ponzi financing scheme is, as a speculative financing scheme, built on the assumption of a “normal” functioning of financial markets, i.e. that debt to meet payment commitments can be placed frictionlessly at required dates and at “normal” financing conditions.

The expected present value \( E \) of Ponzi units is much more sensitive to interest rate and risk premia changes, as well as to disruptions in product and labour markets, than the present value of speculative finance units, implying that present value reversals can happen very fast if there are only slight interest rate and/or risk premia increases, or only small deteriorations in product and factor markets. Moreover, Ponzi units are vulnerable to changes in market sentiment regarding expected gross profits in the final period \( t = n \), since the viability of a Ponzi unit depends on positive expectations regarding to an event far in the future. Only slight reassessments towards a more pessimistic outcome can lead to refusals to obtain liquidity by placing new debt, leading very quickly to bankruptcy and to a stop of the investment project. In contrast to speculative finance units, Ponzi finance units cannot increase their net worth and liquidity in the long run even if gross profit expectations are validated, i.e. even if it holds that \( GPR_t^C = GPR_t \), as interest rate costs always exceed the net income part of cash flow except in the final period, implying that a Ponzi finance unit is subject to a steady decrease of net worth. Consequently, a Ponzi finance unit is exposed to much greater risk of illiquidity and insolvency than hedge and speculative finance units. In case of default, debt restructuring including refinancing and recapitalization is often used as an instrument to transform Ponzi units into speculative units and speculative units into hedge units.
Though Ponzi-investment projects can be tinged with fraud, there are lots of legal Ponzi finance schemes, generally emerging in case of investment projects with long construction periods, as e.g. investments in real estate or in high technology production. During the construction period, investors generally receive almost no cash income and have to finance current labour, material and interest rate costs by placing new debt. Furthermore, there is uncertainty about the development of costs, as well as about whether the completed investment project can be sold at a reasonable price or whether the project validates gross profit expectations. Thus, the investment project is only profitable if costs do not rise over expected levels, and if the sum of expected gross profits is higher than the sum of payment commitments. Likewise, Ponzi schemes also emerge in case of risky investments in real or financial assets when the costs of holding assets are higher than their general net income (dividends or returns), implying that overall returns are only positive in case asset prices appreciate substantially in the future to expected levels.36

Adverse Shocks and Financial Posture “Downgrading”. It has to be emphasized that the classification of hedge, speculative and Ponzi finance units does not only depend on the cash flow position of business units, but also on the size, and on the type of adverse shocks. Thus, adverse shocks are able to transform e.g. a hedge finance unit into a Ponzi finance unit, implying a “downgrading” of liquidity and solvency positions.

Hedge finance units can be only downgraded to speculative and to Ponzi finance units in case of large adverse shocks in product or factor markets, but not by adverse shocks in financial markets. The trigger for the downgrading of a hedge finance unit has to take place somewhere else in the economy and is not caused by the behaviour of hedge finance units. However, this statement is only valid if hedge finance units’ activities were not based upon unrealistic, euphoric expectations with respect to input costs and market development over time. Accordingly, the fragility of a hedge unit, measured as the probability to become a speculative or a Ponzi unit, can also stem from euphoric expectations with respect to factor and product markets. Speculative units can be downgraded to Ponzi finance units both by adverse shocks in the real and in the financial sector, i.e. by increases in factor costs, increases in interest rates and in risk premia. Ponzi finance units can be only downgraded to bankrupt finance units by both adverse real and financial sector shocks. Generally, the size of shocks being necessary to downgrade a business unit to the next lower financial posture decreases due to an increasing probability to become illiquid and insolvent for a given set of shocks.

36Investments in “New Economy” shares during the late 1990s are a typical example of Ponzi financing schemes. During the stock market hype in the late 1990s, high market prices of “New Economy” shares could not be justified by their performance, as cash flows were low or even negative for the near-term periods, and dividends were often not paid, so that holding the asset was not profitable in the near-term. However, investors expected an appreciation of “New Economy” share prices in the future which would have made an investment profitable. But when “New Economy” firms failed to validate investor expectations by actual cash flows and profits, profit expectations collapsed, and led to a worldwide stock market crash and to widespread bankruptcies among “New Economy” firms. A further example is the boom-bust cycle in stock markets during the 1920s having led to the Great Depression, which is a very nice equivalent to the incidents in the late 1990s.
2.3.2.2 Financial Instability in Closed Economies

The Weight of Hedge Finance Units in the Financial Structure of an Economy.
Following the analysis of hedge, speculative and Ponzi finance units, a financial system is stable if adverse disturbances in product and factor markets, as well as increases in interest rates and risk premia, implying a decline in capitalization rates $k_t$, do not appreciably affect the ability of economic entities to fulfill their financial obligations. By way of contrast, in an unstable or fragile financial system, the same disturbances in financial, product and factor markets can affect adversely the ability of business units to fulfill their payment commitments. Ergo, the overall instability of financial systems increases if the ratio of speculative and Ponzi to hedge finance units increases. Furthermore, if there is an increase in the ratio of Ponzi finance to speculative finance and hedge finance units, the already prevailing fragility of the financial structure deteriorates further and is in danger to evolve into a cumulative downward spiral being associated with debt deflation processes.

Industry Structure and Economic Development as a Determinant of the Weight of Hedge Finance Units in the Financial Structure. The weight of hedge finance units in relation to speculative and Ponzi finance units is not only dependent on profit-maximizing decisions of agents with regard to the optimal liability structure, but also on the kind of industry structure and economic development.

Labour-intensive industry structures without high-tech machinery, being prevalent in low developed countries, are characterized by simple and cheap capital assets whose gestation period is short. A large fraction of external financing relates to financing of goods in commerce. In such systems debt repayment is closely linked to the income generation process because there are no sophisticated long-living investment goods with long construction periods which have to be financed by short-term debt. Hence, in such systems the fraction of speculative and Ponzi units in relation to hedge units is very small.

On the contrary, both in highly industrialized and in emerging market countries, the industry structure is characterized by capital-intensive production with high-tech machinery, implying that capital assets are long-living, complicated and expensive, and that gestation periods of investment goods are very long. In such systems, short-period cash flows yield a gross profit which is only very small in relation to the value of the capital assets. Unless financing is organized in long-term contracts, such economies are not able to generate sufficient cash flow to fulfill payment obligations in early periods of production without the use of short-term debt. As a result, the "normal" way of finance is to combine income cash flows from general operation with portfolio transactions by placing new short-term debt, or by rolling over debt. Thus, high developed or emerging market economies, using highly sophisticated capital assets, generally tend to have a higher fraction of speculative and Ponzi finance units than less industrialized countries, which can be seen by the fact that the size of the financial system is much smaller in less developed countries than in high developed or emerging market countries. Thus, high developed and emerging countries have a much more unstable financial structure than low developed countries.

These results have two important implications for economic development policies. Firstly, economic development or growth requires a strong development of the domestic financial sector to transform the industry structure from labour-intensive production with low productivity to capital-intensive production with high productivity. This result
implies that domestic and/or international financial market liberalization is a favourable method to boost productivity and to reduce poverty in low developed countries. Secondly, the transition process towards capital-intensive production with a strong domestic financial sector is associated with an increase in financial instability making transition economies more vulnerable to financial crises. Consequently, financial market liberalization leads to an increase in financial instability and in the frequency of financial crises, which can be validated by the stylized facts being outlined in chapter 3. Summing up, financial liberalization is necessary for economic development but requires strong financial market regulation to prevent the overall financial structure from becoming too fragile.

The Size of Different Economic Sectors as a Determinant of the Weight of Hedge Finance Units in the Financial Structure. A further determinant of the weight of hedge finance units in relation to speculative and Ponzi finance units is the size of different economic sectors, as e.g. the firm, the household or the banking sector, in the total financial structure, as well as the composition of their income streams and payment commitments.

Financial intermediaries are generally, as aforementioned, speculative finance units as they transform by their very nature short-term debt (deposits) in long-term assets (loans), implying that the ability to fulfill near-term payment obligations (e.g. deposit withdrawals) requires a “normal” functioning of financial markets in order to place new debt, or to roll over debt at “normal” financing conditions. Moreover, as financial intermediaries’ gross profits predominantly depend on the liquidity and the solvency status of business firms and households, financial intermediaries also depend on a frictionless functioning of product and factor markets.

Business firms can take all three financial postures, where the fraction of speculative and Ponzi finance units increases with the capital/labour ratio, so that the firm sector in industrialized, as well as in emerging market countries is dominated by speculative and Ponzi finance units. Hence, business firms depend on the frictionless functioning of product and factor markets to generate sufficient income streams, as well as on the “normal” functioning of financial markets to prevent an increase in financing costs.

Households’ financial posture can be subdivided in two broad categories, namely in households’ financial posture of consumption, and in households’ financial posture of asset ownership. Households’ financial posture of consumption, referring to households’ consumption expenditures (housing included), is dominated by hedge finance units as debt contracts for consumption and mortgage finance are generally designed as fully amortized contracts, i.e. as series of (constant) payment commitments which are defined over the entire term of the debt contract, excluding a final extra repayment of a remaining part of the principal.37 Ergo, as households’ income streams mainly consist of wage income, households can only become speculative or Ponzi finance units if actual wage income falls short of expected wage income and other sources of disposable income, like e.g. unemployment insurance. Regarding mortgage debt, households can additionally get into liquidity and solvency problems in case the market value of the hypothecated asset falls short of the face value of outstanding debt as already discussed in section 2.2.4. However,

37A partially amortized contract includes a final payment at the end of the contract’s lifetime which contains a part of the principal. An unamortized contract involves repayment of the entire principal at the end of the contract’s lifetime. For this classification, see Minsky (1982b), p. 30.
a “downgrading” of households, or even a failure of households, can only occur if there has taken place a substantial decline in income and employment, i.e. consumer debt can amplify an economic downturn and a route to financial crises, as outlined in section 2.2.4.3, but it does not generate financial instability. Furthermore, financial market tightening by increasing interest rates and risk premia has no influence on financial stability of households’ consumption financial posture.

By way of contrast, households’ financial posture of asset ownership, referring to households’ investment activities into financial assets, can generate financial instability as it is dominated by speculative and Ponzi finance. Households often engage, and especially during speculative boom phases, in debt finance of securities, as e.g. equities, options, or bonds. As income streams consist mainly of dividends or interest payments, which in most cases do not suffice to meet due payment commitments of debt contracts, and as the profitability of investment projects depends heavily on selling out the position at an appreciated price, households’ portfolio is speculative if the interest rate on debt is lower than the portfolio’s internal rate of return (e.g. the dividend/price ratio), and Ponzi, if the interest rate on debt is higher than than the portfolio’s internal rate. Consequently, as income streams and payment commitments of households’ asset ownership depend mainly on financial market conditions, increases in interest rates, as well as in risk premia can lead very quickly to a move from speculative to Ponzi finance or even to bankruptcy. However, since asset prices are also determined by income streams from product and factor markets, households can be downgraded additionally by adverse disturbances in the real sphere of the economy.

Governments are very often speculative finance units as income streams generally consist of tax revenues and new borrowing, i.e. government expenditures depend crucially on the ability to roll over short-term debt. As long as the sum of expected income streams exceeds the sum of future payment commitments on debts outstanding, there arise no liquidity and solvency problems for governments. However, if expected tax revenues fall short of payment commitments, e.g. due to an economic downturn, or if current running expenses increase, e.g. owing to a general interest rate increase, governments can become very quickly Ponzi units or even bankrupt since rolling over debt can become impossible. Generally, governments’ incentives to engage in speculative or Ponzi finance are not aimed at generating financial instability wilfully. However, there are often distorting incentives which lead governments to engage in “unsound” fiscal policies by increasing short-term debt. Especially governments engaging in large floating short-term debt run the risk of becoming Ponzi or even bankrupt.

Summing up, financial instability increases in case of growing financial intermediation, in case of a growing government sector and increasing government expenditures, in case of a growing capital/labour ratio, and in case of growing investments of households in financial assets. Accordingly, financial stability depends heavily on the relative size of households’ financial posture of consumption.

2.3.2.3 Foreign Hedge, Foreign Speculative, and Foreign Ponzi Finance

Minsky’s original concept of hedge, speculative and Ponzi finance can be only applied to closed economies as it refers solely to money flows in domestic currency, as well as solely to domestic product, factor and financial market conditions. Financial crises in the 1990s however demonstrated, that systemic financial crises, both in emerging market and in
industrialized countries, were influenced by asset and debt positions in foreign currency. Consequently, in order to get a correct measure of overall financial instability in open economies, cash flow positions resulting from transactions in foreign currency have to be considered explicitly. In order to be consistent with the degree of internal financial fragility, having been discussed in the two previous sections, this section enlarges Minsky’s original concept by explicitly considering cash flow positions in foreign currency.

However, the classification of business units in hedge, speculative, and Ponzi units by taking into account cash flows in foreign currency is not as easy as Minsky’s original concept for closed economies. For example, cash flow positions in domestic currency can be used to compensate cash flow positions in foreign currency and vice versa, making it very difficult to assess a business unit’s financial posture. Moreover, cash flow positions in foreign currency can involve payment commitments in foreign currency, but income streams in domestic currency which have to be exchanged in the foreign exchange market to pay debt, exposing the business unit additionally to currency risk. Accordingly, to get a useful measure for financial instability, internal fragility, stemming from cash flow positions in domestic currency, i.e. from the distribution of hedge, speculative and Ponzi finance as defined in section 2.3.2.1, has to be separated from external fragility stemming from cash flow positions in foreign currency. To distinguish internal from external financial instability, external cash flow positions are labelled analogously to Minsky’s original terminology as foreign hedge, foreign speculative, and foreign Ponzi finance. After having discussed the determinants of external financial fragility, section 2.3.2.4 is going to combine internal and external financial fragility to determine the overall degree of financial fragility of single units and of an entire economies.

**Basic Concepts.** The analysis of external cash flow positions follows the terminology and the basic concepts of section 2.3.2.1. The first step to determine the external cash flow position from the overall cash flow position of a business unit is to separate total payment commitments into “external” payment commitments in foreign currency, and into payment commitments in domestic currency. The second step is to single out “external” expected gross profits which are used to fulfill external payment commitments in foreign currency, and into payment commitments in domestic currency. The second step is to single out “external” expected gross profits which are used to fulfill external payment commitments in foreign currency, and into payment commitments in domestic currency. The second step is to single out “external” expected gross profits which are used to fulfill external payment commitments in foreign currency, and into payment commitments in domestic currency. The second step is to single out “external” expected gross profits which are used to fulfill external payment commitments in foreign currency, and into payment commitments in domestic currency. The second step is to single out “external” expected gross profits which are used to fulfill external payment commitments in foreign currency, and into payment commitments in domestic currency. Then, in the third and last step, external expected gross profits, which are used to fulfill external payment commitments in foreign currency, and external payment obligations in foreign currency have to be compared, determining the external cash flow position.

In order to account for foreign exchange risk, evolving in case external expected gross profits are denominated partly, or entirely in domestic currency, the external cash flow position has to be separated further in external cash flow positions containing only money flows in foreign currency, and in external cash flow positions containing money flows in domestic currency as well which have to be exchanged in the foreign exchange market to fulfill external payment commitments.

In case all expected gross profits are denominated in foreign currency, and assuming that in this case income streams only result from transactions with foreigners, the external cash flow position consists only of money flows in foreign currency, implying that only foreign product, factor and financial market conditions are relevant for possible changes
in the external financial posture. Accordingly, the external expected present value of a business unit \( E^* \) in foreign currency, being formally defined as

\[
E^* = \sum_{t=1}^{n} k_t^*(GPR_t^* - PC_t^*),
\]

is determined by discounting external expected gross profits \( GPR_t^* \) less external payment commitments \( PC_t^* \), where the external discount factor \( k_t^* \) only consists of foreign interest rates and risk premia as financing costs need not to be "earned" in domestic currency.

By way of contrast, in case external expected gross profits contain at least partly income streams which are denominated in domestic currency, and assuming that these income streams only stem from transactions with domestic residents, the external cash flow position is additionally exposed to currency risk, implying that foreign product, factor, and financial market conditions, as well as domestic product and factor market conditions are relevant for possible changes in the business unit's financial posture. Thus, in this case, the external discount rate \( k_t^* \) consists of foreign interest rates and risk premia, as well as of the expected rate of change of the exchange rate, as financing costs have to be "earned" in domestic currency, being subject to foreign exchange risk.

**Foreign Hedge Finance.** A prerequisite for a business unit to be classified as a foreign hedge finance unit, is that the external cash flow position has to be denominated in foreign currency in each period, i.e. external expected gross profits have to be denominated completely in foreign currency, implying that there arises no currency risk. Given that all net money flows are denominated in foreign currency, a foreign hedge finance unit’s external expected gross profits exceed in all periods external payment commitments. Accordingly, a foreign hedge finance unit can be only downgraded, and external present value reversals can only happen in case of adverse shocks in foreign product and factor markets, as e.g. a decline in foreign GDP, or an adverse terms of trade shocks reducing domestic net exports. Foreign financial market disturbances cannot lead to downgrading or to external present value reversals.

On the contrary, a unit whose external expected gross profits exceed external payment commitments for all periods, but whose external expected gross profits are partly or entirely denominated in domestic currency, cannot be classified as a foreign hedge finance unit. Rather, such a unit engages in a form of speculative, or even Ponzi finance, due to considerable exchange rate risk, as devaluations of the home currency can lead very quickly to an external present value reversal, even in case of fixed exchange rates, since exchange rates are not invariable in the long-run.

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38 Business units are assumed not to depend on domestic financial market conditions because changes in domestic interest rates, as well as in domestic risk premia do not change payment commitments in foreign currency. It has to be emphasized however, that domestic financial market conditions do have an influence on a business unit’s net worth via the impact on the external discount factor \( k_t^* \) in case external expected gross profits are partly or entirely denominated in domestic currency, and in case these gross profits are “earned” at home. In this case, the external discount factor should be weighted average of domestic and foreign financial market conditions including currency risk, where the weighting factor of domestic financial conditions should be determined by the proportion of external expected gross profits in domestic currency to total payment commitments in foreign currency. Yet, for reasons of simplicity, the influence of domestic financial market conditions on the external discount factor is neglected in the following.
Foreign Speculative and Foreign Super Speculative Finance. A foreign speculative finance unit is defined by four characteristics. Firstly, cash flow positions in all periods are denominated in foreign currency, implying that there arises no currency risk. Secondly, external payment commitments in early periods exceed external expected gross profits. Thirdly, in later periods, external expected gross profits exceed external payment commitments. Fourthly, in early periods interest payments on foreign debt are smaller than the net income part of external cash flow. Accordingly, a foreign speculative finance unit is dependent on the “normal” functioning of foreign financial markets in order to place foreign short-term debt, or to roll-over foreign debt at “normal” foreign financing conditions. Such a unit is vulnerable to adverse shocks in foreign product, factor and financial markets.

A foreign super speculative finance unit is defined by the same characteristics as a foreign speculative finance unit except for the fact that external expected gross profits are partly or entirely denominated in domestic currency, exposing the unit additionally to currency risk, and to adverse disturbances in domestic product and factor markets.

Foreign Ponzi and Foreign Super Ponzi Finance. A foreign Ponzi finance unit is defined by the following four characteristics. Firstly, cash flow positions in all periods are denominated in foreign currency. Secondly, in all periods except for the final period, external expected gross profits fall short of external payment commitments. Thirdly, only in the final period external expected gross profits exceed external payment commitments. Fourthly, in all periods except for the final period, interest rate costs on foreign debt exceed the net income part of external cash flow. As a result, a foreign Ponzi finance unit has to increase its foreign debt stock steadily and is dependent on a normal functioning of foreign financial markets to place steadily new foreign short-term debt, and to roll-over debt at “normal” foreign financing conditions. A foreign Ponzi finance unit is vulnerable to adverse disturbances in foreign product, factor, and financial markets.

A foreign super Ponzi finance is defined by the same characteristics as a foreign Ponzi finance except for the fact, that external expected gross profits are partly or entirely denominated in domestic currency, making the business unit additionally vulnerable to devaluations of the home currency and to adverse disturbances in domestic product and factor markets.

2.3.2.4 Financial Instability in Open Economies

This section studies in a first step determinants of external financial fragility according to the classification of the previous chapter, and enlarges in a second step the concept of internal financial fragility to an open economy context in order to combine finally both results to derive determinants of overall financial instability in open economies.

Determinants of External Financial Instability. Like internal financial instability, external financial instability increases if the ratio of foreign hedge finance units to all other external financial postures decreases, where the weight of foreign hedge finance units in the aggregate external position depends heavily on the stage of development of an economy.
Low developed countries with a low capital/labour ratio, low productivity, and an underdeveloped and often financially repressed\(^{39}\) domestic financial system, tend to have almost no foreign debt as well as no income streams in foreign currency due to three reasons. Firstly domestic financial market regulation often prohibits to get into foreign debt. Secondly, foreign investors are not willing to invest in countries and industries with low productivity and low yields, and thirdly, low productivity implies low export performance and thereby low income streams in foreign currency. Consequently, as there arise almost no transactions in foreign currency, external financial instability in low developed countries is low.

High developed countries, being characterized by a high capital/labour ratio, average productivity, and well-developed domestic financial systems, tends to exhibit generally also a low degree of external financial instability, as the aggregate external cash flow position is dominated by foreign hedge finance units. An overall foreign hedge finance position develops from a low share of foreign debt in total debt, and from external income streams which are mostly denominated in domestic currency, or in foreign currencies with low exchange rate risk.\(^{40}\)

Emerging market or transition economies are generally subject to a high degree of external financial fragility as the aggregate external cash flow position is dominated by foreign (super) speculative and foreign (super) Ponzi finance units. Emerging market or transition economies are subject to a very fast increasing capital/labour ratio, and to huge productivity increases. Yet, the increase in highly sophisticated capital assets with long gestation periods cannot be financed entirely by the domestic financial system, firstly as domestic savings are very often too low, and secondly, as emerging market and transition economies cannot issue domestic debt due to the “original sin” hypothesis\(^{41}\), stating that due to past misbehaviour there is no possibility to borrow in domestic currency, leading to high share of debt denominated in foreign currency. Accordingly, emerging market and transition economies very often engage in heavy short-term foreign borrowing, where income streams are very often earned at home in domestic currency making them extremely vulnerable to foreign exchange risk.

A further determinant of the weight of foreign hedge finance units in the aggregate external finance position is the relative size of different economic sectors, as already outlined in section 2.3.2.2 for the case of internal financial instability. As external financial instability appears predominantly in emerging market and transition economies, the following description concentrates exclusively on external financial postures of different sectors in emerging market and transition economies.

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\(^{39}\) According to McKinnon (1973), Shaw (1973), and Williamson and Mahar (1998), a financially repressed system is defined as a system in which government regulations determine the amount, the price, and the distribution of credit. These regulations are often reinforced by state-owned banks, by licensing and regulating private financial institutions with respect to their general management, and by controlling international capital movements.

\(^{40}\) It has to be emphasized that there are exceptions, especially in the case of small high developed countries with a high degree of openness. For example, Norway, Sweden, and Finland borrowed heavily in foreign currency after domestic financial sector liberalization in the late 1980s, which caused high external financial instability and evolved into systemic financial crises in all three countries at the beginning of the 1990s.

\(^{41}\) See e.g. Eichengreen and Hausmann (1999), and Velasco (2001).
Banks and financial intermediaries in emerging market and transition economies play a dominant role for domestic finance as information asymmetries do not allow business firms or households to take foreign debt directly abroad, implying that foreign funds are generally allocated via the domestic financial sector. Hence, financial intermediaries in emerging market and transition economies are generally foreign super speculative, or even foreign super Ponzi units (as well as domestic speculative finance units), as they transform domestic short-term debt (deposits in domestic currency) and foreign short-term debt (deposits or short-term loans in foreign currency) with floating interest rates, in long-term assets which are denominated in domestic currency (long-term domestic loans). This financial posture implies that the financial sector in emerging and transition economies is subject to high financial instability as it is vulnerable to disturbances in domestic and foreign product, factor and financial markets, as well as to disturbances in foreign exchange markets.

Business firms in emerging market and transition economies are generally subject to low external financial fragility as they are not able to borrow in foreign currency as mentioned above. It must be noted however, that very large business firms, or even conglomerates with international creditworthiness can take foreign debt, and very often engage in foreign short-term borrowing to finance domestic long-term assets generating predominantly income streams in domestic currency. Accordingly, if the industry structure is dominated by such conglomerates, the business firm sector contributes considerably to the emergence of external financial stability, as the external finance position is dominated by foreign super speculative and foreign super Ponzi units.

Households in emerging market and transition economies exhibit in general no external financial instability as they cannot engage in foreign debt finance, firstly, due to lacking creditworthiness, and secondly, due to lacking wealth.

Governments in emerging market and transition economies very often engage in heavy foreign short-term borrowing at flexible interest rates to finance domestic government expenditures as domestic tax revenues are not sufficient. As tax revenues are denominated in domestic currency, governments in emerging market and transition economies are in most cases foreign super speculative, or even foreign super Ponzi units. Accordingly, governments are highly vulnerable to disturbances in domestic and foreign product, factor, and financial markets, as well as to disturbances in foreign exchange markets. It has to be emphasized however, that “unsound” external fiscal policies, which prevailed in the late 1970s and 1980s, have reduced enormously as international financial market liberalization has imposed fiscal discipline on governments.

Summing up, external financial fragility in emerging market and transition economies increases with growing capital inflows which are allocated by the domestic financial system, as well as with increasing government expenditures which are financed by increasing short-term foreign debt.

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42 For example, Argentina’s latest government debt default, as well as the international debt crisis in the 1980s were predominantly caused by external financial fragility which stemmed from heavy foreign short-term borrowing at flexible interest rates, having led to bankruptcy after international interest rates rose considerably and tax revenues dropped due to domestic recessions.

43 For example, government policies in East Asia before the Asian crisis in 1997/1998 were sound and not subject to large amounts of short-term foreign debt.
**Internal Financial Instability Revisited.** To assess the overall degree of financial instability in open economies, the degree of internal financial stability, having been discussed in section 2.3.2.2, has to be modified to fit into an open economy context, as the degree of internal financial stability does not depend solely on domestic disturbances due to current account and capital account transactions. Regarding current account transactions, an initially internal financially stable economy with no external financial instability can be downgraded, e.g. by a drop in foreign GDP, or by a terms of trade shock reducing domestic net exports and thereby domestic expected gross profits which are used to pay back domestic debt. Regarding capital account transactions, in fully liberalized domestic and international capital markets interest parity can be assumed to hold, implying that an economy with no external financial instability, but with a low share of domestic hedge finance units, can be downgraded by a foreign interest rate increase, or by an expected devaluation of the home currency leading to rising domestic payment commitments.

Summing up, in case an economy is characterized by internal financial stability, and exhibits no external financial instability, disturbances in foreign product and factor markets can induce an increase in internal financial fragility, whereas foreign financial market disturbances do not have any considerable effects. In case an economy is characterized by no external, but by internal financial instability, disturbances in foreign product and factor markets, as well as disturbances in foreign financial markets can induce an increase in internal financial fragility.

**Overall Financial Instability in Open Economies.** Financial instability in open economies increases if internal financial instability increases and/or if external financial fragility increases. That is, overall financial instability increases if the ratio of hedge finance units to speculative and Ponzi finance units decreases, and/or if the ratio of foreign hedge finance units to foreign (super) speculative and foreign (super) Ponzi units decreases. Consequently, emerging market and transition economies are much more fragile than industrial or low developed economies, in case their domestic financial system as well as the capital account are liberalized, as they are additionally subject to high external fragility.

### 2.3.3 Adequacy of Refinancing Possibilities

This section refers to the analysis of internal and external cash flow positions of the previous section, and discusses how a systemic financial crisis can be prevented in case an economy is hit by large adverse domestic and/or foreign shocks, normally causing widespread bankruptcies and real economic downturns. The following analysis distinguishes among refinancing possibilities in domestic and in foreign currency, where domestic currency refinancing possibilities determine the degree of internal financial instability, and foreign currency refinancing possibilities determine the degree of external financial fragility.44

**The Adequacy of Refinancing Possibilities in Domestic Currency.** Large adverse disturbances in domestic and/or foreign product, factor and financial markets normally cause systemic financial crises by inducing an enormous downgrading of hedge finance units, and widespread bankruptcies among speculative and Ponzi finance units, as

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44 The analysis of domestic refinancing possibilities is based on Minsky (1972) and (1986), chapter 3.
payment commitments cannot be fulfilled any longer. However, large adverse shocks need not induce systemic financial crises if there exist possibilities for troubled business units to receive sufficient “emergency” liquidity to bridge short-run liquidity gaps. Thus, financial stability also depends crucially on the availability of refinancing resources providing sufficient short-term liquidity.

A troubled business unit whose income streams from normal operation do not suffice to fulfill payment obligations, generally has three possibilities to obtain short-term liquidity in order to prevent bankruptcy. Firstly, placing new debt or rolling over debt, secondly, running down liquid monetary assets, and thirdly, a fire-sale of financial and/or real assets.

The ability of households, business firms and governments to place new debt and/or to run down liquid monetary assets (as e.g. deposits) generally depends on the liquidity status of the financial sector. However, a liquidity crunch among households, firms and the government generally passes to a liquidity crisis of the financial sector due to large deposit withdrawals, and due to a maximum degree of lending, e.g. by an exhaustion of credit lines up to the maximum. That is, a private and government sector liquidity crisis evolving into a financial sector liquidity crisis as defined by condition 2.9 in section 2.2.4.2, passing over definitely into a systemic financial crisis, can be only prevented by an extraordinary provision of central bank credit. Hence, financial instability decreases in case there are effective lender-of-last-resort interventions by central banks.

A widespread fire-sale of assets only generates sufficient liquidity by sales revenues in case the relevant secondary asset markets are independent of system behaviour. Otherwise, a widespread fire-sale of financial or real assets by households, firms, and banks causes an enormous drop in assets’ market prices, causing insolvency and deteriorating liquidity problems as sales revenues drop sharply. Consequently, financial instability increases if the ratio of the value of those assets whose market value is independent of system behaviour to the value of assets which reflect system behaviour decreases. For an asset to be independent of system behaviour, the secondary market for the asset firstly, has to be pegged or rather protected, secondly, has to be very large and deep in order not to result in large price fluctuation if demand and supply conditions change rapidly, and thirdly, must not depend on overall financial conditions. For a secondary market to work effectively and to contribute to financial stability, an asset has to be transformed at any time into cash without a loss of its market value, which requires a set of position takers who buy significant amounts of assets for their own account, and who sell large amounts of assets out of their stock. Position takers in secondary markets in general finance their transactions by borrowing from financial intermediaries, which however does not prevent the occurrence of a systemic liquidity crisis as described above; in case of a widespread fire-sale, the position taker has to increase its bank debt to sell a large amount of assets he generally does not own. Consequently, a position taker contributing to financial stability must have additional sources of emergency or standby liquidity. However, the only source of finance which is truly independent of system behaviour is liquidity support by the central bank. Therefore, financial stability can be considerably increased in case position takers have unlimited access to central bank credit. Furthermore, financial stability can be increased if the central bank takes over the position taker function by itself to

If central banks are not independent, a liquidity crisis of the government sector need not lead to a liquidity crisis of the financial sector. In this case, the government uses central bank reserves directly to pay outstanding debt which can lead to inflation and, in extreme cases, to hyperinflation.
stabilize assets' market prices, as e.g. the market price for Treasury bills, in case of large fluctuations in demand and supply conditions.

**The Adequacy of Refinancing Possibilities in Foreign Currency.** Troubled business units which cannot fulfill payment commitments in foreign currency, generally have three options to prevent bankruptcy. Firstly, a unit can engage in all activities described above to obtain liquidity in domestic currency and to sale revenues in the foreign exchange market. However, this strategy is subject to foreign exchange risk, as a large and sudden increase in demand for foreign currency leads either to a sharp devaluation of the home currency in case of flexible exchange rates, or to a large depletion of central bank foreign reserves in case of a fixed exchange rate system which can possibly lead to a suspension of the peg (and to a devaluation of the home currency) in case foreign reserves are not sufficient. Consequently, external financial instability is negatively dependent on the stock of central bank foreign reserves, and increases in case the foreign exchange market is highly volatile in case of sudden changes in demand and supply conditions.

Secondly, in case the business unit possesses foreign assets, the unit can sell these assets in a fire-sale action in foreign financial markets. This action is not subject to exchange rate risk, but depends on the liquidity of foreign financial markets. Consequently, external financial instability increases if the share of the market value of foreign assets which are independent of foreign system behaviour decreases.

Thirdly, the business unit can increase foreign debt, depending on the liquidity status of foreign financial intermediaries. That is, external financial instability decreases if there are effective lender-of-last-resort interventions by foreign central banks.

### 2.3.4 Excess Volatility in Asset Prices

This section studies the impact of asset price fluctuations on financial stability by asset prices' influence on long-run debt-asset ratios, as well as on long-run cash flow positions. Furthermore, this section analyzes the impact of asset price and debt-asset ratio swings on real economic activity, causing excessive and expectations-led boom-bust cycles in goods and in financial markets, and possibly giving rise to systemic financial crises during the bust phase.

**A General Definition of Excess Volatility.** Asset prices are subject to fluctuations if there is a change in asset prices' determinants. Using a simplified version of equation 2.3, an asset's market price $P_A$ is given formally by

$$P_A = \frac{CF^e}{i_r} = \frac{CF^e P^e}{i - \tilde{p}^e},$$

(2.39)

that is, by expected nominal cash flows $CF^e$ which are discounted by a real risk-adjusted interest rate $i_r$ representing real finance costs. Expected nominal cash flows are defined as expected real cash flows $CF^e_r$ valued at the expected price level $P^e$, i.e. as $CF^e = CF^e_r P^e$, whereas the real interest rate is defined as the difference between the risk-adjusted nominal interest rate $i$ and the price level's $P$ expected growth rate $\tilde{p}^e = \tilde{P}^e / P$, i.e. as $i_r = i - \tilde{p}^e$.

In order to distinguish asset price volatility stemming from (expected or unexpected) price level effects, which are going to be discussed in section 2.3.5, from asset price volatil-
ity stemming from changes in expected real cash flows and from changes in nominal interest rates, it is assumed in the following, that there is no change in the actual and in the expected price level, implying that $P, P^e$ and $\hat{p}^e$ remain constant. Accordingly, volatility in asset prices can be caused only by changes in expected real flows $CF^e$, and by changes in the nominal risk-adjusted interest rate $i$.

If expectations are formed according to the rational expectations hypothesis, i.e. if it holds that expected real cash flows are equal to actual real cash flows $CF^r$ in case exogenous shocks are absent, formally if $CF^e = CF^r$, then a change in asset prices simply reflects changes in economic fundamentals.\(^{46}\) This kind of asset price volatility, being consistent with actual changes in economic fundamentals, is labelled as “normal” or “correct” asset price volatility, as asset price changes indicate correctly fluctuations in economic fundamentals.

By way of contrast, excess volatility in asset prices emerges if expectations, and thereby asset prices, fluctuate with a much higher amplitude than changes in economic fundamentals, implying that expectations do mostly not coincide with actual economic fundamentals. By equation 2.39, excess volatility emerges in case changes in expected real cash flows are larger than changes in actual real cash flows in absolute terms, i.e. if it holds that $|dCF^e| > |dCF^r|$, implying that expected real cash flows are usually not equal to actual real cash flows, i.e. formally it usually holds that $CF^e \neq CF^r$. Consequently, excess volatility in asset prices does not indicate changes in fundamentals correctly, but reflects expected changes in fundamentals which are much larger than actual changes in fundamentals.

Excess Volatility and Extensive Boom-Bust Cycles in Financial and Goods Markets. The existence of excess volatility implies that in boom phases, asset prices generally reflect overly optimistic, or even euphoric expectations as to future growth of real cash flows, though actual growth of real cash flows is much lower. Formally, excess volatility in boom phases is defined by $dCF^e > dCF^r$ and $CF^e > CF^r$, implying the existence of an asset price bubble as an asset’s actual market price, i.e. $P_A = CF^e/i_r = (CF^e P^e)/(i - \hat{p}^e)$, is much higher than its fundamental value $P_A^F = CF/i_r = CF^r P/(i - \hat{p}^e)$. Accordingly, an asset price bubble grows with an increasing difference between market prices and fundamental values, i.e. with a growing difference $P_A - P_A^F = ((CF^e P^e) - (CF^r P))/(i - \hat{p}^e)$.

Asset price bubbles generally cause a large acceleration in economic growth, being caused by demand-side, financial accelerator-induced and supply-side induced cumulative upward processes as described in section 2.2.4.3. Largely rising expenditures during excessive boom phases are financed by an increase in indebtedness leading to a significant rise in debt-asset ratios and to fall in net worth, as the actual growth in profits and cash flows is smaller than the growth in expenditures which are based on expected profits and cash flows. If domestic financial markets’ capacity does not suffice to meet the increasing demand for credit, economies generally start to take foreign debt. Especially emerging market or transition economies, having very often an underdeveloped domestic financial system as outlined in section 2.3.2.4, depend on foreign financial markets’ supply of credit in case of a domestic macroeconomic expansion. But also small industrialized countries,

\(^{46}\)For a general description of the rational expectations hypothesis and its impact on formal solutions to general dynamic economic models, see appendix D.
whose domestic financial system cannot meet rising demand for credit often engage in foreign debt finance (as e.g. Norway, Sweden, and Finland in the late 1980s). As costs of taking foreign debt measured in domestic currency terms, as well as default risk, depend crucially on exchange rate risk, the build-up of foreign debt tends to be much higher in fixed and credible exchange rate systems than in flexible ones.

An increasing indebtedness both in domestic and in foreign currency, generally induces a build-up of aggregate financial instability, being outlined in more detail below, because future domestic and/or foreign interest payments, as well as repayment of domestic and/or foreign debt, can be only met in case future actual cash flows or income streams, both in domestic and in foreign currency, rise to expected levels. Consequently, there is a general increase in the risk of becoming illiquid or insolvent, as business units’ future liquidity and solvency status depends increasingly on the validation of euphoric expectations by actual cash flows. If actual cash flows do not grow to expected levels, many business units are going to become illiquid or insolvent in the future.

Financial instability passes over into actual financial distress when agents realize that expectations were too optimistic, i.e. when actual income streams fall short of expected levels and of payment commitments, causing widespread illiquidity and insolvency. Business failures of especially highly leveraged business units act as triggering events for a sharp downward revision of expectations inducing a “burst” of the asset price bubble. Formally, the burst of an asset’s market price $P_A$ is induced, according to equation 2.39, by a sharp decline in expected real cash flows $CF^e$ (and by an increase in the risk-adjusted nominal interest rate $i$ due to increased default risk), as agents realize that actual real cash flows cannot grow up to expected levels in the future, i.e. agents realize that $CF^e < CF^r$.

The burst of asset price bubbles and beginning failures of highly leveraged business units are generally accompanied by a large increase in real domestic and/or foreign interest rates on debt, as well as by large domestic and/or foreign debt withdrawals due to a sharp increase in overall default risk. In case business units are highly indebted in foreign currency, large debt withdrawals cause, in case of fixed exchange rate systems, a large reduction in foreign exchange reserves according to results of section 2.2.4.3, which very often causes to a currency crisis, i.e. a large devaluation of the home currency, as foreign exchange reserves do not suffice to meet capital outflows. After a devaluation has taken place, the remaining stock of foreign debt is subject to a large increase in domestic currency terms, deteriorating further the liquidity and solvency position of business units. In case of flexible exchange rate systems, large debt withdrawals lead to a devaluation of the home currency, also inducing a rise in the foreign debt stock in domestic currency terms.

Collapsing asset prices, rising interest rates, and increasing failures among business units induce a cumulative downward process according to the mechanisms described in section 2.2.4.3. Bust periods are also subject to excess volatility when asset prices reflect overly pessimistic expectations as to future declines in real cash flows, i.e. if expected declines in real cash flows are larger than actual declines. Formally, excess volatility in bust periods is characterized by $-dCF^e < -dCF^r$, and $CF^e < CF^r$. This “undershooting” of expectations aggravates the downswing more than necessary, as lenders expect default risk to be much higher than actual default risk, leading to higher real interest rates, to much larger drops in asset prices, to much stronger withdrawals of debt, and to much larger devaluations of the home currency, or to much larger declines in foreign exchange reserves, inducing more bankruptcies and a much deeper downswing. Excessive bust
periods come to an end when agents realize that expectations had been too pessimistic, and when debt-asset ratios in balance sheets have declined to “sound” levels.

Excess Volatility, Self-Fulfilling Expectations, and Expectations-Led Cumulative Upward and Downward Processes. Excessive boom-bust cycles, leading to a build-up of financial instability by “overindebtedness”, and possibly causing systemic financial crises, have their roots in irreducible uncertainty about the future. If uncertainty is not irreducible, as it is assumed in standard economic theory, rational expectations provide a powerful tool to forecast the future development without error in case exogenous shocks are absent, implying, as aforementioned, that excess volatility cannot arise. In a real-world environment however, uncertainty is not completely irreducible, connoting that expectations cannot be formed solely according to the rational expectations hypothesis. Rather, to assess future developments which are subject to irreducible uncertainty, expectations tend to be formed by reassessing the actual or past development into the future, implying an adaptive or even extrapolative expectation formation scheme which is compatible with excess volatility, as an increasing reliance can lead to a widening gap of expectations and fundamentals. As a result, real-world expectations tend to be subject to a mixed expectation formation scheme which varies over the business cycle, as boom and bust phases, giving rise to excess volatility, tend to be dominated by adaptive and extrapolative expectations, whereas at the turning points, when agents realize that past expectations have been unrealistic, the expectation formation scheme switches quickly from adaptive and extrapolative to a rational expectation formation scheme, i.e. back to economic fundamentals. Hence, the emergence of excess volatility, financial instability, and systemic financial crises depends crucially on different and varying expectation formation schemes over the business cycle. The degree of financial instability and the severity of the subsequent financial crises is determined firstly, by the strength of adaptive and extrapolative expectations during the upswing and the downswing relative to the influence of rational expectations, determining also the length of the expansion and the contraction phase, and secondly, by the velocity with which “unrealistic” adaptive and extrapolative expectations are transformed into a rational expectation formation scheme, determining the amplitude of asset price swings at the turning points.

The existence of excess volatility implies that the upswing and the downswing of extensive boom-bust cycles are mainly driven by cumulative processes in expectations, giving rise to expectations-led cumulative upward and downward processes in goods and financial markets, which are much larger in amplitude than standard cumulative processes described in section 2.2.4.3. Expectations-led cumulative upward/downward processes are characterized by a self-reinforcing expectation formation scheme, as a past increase/decrease in expected values leads to a further increase/decrease in expectations. However, expectations-led cumulative upward/downward processes may not be misunderstood in the sense that they are completely detached from the actual development of economic fundamentals. Rather, cumulative upward/downward processes induced by adaptive and extrapolative expectations are generally associated with an actual improvement/deterioration of fundamentals up to a certain boundary, justifying a further rise/fall in expectations. As a result, expectations during upswings and downswings are self-fulfilling up to a certain boundary, i.e. optimistic/pessimistic expectations about the
future development generate an actual boom/contraction up to a certain limit by cumulative demand-side and financial accelerator-induced upward/downward processes.

Demand-side cumulative processes, as outlined in section 2.2.4.3, are accelerated by self-fulfilling expectations, as an increase/decrease in expectations causes a rise/drop in asset prices, leading to an improvement/deterioration of demand conditions and to an actual increase/decrease in nominal earnings, cash flows, and net worth, justifying ex post the initial increase/decrease in expectations. If this process was able to be continued, then this cumulative upward/downward process would be no example of excess volatility, but an example of rational behaviour, because in this case expectations would simply reflect correctly, and rationally ex ante the actual behaviour of fundamentals in the future, which would validate expectations ex post, and which would justify a further ex ante increase/decrease in expectations. However, the self-fulfilling character of expectations has a “natural limit” both in boom and in bust periods, which is going to be discussed in the following paragraph, implying that from a certain point on, expectations do not longer “predict” correctly future actual developments, but simply become unrealistic as expectations are not longer formed rationally; thus, expectations become increasingly adaptive and extrapolative, implying a widening gap between actual and expected values, i.e. expectations become overly optimistic in boom periods, and overly pessimistic in bust periods.

Financial-accelerator induced cumulative processes, as outlined in section 2.2.4.3, are amplified by self-fulfilling expectations, as self-fulfilling demand-side cumulative upward/downward processes induce an improvement/deterioration of the aggregate cash flow and solvency position, which justifies an increase/decrease in domestic and foreign indebtedness as well as a decrease/increase in domestic and foreign interest rates on debt, leading to a further improvement in cash flows and net worth, and justifying a further increase in indebtedness. A general rise in indebtedness in boom phases would be no example of an increase in financial instability caused by excess volatility, but also an example of rational behaviour, if actual income streams would rise to expected levels, because in this case, future cash flows would suffice to meet future interest payments and repayment of debt. The build-up of financial instability is about to begin if rising indebtedness is increasingly based on unrealistic adaptive and extrapolative expectations about future income streams, resulting in widespread bankruptcies in the future, as future payment commitments cannot be met. Likewise, debt withdrawals and increases in interest rates on debt during bust periods would be no example of “expectation undershooting” in case default risk was assessed by actual cash flow and net worth positions, and not by expected ones which are overly pessimistic.

Summing up, if there emerges large excess volatility in asset prices, business cycles tend to have a much larger amplitude than business cycles without serious excess volatility. Furthermore, excess volatility and excessive boom-bust cycles are generally associated with a large build-up of financial instability which very often induces systemic financial crises, whereas “tranquil” business cycles without heavy excess volatility tend to exhibit no, or only a slight build-up of financial instability which does not pass over into systemic financial crises. These boom-bust cycles driven by excessive volatility in expectations, and their interaction with the financial accelerator, are going to be discussed and modelled formally in detail in part II of the book, as they are one of the most important determinants of systemic financial crises.
“Natural” Limits of Self-Fulfilling Expectations and Expectations-Led Cumulative Processes. It has been argued that both boom and bust phases are not subject to excess volatility in case expectations are self-fulfilling, i.e. if an increase/decrease in expectations leads to an actual macroeconomic expansion/contraction. If there was no limit to the self-fulfilling nature of expectations, positive economic growth based on rational behaviour could be sustained forever without any increase in financial instability if there were no negative exogenous shocks. However, self-fulfilling expectations are subject to “natural” limits in the real and in the financial sphere of modern capitalist economies which prevent never-ending expansions/contractions by disappointing overly optimistic/pessimistic expectations through an actual deterioration/improvement in cash flow and solvency positions, inducing a downward/upward revision of expectations to actual fundamentals.

In the real sphere of modern capitalist economies there are three main factors preventing a never-ending boom/bust driven by self-fulfilling expectations. Firstly, regarding boom periods, aggregate demand cannot increase unboundedly, as it is limited by maximum production capacity and subject to saturation effects. Respecting bust periods, aggregate demand cannot fall to zero, as there exists a minimum of demand. Secondly, in boom periods, aggregate supply cannot increase limitless due to an upper bound of capacity utilization in a static environment. In a dynamic environment, an increase in production capacity is subject to long gestation periods, implying that output cannot grow as fast as expected output. Regarding bust phases, aggregate supply cannot fall to zero, as there is a minimum of aggregate demand which has to be satisfied, and as a reduction in production capacity is also subject to a long time horizon in comparison with fluctuations in expected output. Thirdly, in boom phases, output cannot be expanded at expected costs as there arise labour and material shortages, connoting an increase in input costs and a deterioration of cash flow and net worth positions. In open economies with fixed exchange rates, rising input costs lead to a deterioration of international competitiveness and to real revaluation of the home currency. In bust phases, a reduction in output leads to lower input costs and to an improvement in international competitiveness, implying an improvement in cash flow and net worth positions.

In the financial sphere of modern capitalist economies there are three factors preventing unbounded expansions/contractions. Firstly, regarding boom periods, rising input costs imply rising actual and/or expected inflation, leading to monetary tightening by central banks. A general increase in interest rates connotes a deterioration of cash flows and net worth positions due to rising payment commitments. In bust periods, lowering input costs causing disinflation lead to monetary expansions and to an improvement in cash flow and net worth positions. Secondly, in boom periods, which are subject to rising debt-asset ratios and rising interest rates, it is possible that there arises a sudden change in overall risk perception by market participants, assessing current indebtedness and cash flow positions as not sustainable. This increase in overall risk perception leads to rising domestic and foreign interest rates on debt due to rising risk premia independently of monetary tightening, to a general tightening of liquidity conditions in domestic and international financial markets, and to rising foreign exchange reserve outflows (especially in the case of fixed exchange rate systems) implying higher domestic interest rates. In bust periods, being subject to falling debt-asset ratios and lowering interest rates, it is possible that there is a relaxation in overall risk perception by market participants, assessing cur-
rent indebtedness and cash flow positions as sustainable. This relaxation in overall risk perception leads to a fall in risk premia, to a decrease in domestic and foreign interest rates on debt independently of monetary policy, to a relaxation in the overall liquidity condition in domestic and international financial markets, and to increasing foreign exchange reserves inflows (especially in case of fixed exchange rate systems) implying lower domestic interest rates. Thirdly, in boom periods, deteriorating cash flow and net worth positions of financial institutions, as well as rising foreign exchange reserves outflows, can cause government authorities to suspend government guarantees in the form of deposit insurance, and bail-out guarantees of troubled banks, as well as to give up a fixed exchange rate regime, as future losses are unavoidable and would lead to an increase in government indebtedness which is not sustainable, e.g. due to rising domestic inflation. A suspension of government guarantees, as well as a suspension of a fixed exchange rate system causes contingent losses to become actual losses leading to a rise in risk premia, to an increase in interest rates, and to a deterioration of financial markets’ liquidity. In bust periods, the existence of government guarantees, as well as the stability of a fixed exchange rate regime can induce an increase in credibility, leading to lower risk premia, lower interest rates and to a relaxation of liquidity conditions in financial markets.

Hitherto, the discussion referred only to factors leading to an actual boundedness of cumulative processes driven by self-fulfilling expectations. However, expectations as to the factors mentioned above can have the same effect due to their self-fulfilling nature. For example, an increase in expected inflation due to expected rising factor costs leads to an expected increase in interest rates, which can lead to an actual interest rate increase in case expected inflation leads to an actual increase in factor costs. Consequently, self-fulfilling expansions and contractions are limited by actual and expected bounds.

Summing up, excess volatility in expectations and in asset prices is caused by agents not considering natural bounds of expectations-led cumulative processes, leading to an adaptive or extrapolative expectation formation scheme, and to a widening gap of expectations and fundamentals. Despite the fact that the limits mentioned above represent no new information for economic agents, as they are prevalent during each business cycle, overly optimistic expectations during boom phases generally abstract from the boundaries of expansion, predominantly due to the belief that “natural” limits of past business cycles have disappeared, e.g. by the introduction of new technology regimes (as e.g. the introduction of new continuous process technologies after World War I having contributed to the stock market bubble in the late 1920s, or the introduction of information and communication technologies having given rise to the “New Economy“ bubble during the late 1990s), or by fundamental changes in the order of domestic and international financial markets (as e.g. large-scale financial liberalization policies in the post Bretton Woods era). By way of contrast, in bust periods agents generally tend to expectation undershooting as overly pessimistic expectations are stronger than the belief in a natural lower limit.

Excess Volatility and Financial Instability. It has been argued that financial instability is generally built up during boom phases by excessively rising asset prices and sharply increasing debt-asset ratios. However, as rising asset prices and increasing debt-
Asset ratios are a common stylized fact of business cycles’ boom periods which do not all cause financial fragility and financial crises, an increase in financial instability cannot be simply detected by a rising debt-asset ratio. Rather, whether an increase in the debt-asset ratio indicates a rise in financial instability or not, depends on the question whether the initial increase in indebtedness is sustainable or not.

Generally, an increase in debt-finance is sustainable if there is no long-run drop in the aggregate liquidity and in the aggregate solvency position of an economy. Consequently, a sustainable increase in debt finance is accompanied by a constant or increasing long-run cash flow position, by a constant or decreasing long-run debt-asset ratio, implying a constant or increasing long-run net worth position. For an increase in debt-finance to be sustainable, the rise in the sum of long-run profits has to be equal or larger than the increase in indebtedness, which can be seen formally by equations 2.6 and 2.8. It has to be emphasized that a sustainable debt increase can be subject to a decrease in the net worth and in the cash flow position, but only in the short-run, stemming e.g. from long gestation periods. Consequently, a sustainable increase in indebtedness requires that expectations as to future income streams, on which the initial increase in debt-finance is based, are going to be validated by the actual development of future income streams, i.e. that the formation of expectations has been rational or realistic.

By way of contrast, an unsustainable increase in indebtedness is characterized by a long-run deterioration of the aggregate liquidity and solvency status of an economy, implying possibly widespread illiquidity and insolvency in the long-run. Accordingly, an unsustainable increase in indebtedness is accompanied by a decreasing long-run cash flow position, by an increasing long-run debt-asset ratio, reflecting a decline in the long-run net worth position. For an increase in the debt-asset ratio to be unsustainable, the initial increase in indebtedness has to be larger than the sum of long-run profits by equations 2.6 and 2.8. If the sum of long-run profits is negative, there is a further rise in the long-run debt-asset ratio. Furthermore, an unsustainable increase in indebtedness has to be based on unrealistic euphoric expectations as to future income streams which cannot be validated, implying either that the initial increase in indebtedness can be repaid only with deteriorating liquidity and solvency positions, or that the debt increase cannot be repaid as income streams fall short of payment commitments, leading to systemic financial crises.

Summing up, a growing positive divergence between expected and actual real cash flows causes steadily increasing asset prices which reflect a growing divergence between expected and actual economic fundamentals. This growing positive divergence between expected and actual fundamentals induces an increasing degree of financial instability if the steadily rising overall debt-asset ratio is increasingly based on irrational or unrealistic expectations about the future, implying that the increasing debt stock both in domestic and in foreign currency becomes more and more unsustainable. On the contrary, in case expectations are formed rationally, there is no increase in financial instability, as increasing short-run indebtedness is sustainable owing to realistic and rational expectations. However, if expectations become more and more irrational, i.e. more and more overly optimistic, a growing degree of financial instability causes an increasing drop in asset prices when agents realize that actual income streams fall short of payment commitments. The larger the drop in asset prices, and the larger the impact of widespread bankruptcies on

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47 For an overview of the stylized time patterns of major economic indicators of empirical business cycle analysis, see Moore (1983), chapter 6, and Zarnowitz (1992), pp. 23-28.
real economic activity, the higher is the probability that expectations tend to undershoot, i.e. to be overly pessimistic, which induces a much longer bust period than necessary by high real interest rates, by excessive debt withdrawals, and by collapsing exchange rates, leading to further bankruptcies and to a further decline in real economic activity.

Empirical studies of excess volatility and its impact on financial instability and aggregate economic activity\(^{48}\) conclude that especially stock and real property prices tend to be subject to excess volatility, giving rise to a build-up of financial instability by a significant increase in debt-asset ratios of business firms, households and financial intermediaries. Though bond markets are generally subject to much less volatility than stock and real property prices, bond prices too can exhibit excess volatility if actual or expected changes in macroeconomic fundamentals cause investors to change abruptly their expectations for inflation and real interest rates. Excess volatility in bond prices and in real interest rates can adversely affect real economic activity via the interest rate channel as the volume of investment financed by bonds (and by long-term borrowing) is typically much larger than the volume financed by equities (Crockett 1997).

### 2.3.5 Monetary Instability and Debt Deflation

This section studies the impact of price level fluctuations on financial instability by their influence on asset prices and real economic activity via volatility in real interest rates, real borrowing costs, and real debt burdens.

**Price Level Instability, Excess Volatility, Extensive Boom-Bust Cycles and Financial Instability.** According to the "Schwartz" hypothesis, named after A. Schwartz (1981, 1986, 1995, 1997), and according to I. Fisher’s (1932, 1933) business cycle theory, price level instability can aggravate, or even cause financial instability by inducing uncertainties and unrealistic expectations of borrowers and lenders about potential real returns of investment projects. The Schwartz hypothesis, as well as I. Fisher’s business cycles theory are very similar to the asset price excess volatility hypothesis, having been outlined in the previous section 2.3.4, as they also claim that financial instability and subsequent financial crises are caused by unrealistic and highly volatile expectations of agents inducing excessive boom-bust cycles in goods and financial markets. Both theories differ however with respect to the “driving” variable of the system, as they claim that excessive boom-bust cycles, financial instability and excess volatility in asset prices are not mainly caused by unrealistic expectations as to real cash flows, but by unrealistic expectations as to the price level’s growth rate, resulting in unrealistic expectations concerning real interest rates, real borrowing costs, and real returns.\(^{49}\)

The emergence of excess volatility in asset prices by excess volatility in the expected price level and in the price level’s expected growth rate can be formally outlined by a modified version of equation 2.3, which corresponds to equation 2.39, determining an

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\(^{48}\)For studies of the nexus between excess volatility and financial instability, see e.g. Bank for International Settlements (1998), International Monetary Fund (2000, 2003a, 2003b) Bordo and Jeanne (2002), Borio and Lowe (2002). For the empirical nexus of financial stability and economic growth, see e.g. Levine (1997).

\(^{49}\)For empirical tests, as well as for a review of the literature on the link between price stability and financial stability, see e.g. Bordo and Wheelock (1998), Bordo, Dueker and Wheelock (2000, 2001a).
that is, as the discounted present value of expected nominal cash flows, where \( P^e \) denotes the expected price level, \( CF_r^e \) expected real cash flows, \( CF = CF_r^e P^e \) expected nominal cash flows, \( i \) the nominal risk-adjusted interest rate, \( \tilde{p}^e = \tilde{P}^e / P \) the price level's expected growth rate, and \( i - \tilde{p}^e \) the expected risk-adjusted real interest rate.

In order to study the emergence of excess volatility in asset prices due to excess volatility in expected future prices, it is assumed in the following that expected real cash flows \( CF_r^e \) are constant, implying that volatility in asset prices is caused by fluctuations in the expected price level, in the price level's expected growth rate, and in the nominal interest rate. Consequently, excess volatility emerges in case price expectations are subject to larger fluctuations than the actual price level, implying that price expectations are not formed rationally. Formally, excess volatility emerges if

\[
|dP^e| > |dP| \quad \text{and} \quad |d\tilde{p}^e| > |d\tilde{p}|
\]

implying that it usually holds that \( P^e \neq P \).

The existence of excess volatility in expectations regarding the future price level implies that boom phases, which are generally associated with inflationary pressures, lead to overly optimistic expectations of real returns and asset prices by overly optimistic expectations as to real interest rates and nominal cash flows via actually rising inflation, and via an expected accelerating inflation rate for the future. These overly optimistic expectations give rise to the emergence of an asset price bubble, as expected cash flows are much higher than actual, and as expected real interest rates are much lower than actual. Formally, excess volatility in asset prices due to expected inflation being much higher than actual inflation is defined, according to equation 2.40, as \( dP^e > dP \) and \( d\tilde{p}^e > d\tilde{p} \), implying \( P^e > P \).

The asset price bubble induces a cumulative upward process in goods and financial markets via expectations-led demand-side and financial accelerator-induced processes as described in sections 2.2.4.3 and 2.3.4. A growing difference between the expected and the actual inflation rate by an increasing reliance on adaptive and extrapolative expectation formation schemes, induces a build-up of financial instability by increasing debt-asset ratios, as the future liquidity and solvency status depend increasingly on the validation of euphoric inflation expectations. If the actual inflation rate does not rise to expected levels due to disinflation or even deflation, asset prices are going to collapse inducing widespread failures among firms and financial institutions.

As outlined in section 2.3.4, the boom phase comes to a halt and passes over into actual financial distress, when agents realize that inflation expectations had been unrealistic due to an actual deterioration of cash flow and liquidity positions, being induced generally by disinflation or even deflation, resulting from tightening monetary policy, from an overall increase in the assessment of risk, and from a reduction in growth. Deflation, disinflation and rising nominal interest rates lead to an increase in actual and expected real interest rates, causing failures of especially highly leveraged business units and triggering the asset price bubble’s burst. Formally, according to equation 2.40, the collapse of asset prices \( P_A \) can be induced by a rise in the nominal interest rate \( i \), by a fall in the expected price level \( P^e \), and by a fall in the price level’s expected growth rate \( \tilde{p}^e \).

The burst of the asset price bubble, as well as failures of business firms and financial institutions induce an expectations-led cumulative downward process which tends to ex-
hibit excess volatility if expected future changes of the price level are smaller than the actual change of the price level, and if the price level's expected future growth rate is smaller than the price level's actual growth rate.\textsuperscript{50} Formally, according to equation 2.40, excess volatility in bust phases is characterized by $dP^e < dP$ and $d\hat{\varphi}^e < d\hat{\varphi}$ implying $P^e < P$. This “expectation undershooting” comes to an end when agents realize that expectations had been too pessimistic, and that cash flow and solvency positions, as well as debt-asset ratios have returned to sustainable levels.

Summing up, financial instability increases/decreases with increasing/decreasing monetary instability, implying that financial instability is reduced by monetary policy aiming at a stabilization of the price level’s actual and expected growth rate, and increases if monetary authorities cause unexpected changes in the price level’s growth rate by unexpected and discretionary shifts in monetary policy leading to excess volatility in price expectations.

**Monetary Instability and Real Debt Burdens - Debt Inflation and Debt Deflation.** Hitherto, the discussion referred mainly to the impact of price level instability on real interest rates, real borrowing costs and asset prices, and neglected the impact of changing real debt burdens via debt inflation and debt deflation on financial instability, having been originally emphasized by I. Fisher (1932, 1933). Debt inflation and debt deflation are commonly defined by the real value of net debt, which is defined as the real value of the sum of debts less the real value of the sum of assets.\textsuperscript{51} Applying this definition to the stylized balance sheet in figure 2.1, the real value of net debt, $NDB_r$, is given as

$$NDB_r = \frac{NDB}{P} = \frac{DB + sDB^* - (P_A A + sP_A^* A^* + LMA)}{P}, \text{ (2.41)}$$

where $NDB$ denotes the nominal value of net debt, and $P$ the general price level. It has to be emphasized that the real value of net debt can be only used to define debt inflation and debt deflation by identifying their determinants, but cannot be applied to “measure” changes in the real debt burden via changing values in $NDB_r$ which has a negative sign in case of solvency, and a positive sign in case of insolvency. For example, in case of solvency, a fall in $P_A$ and $P_A^*$, both engendering debt deflation being outlined below, cause a rise of $NDB_r$, whereas a fall in $P$, also causing debt deflation, leads to a fall in $NDB_r$.

The term “debt inflation”, designating a fall in the real debt burden, and the term “debt deflation”, labelling a rise in the real debt burden, are not uniformly defined in the economic literature. While some authors associate debt inflation/debt deflation with a rise/fall in the aggregate price level, other authors have emphasized asset price inflation/deflation. Common to all definitions is the neglect of open-economy effects, as e.g. the influence of a changing external value of a currency, or the influence of foreign asset prices. In order to overcome existing inconsistencies and to enlarge existing definitions, the present contribution defines debt inflation/debt deflation following equation 2.41, firstly, as a rise/fall in prices of domestic and foreign assets $P_A$ and $P_A^*$, secondly, as a rise/fall in the general price level $P$, thirdly, as a fall/rise in the exchange rate $s$ in case the balance sheet exhibits a foreign net debtor position ($DB^* > P_A^* A^*$), and as a

\textsuperscript{50}Note that this statement is valid both in the case of deflation and in the case of disinflation.

\textsuperscript{51}For the definition of the real value of net debt, as well as for an overview of the literature on the influence of changing real debt burdens on financial stability, see e.g. Eichengreen and Grossman (1997).
rise/fall in the exchange rate $s$ in case the balance sheet exhibits a foreign net creditor position $(DB^* < P_A^* A^*)$. Among debt inflation/debt deflation, the real debt burden decreases/increases in case of a fall/rise in domestic debt and/or foreign debt $DB$ and $DB^*$, as well as in case of a rise/fall in domestic and/or foreign asset stocks $LMA, A$ and $A^*$, implying a fall/rise in the debt-asset ratio.

Financial instability increases/decreases if there is debt deflation/debt inflation, as the amount of debt repayment in real terms increases/decreases. Combining the results of the previous paragraph and of section 2.3.4, boom phases driven by excess volatility are able to lower financial instability due to debt inflation, being caused by a rise in domestic, and possibly foreign asset prices $P_A$ and $P_A^*$, by a rise in the domestic price level $P$, and in case of flexible exchange rates combined with a foreign net debtor position by a fall in the exchange rate $s$. It has to emphasized however, that the fall in the real debt burden is dampened, or can be even overcompensated by an increase in the debt-asset ratio. Consequently, in case there is excessive overborrowing during boom phases which overcompensates the reduction in the real debt burden via inflation, rising asset prices and declining exchange rates, being characteristic of the period just before the upper turning point, financial instability increases.

Bust periods are generally associated with an increase in financial instability due to debt deflation, causing a rise in the real debt burden via declining domestic, and possibly foreign asset prices, deflation, and via an increase in the exchange rate in case of a foreign net debtor position. It has to be emphasized as well, that the rise in the real debt burden can be dampened, or even overcompensated by a general decrease in the debt-asset ratio during the late bust phase. As a result, in case of large reductions in the debt-asset ratio which overcompensate the rise in the real debt burden by deflation, declining asset prices, and rising exchange rates, being characteristic of the period just before the lower turning point, financial instability decreases.

### 2.4 Exogenous and Endogenous Financial Crises

This section discusses briefly different theoretical views of the fundamental causes of financial crises by applying the present analysis of financial instability and financial crises of sections 2.1 to 2.3 to current approaches to financial crises, which are discussed in much more detail in sections 4.5 and 5.5. Standard theory of financial crises, which is going to be discussed in detail in sections 3.5, 4.5, and 5.5, can be classified into two broad categories, namely in theories of endogenously caused financial crises, and in theories of exogenously caused financial crises, as already outlined briefly in section 1.1. The largest part of the existing literature on the causes of financial distress is dominated by standard or mainstream economic theory, assuming that modern capitalist economies are inherently stable and that financial crises can be only caused by adverse exogenous shocks to economic fundamentals, or by an exogenous shift from optimistic towards pessimistic (rational) expectations which become self-fulfilling. By way of contrast, models stressing the endogenous character of financial instability and financial crises, representing the minority in the financial crises literature, assume that modern capitalist economies are inherently unstable, as there are interactions between the real and the financial sphere of modern economies which cause an endogenous build-up of financial instability, leading finally to financial crises.
The following discussion analyzes the propagation mechanisms of exogenous shock-driven and endogenous financial crises, being followed by a short description of mixed approaches. The sections ends with an outlook on an alternative mixed perspective on financial crises which is going to be developed formally in part II of the book.

Exogenous Shock-Driven Financial Crises. Models of exogenous shock-driven financial crises generally abstract from financial instability as defined in section 2.3, as they assume that modern capitalist economies are inherently stable and that agents are subject to rational behaviour. Consequently, financial instability cannot arise as excess volatility in asset prices and in the price level, leading to overindebtedness according to unrealistic expectations, are not possible. Thus, the only possibility for financial crises to occur are large random exogenous shocks to economic fundamentals, or random exogenous shifts in (rational) expectations which become self-fulfilling. Moreover, exogenous-shock driven models are not characterized by extensive boom-bust cycles, but describe only the contractionary effect on real economic activity in case of large exogenous shocks, as the build-up of financial instability during expansionary phases is excluded by the existence of rational expectations.

Following the general definition of financial crises in section 2.3.1, the logic of financial crises driven by exogenous shocks to economic fundamentals runs from random exogenous real sector shocks, as e.g. adverse terms of trade or technology shocks, and/or random exogenous financial sector shocks, as e.g. domestic or foreign interest rate increases, to collapses in asset prices whose effects on general financial market conditions and real economic activity depend on the size of the initial exogenous shock, determining whether a crisis is systemic or spurious. Consequently, large/small adverse exogenous real and/or financial shocks lead to large/small drops in asset prices causing a systemic/spurious financial crises.

Respecting the propagation mechanism of financial crises driven by random shifts in (rational) expectations, the logic runs from an exogenous deterioration of ex ante expectations regarding real sector or financial sector variables, to actions by agents which lead to an actual deterioration of real sector of financial variables and to a collapse of asset prices, so that expectations are validated ex post, i.e. expectations are self-fulfilling. For example, an expected depreciation of the home currency, and an expected rise in domestic interest rates being associated with an expected drop in asset prices, leads to actual large capital outflows, an actual rise in domestic interest rates, an actual collapse of asset prices and, if foreign exchange reserves do not suffice, to an actual devaluation of the home currency. The size of the asset price drop, as well as the impact on real economic activity and financial market conditions, depends on the size of the shift in expectations. Accordingly, a small/large deterioration of expectations leads to an actual small/large drop in asset prices inducing a spurious/systemic financial crisis.

Endogenous Financial Crises. Models of endogenous financial crises contend that financial distress is caused by an endogenous build-up of financial instability as described in section 2.3 in boom phases, passing over finally into financial crises, and real economic contractions due to expectations-led overindebtedness. Accordingly, models of endogenous financial crises assume that modern capitalist economies are inherently unstable due to
unrealistic and irrational expectations giving rise to extensive boom-bust cycles, and that financial crises are a "normal" outcome of economic development.

Following the general definition of financial crises according to section 2.1, and the financial instability analysis owing to section 2.3, the logic of endogenous financial crisis models runs from an endogenous increase in indebtedness, asset prices, inflation, and real economic activity to an unavoidable deterioration of real and financial market activity as described in section 2.3.4 due to the existence of natural limits. Consequently, the endogenous increase in financial instability causes endogenous deteriorations in the real and/or in the financial sector, as e.g. rising input costs, a terms of trade deterioration, domestic and foreign interest rate increases, increases in overall risk perception, etc., which lead endogenously to a drop in asset prices and to systemic financial crises as financial instability is high. In contrast to exogenous-shock driven models, even very small "shocks", i.e. small endogenous deteriorations in the real and/or in the financial sector, suffice to cause systemic financial crises. Consequently, according to the theory of endogenous financial crises, spurious financial crises are a very rare event.

Mixed Approaches. There are only few models of financial crises arguing that financial distress is caused by the combination of exogenous and endogenous factors. Regarding standard theory of financial crises, only asymmetric information models stressing the importance of moral hazard driven financial distress provide a mixed approach. According to these models, moral hazard induces a large endogenous build-up of financial instability by an immoral increase in indebtedness due to distorted risk perceptions resulting from government guarantees. For example, if there is a general government guarantee to bail-out troubled banks, investment decisions by bankers are more risky than without the existence of these guarantees, as the government takes over losses in case of default. Nevertheless, the fact that moral hazard driven financial crisis models explain the build-up of financial instability by endogenous mechanisms, they argue that financial crises only occur in case of exogenous shocks. Consequently, the endogenous build-up of financial instability is sustainable as long as there are no exogenous shocks. Moreover, the reason for an endogenous build-up of financial fragility is the existence of exogenously given government guarantees. Thus, if there were no government guarantees, there would be no endogenous build-up of financial fragility at all.

An Outlook on a Synthetic View of Financial Crises. A detailed analysis of the stylized facts of financial crises, which is going to be set out in the following chapter, shows that financial crises are neither purely exogenous nor purely endogenous events, and that it is unrealistic to assume that a large endogenous build-up of financial instability evolves into a systemic financial crisis only if there arise exogenous shocks. Hence, as the next chapter is going to point out, current approaches to financial crises are too polarized to provide a full understanding of the propagation mechanisms of financial crises.

The present approach, formally outlined in part II of the book, tries to overcome the existing polarization by developing a synthetic view of financial crises which argues, based on stylized facts of business cycles and financial crises, that modern capitalist economies are generally subject to cyclical fluctuations in goods and financial markets, being driven by endogenous fluctuations in expectations and indebtedness. These endogenous business cycles are characterized by cumulative upward and downward processes which are inher-
ently stable in the absence of exogenous shocks. Hence, a “normal” functioning implies an endogenous build-up of a low degree of financial instability during the boom phase, which however does not cause a systemic financial crisis but only a mild recession giving rise to the next business cycle. By way of contrast, systemic financial crises can be caused only by positive exogenous shocks to expectations leading to an unsustainable increase in financial instability and to extensive boom-bust cycles, or by exogenous adverse real or financial sector shocks resulting in a large contraction.
Chapter 3

Stylized Facts and Standard Theory of Financial Crises

3.1 Defining and Identifying Financial Crises

Hitherto, financial crises have been defined and categorized, according to the general definition set out in section 2.1, by asset price drops and by the strength of the transmission mechanism of financial sector disturbances into the real sphere of an economy. Notwithstanding the fact that this general definition provides deep theoretical insights into the explanation of financial crises and financial instability, it cannot be applied to identify and to “measure” financial crises empirically due to a limited capacity to observe and to process relevant variables. If financial crises were identified and measured according to the general definition set out in section 2.1, an empirical study would have to observe asset price and interest rate behaviour of a large number of different financial and real assets, as well as a huge number of microeconomic cash flow and balance sheet data of a large number of financial and nonfinancial firms, being not feasible from an empirical perspective.

In order to bridge the gap between the necessity of a multidimensional approach to identify and to measure financial crises, and a limited capacity and number of well-observable macroeconomic variables and indicators, the empirical literature generally distinguishes among three types of financial crises, namely, currency crises, banking crises and twin crises (being defined as the simultaneous occurrence of currency and banking crises within a certain time period), whose identification and measurement is not trivial, but feasible from an empirical perspective. The following three subsections 3.1.1 to 3.1.3 are going to describe both the empirical definition as well the identification of currency, banking and twin crises, serving as a basis for the following sections of this chapter.

3.1.1 Currency Crises

Following the empirical literature on financial crises, currency crises are generally defined as follows:

A currency crisis is a situation in which a speculative attack on the exchange value of a currency causes a devaluation, or a sharp depreciation of the currency, or forces authorities (central banks or governments) to defend the cur-
This definition reflects the empirical fact that currency crises can be observed under all kinds of exchange rate regimes, and need not result in a devaluation or depreciation of the currency in case authorities successfully defended a speculative attack. Furthermore, the definition states that a crisis situation only arises in case of the emergence of speculative pressure on a currency by the private sector, implying that not each devaluation or depreciation can be labelled as a currency crisis, like e.g. regular devaluations directed by officials (realignments), an official widening of fluctuation bands, or "normal" depreciations of flexible exchange rates.

Empirically, currency crises are identified by an index of speculative pressure (ISP), which is generally calculated, following the definition above, as a weighted average of nominal exchange rate changes, short-term interest rate changes and foreign exchange reserve changes, where all variables are measured relative to a reference country, being characterized by a stable and credible currency.\(^1\) Formally, a general index of speculative pressure on country \(x\)'s currency at time \(t\), \(ISP_{x,t}\), could take the following form,

\[
ISP_{x,t} = \frac{1}{\sigma_s} \left( \frac{\Delta s_{x,t}}{s_{x,t-1}} \right) + \frac{1}{\sigma_i} \Delta (i_{x,t} - i_{ref,t}) - \frac{1}{\sigma_Z} \left( \frac{\Delta Z_{x,t}}{Z_{x,t-1}} - \frac{\Delta Z_{ref,t}}{Z_{ref,t-1}} \right),
\]

where \(s_{x,t}\) denotes the price of one unit of the reference country's currency in \(x\)'s currency at time \(t\), \(i_{x,t}\) the short-term interest rate in country \(x\) at time \(t\), \(i_{ref,t}\) the short-term interest rate in the reference country at time \(t\), \(Z_{x,t}\) foreign exchange reserves of country \(x\) at time \(t\), and \(Z_{ref,t}\) foreign exchange reserves of the reference country at time \(t\), and \(\Delta y_j\) the change of variable \(y\) in country \(j\) between time \(t\) and \(t-1\), i.e. it holds that \(\Delta y_j = y_{j,t} - y_{j,t-1}\). Since the volatility of exchange rates, interest rate differentials and foreign exchange reserves differentials is very different, the three components are generally weighted by the inverse of their standard deviation to equalize the volatilities of the three components, thereby preventing any one of them dominating the index, where \(\sigma_s\) denotes the standard deviation of the rate of change of the nominal exchange rate \(s\), \(\sigma_i\) the standard deviation of the change of the short-term interest rate differential, and \(\sigma_Z\) the standard deviation of the difference of the rate of change of foreign exchange reserves in the reference country and in country \(x\).\(^2\)

Currency crises are defined as "extreme" values of the speculative pressure index, where extreme values are distinguished from "normal" values by exceptional deviations

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\(^1\)For a theoretical foundation of the speculative pressure index's components, see Girton and Roper (1977).

\(^2\)For this type of speculative pressure index based on the general definition of currency crises as aforementioned, see e.g. Eichengreen, Rose and Wyplosz (1995, 1996), International Monetary Fund (1998a), chapter IV, Goldstein et al. (2000), and Bordo et al. (2001b). Though most empirical studies use speculative pressure indexes as represented above, there are also studies, as e.g. Kaminsky and Reinhart (1999), which neglect short-term interest rate changes due to the existence of interest rate controls in some sample countries. Other studies, as e.g. Goldfajn and Valdés (1997a), use real exchange rate changes instead of nominal exchange rate changes to distinguish changes in nominal exchange rates caused by inflation differentials from changes which affect the purchasing power of a currency. According to these studies, nominal depreciations that solely keep up with inflation differentials leaving the real exchange rate unchanged, are not considered as currency crises, implying that large devaluations stemming from hyperinflation are not classified as currency crises.
from average deviations. Formally, currency crises are identified in most cases by ISP-values which are 2 standard deviations or more above the sample mean, i.e. currency crises are defined by an \( ISP_{x,t} \) value, satisfying

\[
ISP_{x,t} > \mu_{ISP} + 2 \sigma_{ISP},
\]

where \( \mu_{ISP} \) denotes the sample mean, \( \sigma_{ISP} \) the standard deviation of the ISP-index.\(^3\)

### 3.1.2 Banking Crises

In contrast to currency crises, the empirical literature provides no general definition of banking crises which could serve as a basis for their empirical identification. Rather, empirical studies mainly refer to a mixed set of empirically observable indicators which are used to "define" banking crises. In order to establish a uniform basis for the empirical analysis of banking distress in the following, banking crises are defined, according to the results of section 2.2.4, as follows:

**A banking crisis is a situation in which the banking sector is faced with sharply deteriorating liquidity and/or solvency positions, causing bankruptcy by illiquidity and/or insolvency, or inducing interventions by central banks and governments in the form of liquidity and capital support (bail-out programmes) to prevent bankruptcies.**

Empirically, banking crises are identified predominantly by a qualitative approach stressing "events" due to the lack of quantitative high-frequency data.\(^4\) The first group of events indicating a banking crisis are bank runs which lead to a closure, or to a merger of one of more financial institutions, or which cause a takeover of one of more banks by the public sector. Bank runs, having been defined formally by condition 2.9 in section 2.2.4.2, are generally identified by changes in bank deposits, and thereby indicate bankruptcy in the form of illiquidity, stemming from the debt side of banks’ balance sheets.

However, though data on bank deposits are readily available for almost all countries, detecting banking crises by bank runs can be a very poor measure for banking distress if there are effective lender of last resort interventions by central banks, or if there exist efficient deposit insurance systems, preventing bank runs in spite of severe distress in the banking sector. Furthermore, in most cases, bank runs are the result rather than the cause of banking sector distress, because illiquidity and insolvency in recent years were predominantly caused by a deterioration of banks’ asset quality, having been induced e.g. by collapses in real estate or stock prices, or by increasing bankruptcies in the nonfinancial sector having led to a rise in the share of nonperforming loans. This suggests that large fluctuations in real estate and stock prices, the share of nonperforming loans in banks’ portfolios and indicators of business failures could serve as much better indicators for banking distress than bank runs. However, data for these variables are readily not available or are incomplete due to banks’ desire to hire liquidity and solvency problems as long as possible. Hence, given these data limitations, banking crises which are not associated

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\(^3\)Some studies, as e.g. Eichengreen, Rose and Wyplosz (1996), use a smaller range, defining currency crises by ISP-values which are 1.5 standard deviations or more above the sample mean.

\(^4\)For this type of approach to identify banking crises, see e.g. Sundararajan and Baliño (1991), Lindgren et al. (1996), and Kaminsky and Reinhart (1998, 1999).
with bank runs, are generally identified by a second group of events which concentrates on closures, mergers, takeovers, or massive central bank or government assistance to one or more financial institutions.

3.1.3 Twin Crises

The empirical literature provides a controversial perspective respecting both the definition and the identification of twin crises. For example, Kaminsky and Reinhart’s (1998, 1999) definition of twin crises reads as follows:

A twin crisis is a situation in which a banking crisis is followed by a currency crisis.

According to this definition, implying that currency crises which are followed by banking crises are not considered as twin crises, episodes of twin crises are identified as instances in which the beginning of a banking crisis is followed by a currency crisis within 48 months, where currency crises and banking crises are identified as aforementioned. By way of contrast, according to Glick and Hutchinson (1999), twin crises’ definition is less restrictive as it allows for both directions of causality, reading as follows:

A twin crisis is a situation in which a banking crisis is associated with a currency crises, or vice versa.

Following this definition, twin crises are identified as instances in which a banking crisis is accompanied by a currency crisis in either the previous, current, or following year. Summing up, as there exists no consensus view on both the definition and the identification method of twin crises, the following description of the stylized facts of twin crises is going to adopt all definitions and identification methods of each empirical study cited.

3.2 Frequency and Severity of Financial Crises

This section is based on the empirical studies by Bordo et al. (2001b) and Eichengreen and Bordo (2002). These two studies are exceptional in comparison to other studies, as e.g. Kaminsky and Reinhart (1998, 1999) and International Monetary Fund (1998a, chapter IV), as they investigate the incidence and costs of financial crises over the last 120 years, distinguishing the gold standard period (1880-1913), the interwar period (1919-1939), the Bretton Woods period (1945-1971), and the post Bretton Woods period (1973-1997), whereas other studies only refer to the post Bretton Woods era. A historical perspective over 120 years, taking into consideration very different monetary, financial and exchange rate regimes with distinct degrees of financial market liberalization and openness of capital accounts, allows for a much better, and more objective analysis of the questions whether the crisis problem has grown more frequent and more severe in the recent decade, and whether domestic and international financial liberalization generally cause a higher degree of financial instability.

The sample consists of 21 countries containing both industrial and emerging market nations for the entire 120-year period. To ease the comparison with other studies referring solely to the post Bretton Woods era, as e.g. Kaminsky and Reinhart (1998, 1999) and
International Monetary Fund (1998a, chapter IV), the study additionally contains a 56-country sample for the 1973-1997 period. Crises dates are identified by the methods outlined in section 3.1. For further details regarding the country sample or crises dates, see the Web Appendix of Bordo et al. (2001b), and section 3.3.

The incidence of financial crises is quantified by the crisis frequency, being calculated by dividing the number of crises by the number of country-year observations in each sub-period, representing the annual probability of a financial crisis in per cent. Furthermore, crisis frequency in each sub-period is determined separately for currency crises, banking crises, twin crises, and for the sum of all crises. The severity of financial crises is measured by the average recovery time and by the output loss. To quantify both numbers, a trend rate of GDP growth is calculated for the five years preceding a financial crisis. Then, average recovery time, being equivalent to crisis duration, is computed as the number of years until actual GDP growth has returned to the GDP growth trend. Subsequently, output loss is computed as the cumulated difference, over the average recovery time, between actual GDP growth and trend GDP growth.

The following description of the empirical data by Bordo et al. (2001b) and Eichen-green and Bordo (2002) does not coincide completely with the authors' interpretation, but departs partly, especially with respect to the effects of financial liberalization.

### 3.2.1 Incidence of Financial Crises

**All Crises.** Table 3.1 summarizes the frequency of financial crises in each sub-period for all sample countries, where the last column portrays the crisis frequency for the sum of currency, banking and twin crises. It shows that the overall frequency of financial crises has grown since 1973 and is high by historical standards. Only the interwar period, being dominated by financial distress caused by the Great Depression, is subject to a slightly higher crisis frequency. A frequency of 12.2% for the 56-country sample during the 1973-1997 period indicates that there was a probability of one eights that countries suffered a currency, banking, or twin crisis in a given year. Comparing the post Bretton Woods era with the gold standard era indicates that financial instability need not be solely caused by globalization of goods and financial markets.

**Currency Crises.** Table 3.1 indicates that the high overall crisis frequency in the post Bretton Woods era is mainly caused by the high frequency of currency crises (7.5%), being highest by historical standards. Only the Bretton Woods era is characterized by nearly the same frequency of currency crises. There is an observable trend towards an increasing frequency of currency crises from 1880 until 1997, indicating that instability in foreign exchange markets does not only depend on the degree of capital mobility, but also on the credibility of currency pegs even in times of stiff financial market regulations and capital controls, as e.g. during the Bretton Woods era.

**Banking and Twin Crises.** Highest frequency of banking and twin crises can be observed during the interwar period, having been caused mainly by the Great Depression. However, crisis frequency during the post Bretton Woods era closely follows the financially unstable interwar period. By way of contrast, tight regulations of domestic and international financial markets during the Bretton Woods era led to an almost complete absence
of banking and twin crises, despite a high currency crisis frequency indicating that capital controls were not as successful as banking regulation. Comparing the goldstandard era with the post Bretton Woods era shows a similar degree of financial instability, implying that especially the occurrence of banking and twin crises, being subject to highest costs as described below, is positively correlated with the degree of financial liberalization.

### Table 3.1: Frequency of Financial Crises (annual % probability), 1880-1997

<table>
<thead>
<tr>
<th>Period</th>
<th>Banking Crises</th>
<th>Currency Crises</th>
<th>Twin Crises</th>
<th>All Crises</th>
</tr>
</thead>
<tbody>
<tr>
<td>1880-1913</td>
<td>2.3</td>
<td>1.2</td>
<td>1.4</td>
<td>4.9</td>
</tr>
<tr>
<td>1919-1939</td>
<td>4.8</td>
<td>4.3</td>
<td>4.0</td>
<td>13.2</td>
</tr>
<tr>
<td>1945-1971</td>
<td>0.0</td>
<td>6.9</td>
<td>0.2</td>
<td>7.0</td>
</tr>
<tr>
<td>1973-1997 (21 countries)</td>
<td>2.0</td>
<td>5.2</td>
<td>2.5</td>
<td>9.7</td>
</tr>
<tr>
<td>1973-1997 (56 countries)</td>
<td>2.3</td>
<td>7.5</td>
<td>2.4</td>
<td>12.2</td>
</tr>
</tbody>
</table>


Crisis Frequency in Industrial and Emerging Market Countries. Table 3.2 summarizes the frequency of financial crises separately for industrial and emerging market countries from 1880 until 1997, where the 56-country sample for the post Bretton Woods era has been neglected. It indicates that financial crises during the goldstandard and during the post Bretton Woods era were mainly centered in emerging market countries, whereas financial crises during the interwar era occurred predominantly in industrial countries. This result validates the findings by de Cecco (1974), Bernanke and James (1991), and Triffin (1998), stating that the financial stability of the center countries (industrial nations) and the financial instability of the periphery (emerging market nations) during the goldstandard era reversed during the interwar period which has been characterized by a financially unstable center and a financially stable periphery.

In order to study the question of whether financial crises have become more frequent within the post Bretton Woods era, Bordo et al. divided the period 1973-1997 in two periods, where 1988 was taken as the borderline when huge portfolio flows from industrial countries to emerging markets started. Regarding currency crises, the first period 1973-1987 was subject to a higher frequency (8.8% annual probability for all countries) than the second period 1988-1997 (5.6% annual probability for all countries), whereas the frequency of banking and twin crises has risen sharply during the second period. The authors calculated that the frequency of banking and twin crises in the second period doubled in the 21-country sample, and increased by 50% in the 56-country sample, indicating that the frequency of financial crises, especially in emerging market countries as aforementioned, has sharply risen during the second half of the post Bretton Woods era.\(^5\)

---

\(^5\)For similar results regarding crisis frequency within the post Bretton Woods era, see International Monetary Fund (1998a), chapter IV, and Kaminsky and Reinhart (1999).
An Assessment. Summing up, the comparison of the frequency of financial crises over the last 120 years indicates that financial crises have become more frequent in the post Bretton Woods era, and are subject to almost the same crisis frequency as in the inter-war years. Particular impressive is the increase in the frequency of twin crises, both in industrial and especially in emerging market countries, during the second half of the post Bretton Woods era, being only slightly surpassed by twin crises’ frequency during the Great Depression period.

Table 3.2: Frequency of Financial Crises in Industrial and Emerging Market Countries (annual % probability), 1880-1997

<table>
<thead>
<tr>
<th>Period</th>
<th>Banking Crises</th>
<th>Currency Crises</th>
<th>Twin Crises</th>
<th>All Crises</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Industrial Countries</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1880-1913</td>
<td>2.0</td>
<td>1.0</td>
<td>0.5</td>
<td>3.5</td>
</tr>
<tr>
<td>1919-1939</td>
<td>3.7</td>
<td>4.3</td>
<td>4.0</td>
<td>12.0</td>
</tr>
<tr>
<td>1945-1971</td>
<td>0.0</td>
<td>5.4</td>
<td>0.0</td>
<td>5.4</td>
</tr>
<tr>
<td>1973-1997</td>
<td>2.5</td>
<td>8.1</td>
<td>1.7</td>
<td>12.2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Emerging Market Countries</th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1880-1913</td>
<td>2.6</td>
<td>1.4</td>
<td>1.9</td>
<td>6.0</td>
</tr>
<tr>
<td>1919-1939</td>
<td>5.8</td>
<td>2.5</td>
<td>2.5</td>
<td>10.8</td>
</tr>
<tr>
<td>1945-1971</td>
<td>0.0</td>
<td>10.3</td>
<td>0.6</td>
<td>10.9</td>
</tr>
<tr>
<td>1973-1997</td>
<td>2.4</td>
<td>9.8</td>
<td>14.6</td>
<td>26.8</td>
</tr>
</tbody>
</table>

Source: Bordo et al. (2001b), Web Appendix, Table 1.

3.2.2 Duration and Costs of Financial Crises

Average Recovery Time. Table 3.3 summarizes the duration patterns of financial crises over the last 120 years. As for currency crises, the average recovery time in the post Bretton Woods era, especially for industrial countries, has fallen in comparison with the goldstandard era, though the frequency of currency crises was much higher in the post Bretton Woods era. Furthermore, average recovery time of currency crises in the 1913-1997 period has fallen significantly, especially for industrial countries as well, in comparison with the goldstandard period, whereas there are no further signs of changing time patterns during the 1913-1997 period. By way of contrast, comparing the average recovery time from twin crises of the goldstandard era with the post Bretton Woods period indicates a significant rise over time, again most remarkably in industrial countries, whereas there is no significant change in emerging market countries. Regarding the average recovery time from twin crises for all countries, there is a significant rise over the last 120 years which is only interrupted by the Bretton Woods period. Concerning the average recovery time from banking crises, there is no significant change in time patterns. Summing up all time trends for all countries and all crises, there is no significant change in the average recovery time during the last 120 years.
Table 3.3: Duration of Financial Crises in Industrial and Emerging Market Countries (average recovery time in years), 1880-1997

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Currency Crises</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>2.6</td>
<td>1.9</td>
<td>1.8</td>
<td>1.9</td>
</tr>
<tr>
<td>Industrial Countries</td>
<td>3.0</td>
<td>1.9</td>
<td>1.7</td>
<td>1.8</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>2.5</td>
<td>2.0</td>
<td>2.1</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Banking Crises</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>2.3</td>
<td>2.4</td>
<td>†</td>
<td>3.1</td>
</tr>
<tr>
<td>Industrial Countries</td>
<td>3.0</td>
<td>2.5</td>
<td>†</td>
<td>3.4</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>2.0</td>
<td>2.1</td>
<td>†</td>
<td>1.0</td>
</tr>
<tr>
<td><strong>Twin Crises</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>2.2</td>
<td>2.7</td>
<td>1.0</td>
<td>3.7</td>
</tr>
<tr>
<td>Industrial Countries</td>
<td>1.0</td>
<td>2.3</td>
<td>†</td>
<td>5.4</td>
</tr>
<tr>
<td>Emerging Countries</td>
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<td>4.3</td>
<td>1.0</td>
<td>2.3</td>
</tr>
<tr>
<td><strong>All Crises</strong></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Countries</td>
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<td>2.4</td>
<td>1.8</td>
<td>2.6</td>
</tr>
<tr>
<td>Industrial Countries</td>
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<td>2.3</td>
<td>1.6</td>
<td>2.8</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>2.3</td>
<td>2.6</td>
<td>2.0</td>
<td>2.1</td>
</tr>
</tbody>
</table>

†: no crisis

Source: Bordo et al. (2001b), Web Appendix, Table 3.

Output Losses. Table 3.4 represents a summary of the costs of financial crises in the form of cumulated GDP growth loss. Comparing the two globalization periods 1880-1913 and 1973-1997 indicates that output losses of currency and banking crises declined in the 1973-1997 period, whereas the costs of twin crises increased. Highest output losses for all types of crises during the last 120 years are centered in the interwar period. Most striking are the high output costs of currency and twin crises in comparison with the other periods, especially in emerging market countries, despite the fact that industrial countries were subject to higher crisis frequency in interwar period. Respecting banking crises, output losses in 1919-1939 period were highest as well, but with a smaller difference to the other periods. Comparing the Bretton Woods period with the post Bretton Woods era indicates that, notwithstanding the fact that output loss from each type of crisis remains constant, output loss in the 1973-1997 period for all crises is larger than in the 1945-1971 period, being mainly caused by an increasing incidence of banking and twin crises in the post Bretton Woods era.
### Table 3.4: Output Loss in Industrial and Emerging Market Countries (cumulated GDP growth loss in per cent), 1880-1997

<table>
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</tr>
<tr>
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<td>14.2</td>
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<td>5.5</td>
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<td>11.4</td>
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<tr>
<td>Emerging Countries</td>
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<td>26.5</td>
<td>9.0</td>
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<td>6.4</td>
</tr>
<tr>
<td><strong>Banking Crises</strong></td>
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<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>8.3</td>
<td>10.5</td>
<td>†</td>
<td>7.0</td>
<td>6.2</td>
</tr>
<tr>
<td>Industrial Countries</td>
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<td>11.5</td>
<td>†</td>
<td>7.9</td>
<td>7.0</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>7.2</td>
<td>8.9</td>
<td>†</td>
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<td><strong>Twin Crises</strong></td>
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</tr>
<tr>
<td>All Countries</td>
<td>14.5</td>
<td>15.8</td>
<td>1.7</td>
<td>15.7</td>
<td>18.6</td>
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<td>17.5</td>
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<td>Emerging Countries</td>
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<td>24.0</td>
<td>1.7</td>
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<td><strong>All Crises</strong></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>9.8</td>
<td>13.4</td>
<td>5.2</td>
<td>7.8</td>
<td>8.3</td>
</tr>
<tr>
<td>Industrial Countries</td>
<td>7.7</td>
<td>12.3</td>
<td>2.4</td>
<td>6.7</td>
<td>6.3</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>10.4</td>
<td>16.5</td>
<td>8.6</td>
<td>10.8</td>
<td>9.2</td>
</tr>
</tbody>
</table>

†: no crisis  
Source: Bordo et al. (2001b), Web Appendix, Table 3.

**Financial Crises With Output Losses.** Table 3.5 illustrates that not each financial crisis was associated with output losses. In the post Bretton Woods era, approximately 75-80% of all financial crises led to a drop in economic growth, where twin crises represent an exception, because each twin crisis causes a recession. The time patterns for other periods are similar, but also exhibit slight variations, as e.g. the fact that financial crises in the goldstandard era were generally subject to larger output losses than financial crises during the interwar, or during the Bretton Woods era.

**An Assessment.** Summing up, both the time patterns of average recovery time and of output losses indicate that financial crises have not become more severe. The depth of financial crises in the two globalization eras 1880-1913 and 1973-1997 are similar high, being only surpassed by the interwar period. The depth of financial crises in the Bretton Woods period, having been subject to stiff domestic and international financial market regulations, is exceptional low due to the absence of banking crises. However, though the crisis problem has not grown more severe regarding the average effect of currency, banking, and twin crises on the real sector, the crisis problem on the aggregate has grown...
Table 3.5: Financial Crises with Output Losses of Total Financial Crises (in per cent), 1880-1997

<table>
<thead>
<tr>
<th></th>
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</thead>
<tbody>
<tr>
<td><strong>Currency Crises</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>75.00</td>
<td>56.25</td>
<td>72.97</td>
<td>78.26</td>
<td>72.94</td>
</tr>
<tr>
<td>Industrial Countries</td>
<td>100.00</td>
<td>53.85</td>
<td>57.14</td>
<td>84.21</td>
<td>82.14</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>66.67</td>
<td>66.67</td>
<td>93.75</td>
<td>50.00</td>
<td>68.42</td>
</tr>
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<td><strong>Banking Crises</strong></td>
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<td></td>
</tr>
<tr>
<td>All Countries</td>
<td>86.67</td>
<td>72.22</td>
<td>†</td>
<td>66.67</td>
<td>73.08</td>
</tr>
<tr>
<td>Industrial Countries</td>
<td>100.00</td>
<td>72.23</td>
<td>†</td>
<td>75.00</td>
<td>66.67</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>81.82</td>
<td>71.43</td>
<td>†</td>
<td>0.00</td>
<td>76.47</td>
</tr>
<tr>
<td><strong>Twin Crises</strong></td>
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</tr>
<tr>
<td>All Countries</td>
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<td>87.50</td>
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</tr>
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<td>Emerging Countries</td>
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<td>100.00</td>
<td>100.00</td>
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</tr>
<tr>
<td><strong>All Crises</strong></td>
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<td></td>
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</tr>
<tr>
<td>All Countries</td>
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<td>70.83</td>
<td>72.97</td>
<td>80.95</td>
<td>77.94</td>
</tr>
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<td>68.57</td>
<td>55.00</td>
<td>83.87</td>
<td>80.95</td>
</tr>
<tr>
<td>Emerging Countries</td>
<td>79.17</td>
<td>76.92</td>
<td>94.12</td>
<td>72.73</td>
<td>76.60</td>
</tr>
</tbody>
</table>

†: no crisis

Source: Bordo et al. (2001b), Web Appendix, Table 6.

during the post Bretton Woods era due to an increasing crisis frequency, especially of twin crises whose adverse effects on output have also grown over time.

### 3.3 Business Cycles, Financial Liberalization, and Financial Crises

#### 3.3.1 Basic Links

Tables 3.6 to 3.10, being based on Bordo et al. (2001b) and Eichengreen and Bordo (2002), portray business cycle turning points and financial crises dates over the last 120 years, distinguishing the goldstandard period 1880-1913 (table 3.6), the interwar period 1919-1939 (table 3.7), the Bretton Woods period 1940-1971, and the post Bretton Woods period 1972-1998 (tables 3.9 and 3.10). The country sample for the 1880-1998 period consists of twelve selected countries (Argentina, Brazil, Canada, Chile, Finland, France, Germany, Japan, Norway, Sweden, UK, US), where the post Bretton Woods period has been enlarged by eleven further countries (Denmark, Indonesia, Israel, Korea, Malaysia,
Mexico, Philippines, Spain, Thailand, Turkey, Uruguay), as well as by the dates of the beginning of financial liberalization in the aftermath of the breakdown of the Bretton Woods system, which are taken from Williamson and Mahar (1998) who define financial liberalization by six dimensions, namely by the elimination of credit controls, the deregulation of interest rates, free entry into the banking and into the financial services industry, bank autonomy, private ownership of banks, and by the liberalization of international capital flows.6 Regarding financial crises dates, tables 3.6 to 3.10 illustrate the occurrence of banking and currency crises and waive an extra specification of twin crises, since they are indicated, as outlined in section 3.1.3, by a banking crisis which is accompanied by a currency crises in the previous, current, or following year.

The analysis of the empirical data with respect to the link between business cycles, financial liberalization and financial crises depicted in tables 3.6 to 3.10 can be summarized in five empirical regularities which hold for the entire 120 year period, thereby providing important insights into the causes and propagation mechanisms of financial crises which serve as a basis for the theoretical analysis in part II of the book.

Firstly, in periods of highly regulated financial systems, as e.g. in the Bretton Woods era and in the beginning of the post Bretton Woods period, there is no apparent link between banking and currency crises, indicating that the frequency of twin crises is low or even absent, as already stated in the previous section. By way of contrast, in periods of liberalized domestic and international financial markets, as e.g. in the goldstandard era, in the interwar period, and in the second half of the post Bretton Woods period, banking and currency crises become closely intertwined, implying that the frequency of twin crises is positively correlated with the degree of financial liberalization. Respecting the post Bretton Woods era, there exists a very close link between financial liberalization and the occurrence of twin crises.7

Secondly, financial crises are inseparably associated with business cycles fluctuations. Currency, banking and twin crises generally occur shortly after economies have passed business cycle peaks and enter a recession, or the downswing period. Recessions following financial crises are more severe in terms of GDP losses than recessions without the occurrence of a financial crisis, i.e. crises make recessions worse.8

Thirdly, twin crises are subject to a characteristic time pattern regarding the order of banking and currency crises. In most cases, a twin crisis starts with banking sector problems after the economy has entered a recession leading to a currency crisis. The currency crash deepens further the banking crisis and aggravates the recession by high domestic interest rates which have been increased to defend the exchange rate peg, or to support risky exposures of domestic residents in foreign currency, engendering a vicious spiral. Accordingly, the direction of causality between currency and banking crises is not unidirectional. The empirical picture indicates that there are also cases in which twin crises are initiated by currency crises, being however subject to a much lower incidence.

Fourthly, notwithstanding the fact that financial crises occur recurrently over time and are an inseparable part of business cycles, not each business cycle is associated with finan-

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6. The causes and elements of large-scale financial sector liberalization in the post Bretton Woods era, both in industrial and in emerging market countries, are briefly discussed in the following section.

7. For this result, see also Kaminsky and Reinhart (1999).

8. For this result, see also Mitchel (1941), Cagan (1965), Zarnovitz (1992), pp. 105-109, Milesi-Ferretti and Razin (1998), Honohan and Klingebiel (2000), and International Monetary Fund (2002), chapter III.
cial crises. Rather, there are periods with "tranquil" business cycles being characterized by stable financial and goods market conditions, which are interrupted by business cycles being associated with financial crises. As the following section is going to show, cycles associated with financial crises are subject to a much higher amplitude of macroeconomic variables than tranquil business cycles. That is, business cycles generating financial crises are characterized by an extensive expansion phase, being driven by domestic credit booms and large volumes of capital inflows which lead to asset price bubbles and overindebtedness, and finally to severe and systemic financial crises being followed by recessions, or even depressions and debt-deflation.  

Fifthly, after the occurrence of financial crises associated with deep downswings in macroeconomic activity, economies generally tend to recover and return to tranquil business cycle fluctuations, though the recovery period can be very long. This result suggests that economies tend to be cyclically stable in the long-run, i.e. economies tend to return endogenously after a "financial crisis cycle" to tranquil business cycle fluctuations. Furthermore, this observation suggests also that financial crises are not a "natural" or endogenous outcome of capitalist systems, but can be considered as the result of some exogenous events giving rise to extensive boom-bust cycles which lead to financial crises.  

A further important empirical regularity, which however cannot be derived from tables 3.6 to 3.10, is the stylized fact, that both tranquil and financial crisis business cycles in emerging markets are subject to much higher amplitudes, i.e. to much higher fluctuations in real and financial sector variables, than tranquil and financial crisis cycles in industrial countries.  

There are three main explanations for higher amplitudes of business cycles in emerging markets. Firstly, emerging market are more vulnerable to commodity price and terms of trade shocks as they export highly specialized products, and as they are more dependent on commodity imports, as e.g. oil. Secondly, financial systems in emerging market countries are less developed and less regulated than financial systems in industrial countries, implying less possibilities to diversify risk (credit risk, exchange rate risk, etc.), a higher degree of systemic risk due to larger information asymmetries, and larger fluctuations in domestic credit and capital flows. Thirdly, macroeconomic policies in emerging markets tend to be procyclical owing to weak institutions and larger external shocks requiring larger compensating macroeconomic policies.  

### 3.3.2 Financial Liberalization in the Post Bretton Woods Era

It has been argued in the previous section that there exists a close empirical link between financial sector liberalization and the occurrence of extensive boom-bust cycles giving rise to twin crises, being very marked in the post Bretton Woods era. In order to get a deeper understanding of financial liberalization policies in the post Bretton Woods era,
this section is going to provide background information on the causes for widespread liberalization policies, both in industrial and in emerging market countries, and discusses furthermore theoretical arguments, expected benefits and empirical evidence on financial liberalization.

Causes for Liberalization Policies in Industrial Countries. Widespread liberalization policies in industrial countries in the 1980s originated from a neoclassical counter-revolution in economic theory and policy which was initiated by conservative governments in the U.S., Canada, Britain and West Germany in the late 1970s. The causes for liberalization stemmed from a bad economic macroeconomic performance during the 1970s especially in the U.S., which was characterized by stagflation and low productivity growth.

The poor macroeconomic record was predominantly explained by an ineffective demand-side policy mix that increased aggregate demand with easy money while restricting output with high taxes, by the two oil price shocks in 1973 and 1979, and by a breakdown of the Phillips-Curve due to the existence of rational expectations having resulted in the inefficiency of monetary policy as a demand management tool. Furthermore, stagflation and low productivity growth were also explained by inefficient government regulation of network industries, as e.g. in the telecommunications and aviation sectors, and by heavy domestic and international financial market regulations in the form of interest rate controls, capital controls, etc., having led to an inefficient allocation of savings into investment opportunities, to low GDP growth, and to low productivity growth. Strong financial market regulations at the beginning of the early 1970s originated from the Bretton Woods system and were imposed, as a consequence of the Great Depression, to prevent future systemic financial crises.

In order to improve macroeconomic performance, the Reagan administration in the U.S. officially abandoned conventional demand management policies, and implemented supply-side economics in order to expand output by lowering the after-tax cost of labour and capital which was supported in the beginning by tight monetary policy to restrain inflation. Supply-side economics is based on the neoclassical view that relative prices determine macroeconomic performance as they govern economic agents’ decision how to allocate income between consumption and saving, and how to allocate time between leisure and work. Regarding economic policy, supply-side economics generally claims that fiscal policy can be only stimulative by lowering the marginal tax rate, leading to an increase in the discounted income stream, to a rise in the price for current consumption and thereby to higher savings, to a rise in the price for leisure and thereby to an increasing labour supply, which increases investment and promotes growth. By way of contrast, fiscal policy is not believed to be stimulative by increasing disposable income, for example by raising government expenditures. Monetary policy as a demand management tool is believed to ineffective due to the existence of rational expectations. Respecting the origin of business cycle fluctuations, supply-side economics generally assumes that business cycles, following “real business cycle theory”, are mainly driven by exogenous shocks to technology and preferences, and by the incentives and disincentives of tax policy, but not by monetary phenomena as Keynesians and monetarists would claim.12

For supply-side policy to work efficiently, distortions in the price mechanism have to be absent which requires that markets are fully competitive. As a result, the belief that

12For a formal treatment of supply-side economics, see e.g. Lucas (1990).
markets are only efficient in case they are fully liberalized led to widespread liberalization policies in all regulated sectors and fields, as e.g. in aviation, telecommunications, financial services, international trade, international capital movements, etc.\textsuperscript{13}

**Causes for Liberalization Policies in Emerging Markets.** Product, factor and financial markets in emerging market countries were heavily regulated at the beginning of the post Bretton Woods period, predominantly as a consequence of the “International Dependence Revolution” underdevelopment theory of the 1960s. Dependence theory argues that Third World underdevelopment is predominantly caused by predatory activities of the First World. To end predation, the Third World has to protect itself by heavy government interventions from the First World by limiting international trade with the First World to become autarkic, and by outright expropriation of privately owned assets, as public asset ownership and control is believed to be more effective to reduce poverty, income inequality, and unemployment. A widespread implementation of dependence theory in emerging market countries led to the evolution of socialist societies, very often by violent overthrow of existing elites, to industrial nationalization and to financial repression.

A financially repressed economy is subject to heavy government regulations determining the price, the amount and the distribution of credit. Furthermore, financially repressed systems are characterized by administered interest rates at levels below market-clearing interest rates. These artificial interest rates generally cause credit rationing which represses investment finance due to a shortage of savings. Administered interest rates below market-clearing levels are predominantly set to finance budget deficits by the issuance of low-interest bonds to private financial institutions, having led very often to negative real interest rates by high fiscal deficit-induced inflation. Another way to finance budget deficits in financially repressed economies is to tax the banking system by high required reserve ratios (up to 50%) if income taxes are low, if domestic markets for the issuance of government debt are absent, and if there exists no access to international credit markets.\textsuperscript{14}

The neoclassical counterrevolution in industrial countries in the late 1970s led to a fundamental change in the theoretical view about economic development in emerging market countries. As opposed to dependence theorist, proponents of the neoclassical counterrevolution argue that underdevelopment in emerging markets results predominantly from poor resource allocation caused by incorrect pricing and heavy government interventions. To end underdevelopment, economic growth and productivity have to be boosted by widespread liberalization of factor, product, and financial markets, by privatizing state-owned enterprises, and by promoting free trade. As past macroeconomic records under heavy government interventions were poor, there was a quick switch to market fundamentalism in emerging market countries at the end of the 1970s and at the beginning of the 1980s.

The first wave of extensive liberalization of product, factor, and especially of financial markets, mainly in Latin America (Brazil, Mexico, and in the Southern Cone countries Chile, Argentina and Uruguay\textsuperscript{15}) and in Africa, gave rise to extensive boom phases which

\textsuperscript{13}For further details on liberalization policies and supply-side economics in industrial countries, see e.g. Krugman (1994) and Roberts (2003).

\textsuperscript{14}For details on financial repression, see McKinnon (1973), Shaw (1973), and McKinnon and Matthieson (1981).

\textsuperscript{15}For details on the liberalization process in the Southern Cone countries having been followed by
were mainly driven by foreign capital inflows from European and US-American banks, and which led to heavy overborrowing. The boom phases came to an end at the beginning of the 1980s due to four reasons. Firstly, overly optimistic expectations with regard to revenues from future exports were disappointed due to dropping market prices for international non-oil tradables and recessions in industrial countries which led to an enormous deterioration of the terms of trade and of the current account. Secondly, capital inflows were predominantly used to finance private consumption and government expenditures which led to a large increase in fiscal deficits, imports, real overvaluations of domestic currencies by high inflation and fixed exchange rates, and to large current account deficits, having caused an enormous deterioration of the international liquidity and solvency position to service due foreign debt. Thirdly, the two oil price shocks in 1973 and 1979 led also to an enormous deterioration of the current account of non-oil exporting emerging market countries. Fourthly, the imposition of supply-side economics in the US led to sharply increasing interest rates and to a further deterioration of emerging market countries' liquidity and solvency position as most foreign debt was short-term and subject to floating interest rates. These four factors led to the international debt crisis, which was initiated by international illiquidity of Mexico in 1982, having been followed by most Latin American countries and later by a large number of other emerging market countries. International bankruptcy of emerging market countries led to systemic twin crises by sudden and large capital outflows. These systemic financial crises caused severe and long-lasting recessions especially in Latin America, being often referred to as the “lost decade”, which is illustrated in tables 3.9 and 3.10 (see especially Argentina, Brazil, Chile, Mexico and Uruguay). 16

The international debt crisis during the 1980s led to a drying up of international liquidity for emerging market countries as access to international capital market was denied. However, in the early 1990s the second wave of liberalization policies in emerging market countries started, having been initiated by the establishment of the “Washington Consensus” by J. Williamson as the lowest common denominator of policy advice by the World Bank and the International Monetary Fund to Latin American countries in 1989 to overcome the adverse impacts of international debt crisis. Following Williamson (1990, 2000), the Washington Consensus can be summarized in ten propositions, namely, fiscal discipline, redirection of government expenditures in fields with high prospective future returns to improve income distribution as e.g. health care, tax reform by lowering marginal tax rates (as proposed by supply-side economics), interest rate liberalization, competitive exchange rates, trade liberalization, liberalization of inflows of foreign direct investment, privatization, deregulation to abandon barriers of entry and exit, and the establishment of secure property rights. The Washington Consensus led to large-scale liberalization policies, especially in financial sectors, which attracted a new wave of large capital inflows to emerging market countries having caused extensive booms and overborrowing which ended, as the international debt crisis, in severe financial crises in Mexico (1994), Asia (1997-1998), Argentina (1995 and 2000), and in Brazil and Russia (1998) which led almost to a collapse of the U.S. banking system (LTCM affair). Furthermore, large-scale financial liberalization in the 1990s led also to severe financial crises in the Nordic countries Finland, severe twin crises, see e.g. Diaz-Alejandro (1985) and Velasco (1987).

16 For details on the international debt crisis, see e.g. Bank for International Settlements (1983), Sachs and Larrain (1993), and Lamfalussy (2000).
Norway and Sweden which are comparable to the emerging market crises in Mexico (1994) and in Asia (1997-1998).\textsuperscript{17}

\textbf{Theoretical Arguments for the Efficiency of Liberalization.} The general argument that liberalization policies, and especially financial liberalization which is going to be referred to in the following, improve economic efficiency originates from the combination of the first part of the fundamental theorem on welfare economics with the efficient (capital) market hypothesis (Eatwell 1996). The first part of the fundamental theorem on welfare economics states that each equilibrium in competitive markets is Pareto-optimal, implying that only liberalized financial markets can be efficient.\textsuperscript{18}

The efficient (capital) market hypothesis can be interpreted as an application of the rational expectations hypothesis to the pricing of securities whose results can be summarized in three fundamental statements. Firstly, financial markets are assumed to be efficient with respect to the collection and the processing of information, implying that prices of securities are set so that the optimal forecast of a security's return corresponds to the security's equilibrium return which equals, under rational expectations, the security's expected return. Secondly, in an efficient market which is fully competitive, all unexploited profit opportunities will be eliminated, which implies that in efficient capital markets, all prices of securities always reflect market fundamentals.\textsuperscript{19} Thirdly, government interventions can only increase the efficiency of financial markets in case government officials have a better understanding and more information regarding the pricing of securities.

Summing up, the first part of the fundamental theorem on welfare economics states that highest economic efficiency in the real economy can be only reached if goods markets are fully liberalized and competitive, whereas the efficient (capital) market hypothesis states that prices of securities can only reflect correctly the "true" fundamentals of the real sector if financial markets are fully liberalized and competitive, so that information can be collected and processed optimally. As a result, if both goods and financial markets are fully liberalized and competitive, goods markets generate Pareto-efficient equilibria which are reflected correctly in financial asset prices, permitting agents trading assets in fully competitive financial markets to make Pareto-efficient decisions.

\textbf{Expected Benefits and Empirical Evidence on the Impact of Financial Liberalization.} Financial liberalization is generally expected to engender three main benefits. Firstly, liberalized domestic and international capital markets are expected to allocate savings into the most productive investment opportunities. Secondly, savings and thereby investment are expected to increase, inducing higher long-run growth. Thirdly, }

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\textsuperscript{17} According to Williamson (2000), the need for liberalization was misinterpreted as a swing to the opposite extreme of market fundamentalism and for a minimalist role of the government. For more detailed discussions of the entire set of policies following the Washington Consensus and their consequences for emerging market countries, see Berg and Taylor (2000), Taylor (2000), Gore (2000), and Stretton (2000).

\textsuperscript{18} The second part of the fundamental theorem on welfare economics states that any Pareto-optimum has to be a competitive equilibrium, or alternatively, that any allocation on the contract curve can be sustained as a competitive equilibrium. The third part states that there is no logically inerrant way to aggregate preferences of individuals, implying that the problem of distribution cannot be solved and is therefore neglected.

\textsuperscript{19} Consequently, excess volatility, as described in section 2.3.4, is not possible according to the efficient (capital) market hypothesis.
capital is expected to flow from capital-rich (industrial) countries into capital-poor but opportunity-rich (emerging market) countries leading to a long-run convergence in economic development.\textsuperscript{20}

Empirical evidence however shows, that despite a more efficient allocation of savings into investment opportunities, financial liberalization has not led to higher savings, higher investment and higher growth in the past. Rather, there is strong empirical evidence that financial liberalization generates financial crises with adverse repercussions on growth. Furthermore, though international gross capital flows have been large, net capital flows have been very small and were predominantly allocated in developed countries, particularly in the U.S. There is no empirical evidence that there are convergence-inducing capital flows from capital-rich industrial countries to opportunity-rich emerging markets nations, as capital flows to emerging markets are highly volatile, dominated by short-term portfolio investments, and lead in most cases to systemic financial crises when capital inflows come to a sudden stop, or turn into quick capital outflows. In the post Bretton Woods period, there were two main boom-bust cycles in capital flows to emerging market countries. The first boom-bust cycle of capital flows to emerging market countries began in the late 1970s with the first large-scale financial liberalization period which ended up in the international debt crisis in the early 1980s. Until the mid-1990s emerging markets’ access to international capital markets was denied so that net capital flows on the average were almost zero from 1982 until 1992. The second boom-bust cycle was initiated by Washington Consensus-induced financial liberalization processes which ended up in the Mexican crisis in 1994, and in the Asian crisis 1997-1998.\textsuperscript{21}

3.4 Stylized Behaviour of Macroeconomic Variables During Episodes of Financial Crises

This section studies the stylized behaviour of a large number of macroeconomic variables before, during, and after the occurrence of currency, banking, and twin crises, where the analysis is restricted to the post Bretton Woods era (1973-1997) due to the lack of appropriate empirical data for earlier periods. The empirical literature on financial crises provides three different classes of studies which can be used to describe the stylized behaviour of macrovariables during periods of financial distress. The first class of studies\textsuperscript{22} analyzes the average behaviour of macrovariables before, during and after the occurrence of financial crises by comparison with “tranquil” periods which are characterized by the


\textsuperscript{22}See, for example, studies by Eichengreen, Rose and Wyplosz (1995), Eichengreen and Rose (1998), International Monetary Fund (1998a, chapter IV), Kamin (1999), and Kaminsky and Reinhart (1999).
absence of financial distress. These studies generally use large country samples consisting of both industrial and emerging market countries.

The second class of studies analyzes the stylized behaviour of macrovariables of single countries, or of small country groups in case studies. In contrast to the first class of studies, the second class generally does not compare the behaviour of variables during periods of financial distress with the behaviour during tranquil periods. Furthermore, second class studies referring to country groups use either pure industrial country samples or pure emerging market country studies, and do not consider mixed country samples.

The third class of studies, focusing on the analysis of business cycle characteristics of balance sheet data (liquidity and solvency indicators), is neglected by most standard empirical and theoretical approaches to financial crises as they are considered not to have an explanatory power with respect to the causes of financial crises. However, the introductory analysis on financial crises in chapter 2, as well as the description of empirical regularities in section 3.3 have shown that periods of financial distress are inseparably linked to business cycle fluctuations and variations in liquidity and solvency positions of economic units, providing a justification to declare the stylized business cycle characteristics of balance sheet data as stylized facts of financial crises. Moreover, studies of the third class generally refer to the stylized behaviour of balance sheet data over long time horizons including periods of financial crises. In contrast to studies of the first and of the second class, studies of the third class are only available for industrial countries, firstly, because standard approaches to financial crises generally neglect balance sheet data, and secondly, because the availability of balance sheet data in emerging market economies is limited.

The following description of the stylized behaviour of macroeconomic variables during episodes of financial distress refers predominantly to studies of the first and of the third class and analyzes the evolution of 35 macroeconomic variables before, during, and after the outbreak of currency, banking and twin crises, where variables are classified into financial market, current account, capital account, real sector and balance sheet variables. The description of the evolution of excess real M1 balances, the ratio of M2 to foreign exchange reserves, the M2 multiplier, the ratio of domestic credit to GDP, real commercial bank deposits, the real interest rate on deposits, the ratio of lending rates to deposit rates, equity prices, real estate prices, the real exchange rate, the terms of trade, foreign exchange reserves, the domestic-foreign real interest rate differential on deposits, the ratio of short-term capital inflow to GDP, and output is based on Kaminsky and Reinhart (1999), whereas the description of the time pattern of nominal M2 growth, the change in the M2 to M1 ratio, the current account balance, the ratio of private capital net inflow to GDP, inflation, and the ratio of investment to GDP is based on International Monetary Fund (1998a, chapter IV). The behaviour of world interest rates, the ratio of interest payments to GDP, the ratio of short-term foreign debt to total foreign debt, the ratio of interest payments to GDP, and the ratio of total debt to GDP is based on Eichengreen and Rose

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24See, for example, studies by Bordo and Jeanne (2002), International Monetary Fund (2002), chapter III, and International Monetary Fund (2003b), chapter II.
(1998), whereas the evolution of the real lending rate is taken from Palma (2000). The
description of the evolution of the interest coverage of the corporate and the banking
sector, gross and net profits of the corporate sector, net profits of the banking sector, the
ratio of short-term domestic debt to total domestic debt, the market valuation of firms
(Tobin's $q$), the debt-asset ratio of firms and banks, and the ratio of debt to market value
of equity of firms is based on International Monetary Fund (2003b, chapter II).

Descriptions of the stylized behaviour of macroeconomic variables which are based
on studies by Eichengreen and Rose (1998), International Monetary Fund (1998a, chap-
ter IV), and Kaminsky and Reinhart (1999), compare the pre- and post-crisis behaviour
of a variable relative to its tranquil period mean. An above-average/below-average value
of a variable indicates that the value of the variables lies above/below its tranquil pe-
riod mean. If there is no explicit differentiation between a variable's behaviour during
episodes of currency, banking, and twin crises, the statement is valid for all three types of
crises. Descriptions of the stylized behaviour of variables which are based on International
Monetary Fund (2003b, chapter II) refer to the average behaviour of variables before and
after the burst of stock market and real estate bubbles, and do not explicitly consider
additionally the date of the outbreak of currency, banking, and twin crises. However,
as the following analysis is going to show, the outbreak of currency, banking and twin
crises, is generally preceded by the burst of stock market and real estate bubbles, implying
that the pre-bubble period generally refers to the pre-crisis period, and that the
post-bubble period refers both to the (short) period before the outbreak of the crisis and
to the entire post-crisis period. In case there arise significant differences between the be-
haviour after the burst of the bubble and the behaviour during the post-crisis period, the
description considers all three periods (pre-bubble period, post-bubble-pre-crisis period,
and post-crisis period).

3.4.1 Financial Market Variables

3.4.1.1 Monetary Aggregates and Foreign Exchange Reserves

*Excess Real M1 Balances.* Excess real M1 balances increase above-average before the
crisis and peak at the outbreak, indicating either lax monetary policy, or fiscal deficit
financing by central banks. In the post-crisis period, excess real M1 balances decrease,
but remain higher than in tranquil periods.

*Nominal M2 Growth.* There is an above-average monetary expansion in the pre-crisis
period which peaks before the outbreak. From its peak, nominal M2 growth falls steadily
until the outbreak of the crisis, but remains higher than in tranquil periods. After the
crisis, nominal M2 growth increases slightly and remains at levels above the average.

*Ratio of M2 to M1.* There is an above-average increase before the crisis which peaks
before the outbreak. After the peak, there is a fall at first, which turns into a sharp
increase just before the outbreak of the crisis indicating possibly liquidity supports to
troubled financial institutions by central banks. After the crisis, there is a further in-
crease being higher than in tranquil times.

25 Excess real M1 balances are defined and calculated as actual less estimated money demand.
**Ratio of M2 to Foreign Exchange Reserves.** Prior to the crisis, the ratio increases above-average, where the increase is caused by a large rise in nominal M2 growth and by a sharp decline in foreign exchange reserves indicating increasing financial vulnerability due to a decreasing backing of foreign liabilities by international reserves. After the outbreak of the crisis, the ratio falls steadily and reaches below-average levels.

**M2 Multiplier.** The M2 multiplier rises steadily above-average before the crisis and peaks before the outbreak, which is mainly due to drastic reductions in required reserve ratios which generally accompany financial liberalization policies. After its peak, the multiplier decreases steadily and reaches lower levels than in tranquil times.

### 3.4.1.2 Deposits and Domestic Credit

**Ratio of Domestic Credit to GDP.** The time pattern of the domestic credit/GDP ratio exhibits the characteristics of typical boom-bust cycle in domestic credit markets and in real economic activity. Before the crisis, there is an above-average increase in the ratio owing to an overproportional rise in domestic credit as the economy is still in an expansion phase with rapid GDP growth (see below). The domestic credit/GDP ratio reaches its peak at the outbreak of the crisis when the (over-)leveraging of the private sector becomes evident by deteriorating liquidity and solvency positions due to a fall in GDP which begins shortly before the outbreak of the crisis and passes into a recession. The domestic credit/GDP ratio falls sharply to slightly below-average levels in the post-crisis period due to an overproportional decline in domestic credit, indicating a credit-crunch induced recession.

**Real Commercial Bank Deposits.** Real bank deposits remain at average levels in the pre-crisis period. After the outbreak of the crisis, real bank deposits decrease sharply to lower levels than in tranquil times, indicating possibly capital flight or bank runs.

### 3.4.1.3 Interest Rates

**Real Interest Rate on Deposits.** The real interest rate on deposits exhibits a different behaviour for currency, banking and twin crises. For currency crises, the real deposit rate remains at below-average levels before, during and after the crisis, indicating either lax monetary policy, or administered interest rates as most currency crises occurred in the 1973-1987 period when financial markets were still highly regulated. For banking and twin crises, the real deposit rate remains at above-average levels before, during and after the crisis. Above-average rates before the occurrence of banking and twin crisis, whose frequency increased markedly in the 1987-1998 period, can be due to interest rate liberalization, high risk taking by banks, or tight monetary policy to defend the currency peg, whereas above-average rates after the occurrence of banking and twin crises possibly reflect banks’ response to the risk of increasing deposit withdrawals.

**Real Lending Rate.** The real lending rate declines sharply before the crisis, reflecting the boom phase in private credit markets, but starts to increase shortly before the crisis when financial difficulties in the private sector are revealed, and credit market conditions start to tighten. After the crisis, there is a further sharp increase in the real lending rate,
indicating a credit crunch which aggravates the downturn in real economic activity (see below).

**Ratio of Lending to Deposit Rate.** Before the crisis, the ratio remains at an average level, but starts to increase just before the outbreak of the crisis, indicating an increase in credit risk. After the crisis, the ratio remains higher than in tranquil times, indicating the unwillingness to lend.

### 3.4.1.4 Equity and Real Estate Prices

**Equity Prices.** Before the crisis, there is an above-average increase in stock prices which very often passes into a stock market bubble. The upward trend reverses just before the outbreak of the crisis, when the stock market bubble bursts and stock prices fall sharply to below-average values due to deteriorating liquidity and solvency positions which are mainly caused by rising domestic and foreign lending rates, and real overvaluations of the domestic currency (see below). After the burst of the stock market bubble, stock prices decrease further and reach their lowest levels at the peak of the crisis. In the post-crisis period, stock prices remain lower than in tranquil periods.

**Real Estate Prices.** Real estate prices are subject to the same stylized behaviour as stock prices.

### 3.4.2 Current Account Variables

**Real Exchange Rate.** In the pre-crisis period, the real exchange rate is lower relative to its average level during tranquil times, and declines further until the outbreak of the crisis, indicating a large real overvaluation of the domestic currency. At the outbreak of the crisis, the real exchange rate reverses sharply and rises to above-average levels, where the increase at the onset of the crisis is more pronounced during episodes of currency and twin crises due to large nominal devaluations of the domestic currency. Especially exchange-rate-based inflation stabilization programmes very often lead to large real overvaluations of the domestic currency and undermine international competitiveness, as domestic inflation fails to reduce to foreign levels. In the post-crisis phase, the real exchange rate appreciates substantially and remains at higher levels than in tranquil times.

**Terms of Trade.** The terms of trade are lower than in tranquil periods and deteriorate further until the outbreak of the crisis. After the crisis, the terms of trade improve and rise to average levels.

**Current Account Balance.** In the pre-crisis period, there is a large above-average current account deficit which deepens steadily just before the outbreak of the crisis. Increasing

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26 The real exchange rate is defined as the ratio of the price of foreign goods (in domestic currency) to the price of domestic goods, i.e. formally, the real exchange rate \( s_r \) is given by \( s_r = s P^*/P \), where \( s \) denotes the nominal exchange rate (the price of one unit of foreign currency in domestic currency), \( P^* \) the foreign price level, and \( P \) the domestic price level. The real exchange rate is measured by its deviation from trend relative to tranquil periods, indicating the degree of misalignment.

27 The terms of trade are defined as the ratio of the unit value of exports to the unit value of imports.
current account deficits are generally caused by poor export performance and rising boom-induced imports, where the growth of imports of consumer goods is overproportionally high. In the post-crisis period, the current account reverses quickly and passes into a current account surplus which is larger than in tranquil times. Current account reversals are generally caused by a large drop in imports due to a considerable decline in GDP, and by an improving export performance mainly due to a large nominal devaluation of the domestic currency.

3.4.3 Capital Account Variables

*Foreign Exchange Reserves.* Prior to the crisis, central banks lose foreign exchange reserves at an above-average rate which accelerates just before the outbreak. The loss in reserves peaks at the outbreak of the crisis. The discontinuous decline in foreign exchange reserves indicates that central banks try to “lean against the wind” by fighting reserve losses with contractionary monetary policy (see the behaviour of interest rates) before the currency collapse. After the crisis, i.e. after the devaluation or floatation, there is a rise in foreign exchange reserves to tranquil time levels.

*Real Interest Rate Differential Between Domestic and Foreign Deposits.* There are different time patterns for currency, banking and twin crises. Regarding currency crises, the real interest differential is lower than in tranquil times before, during, and after the crisis, indicating that there arise no devaluation expectations in the pre-crisis period. Respecting banking and twin crises, the differential increases markedly relative to tranquil times in the run-up to the crisis indicating devaluation expectations, and returns to average levels in the post-crisis period.

*World Interest Rates.* In the pre-crisis period, world interest rates are higher than during tranquil times and rise steadily up to their peak at the outbreak of the crisis. After the outbreak, world interest rates remain firstly at the crisis level and decline afterwards to tranquil time levels. The increase in world interest rates in the pre-crisis period may either reflect an exogenous shock, or increasing risk premia on foreign debt when financial difficulties in the private sector are revealed. The decline in the post-crisis period may reflect decreasing credit risk.

*Ratio of Private Capital Net Inflow to GDP.* The ratio increases in the pre-crisis period at an above-average rate and peaks just before the outbreak of the crisis. After its peak, the ratio declines and reaches its lowest point at the outbreak of the crisis but still at above-average levels. In the post-crisis period the ratio remains constant at slightly above-average values. It has to be emphasized that the private capital net inflow/GDP ratio consists of both FDI and portfolio flows, where FDI flows are always positive and prevent the private capital net inflow/GDP ratio from becoming negative. By way of contrast, portfolio flows sharply increase in the run-up to the crisis, indicating an increasing leverage in foreign currency, and come to a “sudden stop” just before the outbreak, being followed by large net portfolio outflows during the crisis and in the post-crisis period.

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28 World interest rates are determined as a weighted average of short-term “Northern” interest rates for the United States, Germany, Japan, France, the United Kingdom and Switzerland.
**Ratio of Short-Term Capital Inflow to GDP.** This ratio, consisting mainly of short-term portfolio flows, is characterized by the same boom-bust cycle pattern as the domestic credit/GDP ratio. The ratio increases sharply in the pre-crisis period at an above-average rate and comes to a "sudden stop" just before the outbreak of the crisis. After its peak, the ratio declines sharply to below-average levels due to large net capital outflows, and reaches its lowest level at the outbreak of the crisis. In the post-crisis period the ratio slightly increases but remains at lower levels than in tranquil times.

3.4.4 Real Sector Variables

*Output.* The time pattern of output exhibits the characteristics of a typical extensive boom-bust cycle. In the pre-crisis period, there is an above-average increase in GDP indicating a boom in the real sector. The boom comes to a halt in the run-up to the crisis, and turns into a recession just before the outbreak, being mainly caused by rising domestic and foreign interest rates, and by the real overvaluation of the domestic currency. The recession, being characterized by large below-average GDP values, deepens due to the outbreak of the crisis, and reaches its lowest level in the post-crisis period. Afterwards, output recovers and returns to tranquil time levels. As aforementioned in section 3.2.2, recessions accompanied by banking and twin crises are much deeper than recessions accompanied by currency crises.

*Inflation.* The inflation rate is characterized by above-average levels during the entire pre-crisis period, and decreases slightly in the run-up to the crisis until the outbreak. The decline in the inflation rate in the pre-crisis period may be caused by attempts to reduce the real overvaluation of the domestic currency and to curb the overheating of the economy. After the outbreak of the crisis, there is a large above-average rise in inflation, being mainly caused by the nominal devaluation of the domestic currency which is reflected in increasing domestic prices. After its post-crisis-peak, inflation starts to reduce slightly, but is still higher than during tranquil times.

*Ratio of Investment to GDP.* The boom-bust cycle in real output is largely driven by an extensive boom-bust cycle in investment which is induced by the boom-bust cycle in domestic credit and in net capital flows. Prior to the crisis, there is an above-average increase in the investment/GDP ratio, where investment is increasingly financed by domestic and foreign debt.\(^{29}\) The investment boom peaks just before the outbreak of the crisis like the domestic credit/GDP ratio, the private net capital inflow/GDP ratio and the short-term capital inflow/GDP ratio. After its peak, the investment/GDP ratio declines steadily. The outbreak of the crisis leads to a further deterioration of the investment/GDP ratio which reaches lower levels than during tranquil times in the post-crisis period.

*Ratio of Fiscal Deficit to GDP.* Though lots of crises in the early post Bretton Woods period, especially in emerging market countries, were predominantly driven by unsound

\(^{29}\)Investment booms have been very often subject to an overproportional rise in real estate investment by comparison with investment in machinery, infrastructure and business construction, having induced a bubble in real estate prices, as e.g. in Japan in the late 1980s (Werner 2003, p. 100) or in Mexico in the early 1990s (Palma 2000, p. 21).
fiscal and monetary policies, there is only a slight rise in the fiscal deficit/GDP ratio in the pre-crisis period relative to tranquil times, indicating that fiscal deficits have played a less regular role in past financial crises. The increase in the fiscal deficit/GDP ratio may be caused either by higher government spending, or by a recession-induced shortfall in revenues. The fiscal/deficit ratio improves in the post-crisis period.

3.4.5 Balance Sheet Variables

3.4.5.1 Liquidity and Profit Variables

Interest Coverage of the Corporate and the Banking Sector.\textsuperscript{30} In the pre-crisis period, interest coverage firstly increases steadily and peaks some time before the burst of the asset price bubble and before the outbreak of the crisis. The pre-crisis rise in interest coverage is caused by a large output-induced rise in earnings, which overcompensates increasing interest expenses. The overall rise in interest expenses is due to a percentage increase in total debt being larger than the decrease in interest rates. From its peak, interest coverage declines sharply until the outbreak of the crisis. The fall in interest coverage is caused by a output-induced drop in nominal earnings and by rising interest expenses. The rise in interest expenses is due to rising domestic and foreign interest rates and due to percentage reductions in debt which are smaller than the increase in interest rates. Furthermore, interest expenses in foreign currency increase sharply during episodes of currency and twin crises by nominal devaluations of the domestic currency. In the post-crisis period, there is a further decline in the interest coverage which recovers later on. A similar measure to assess the influence of interest expenses on the overall liquidity position is the ratio of interest payments to GDP, as e.g. used in Eichengreen and Rose (1998), which is subject to a steady increase before, during, and after the occurrence of the crisis, indicating also a deteriorating liquidity position over the entire boom-bust cycle.

Gross and Net Profits of the Corporate Sector. In the pre-crisis period, gross profits of the corporate sector, which are defined as earnings before interest, taxes, and depreciation, increase steadily until the burst of the asset price bubble and collapse afterwards during the entire post-crisis period. By way of contrast, net profits, which are defined as earnings less interest expenses before taxes and depreciation, increase in the pre-crisis period, but peak before the asset bubble’s burst and decline steadily afterwards during the entire post-crisis period.

Ratio of Investment to Retained Earnings. Prior to the crisis, there is a large rise in the ratio of investment to retained earnings, implying an increasing debt-asset ratio (see below) because the increase in investment is larger than retained earnings. The ratio peaks at the outbreak of the crisis and is subject to a large decline in the post-crisis period due to a large drop in investment.

Net Profits of the Banking Sector. Net profits of the banking sector are subject to the same time pattern as net profits of the corporate sector, where net profits are additionally

\textsuperscript{30}Interest coverage of the corporate and the banking sector is defined as the ratio of earnings before interest, taxes, and depreciation to interest expenses.
decreased after their peak by increasing non-performing loans when the economy starts to enter the recession period just before the asset price bubble's burst.

*Ratio of Short-Term Domestic Debt to Total Debt.* There is a considerable rise in the ratio of domestic short-term debt to total debt in the pre-crisis period, indicating rising liquidity risk as firms and banks become increasingly dependent on financial markets' capacity to roll-over short-term debt. The ratio peaks at the asset price bubble's burst and is subject to a slow fall during the entire post-crisis period. This time pattern indicates that the willingness to lend does not consider the drop in net profits before the bubble's burst as an indicator for increasing liquidity risk.

*Ratio of Short-Term Foreign Debt to Total Debt.* The ratio of short-term foreign debt to total debt follows the same time pattern as the ratio of short-term domestic debt to total domestic debt, being also consistent with the behaviour of the ratio of short-term capital inflows to GDP. Consequently, there is a further rise in liquidity risk during the boom phase, as firms and banks additionally depend on foreign financial markets' capacity to roll-over short-term debt in foreign currency.

3.4.5.2 Market Valuation and Solvency Variables

*Market Valuation of Firms - Tobin's q.* Market valuation of firms, or Tobin's $q^{31}$, being measured by the ratio of market to book value of equity (as a proxy for Tobin's $q$), increases steadily and peaks when the asset bubble bursts. Afterwards, there is a steady decline during the entire post-crisis period.

*Debt-Asset Ratio of Firms and Banks.* There is a considerable rise in the debt-asset ratio in the period before the burst of the asset price bubble, being predominantly caused by the large increase in short-term domestic and foreign debt. After the burst of the asset price bubble, there is a further, but smaller rise in the debt-asset ratio, peaking during the post-crisis period. The rise in the debt-asset ratio in the post-bubble period is caused firstly, by an increase in domestic and foreign interest rates, secondly, by a transformation of short-term debt and short-term interest payment obligations which both cannot be met into long-term debt contracts, and thirdly, by nominal devaluations of the domestic currency which lead to an increase in the stock of foreign debt valued in domestic currency. After its peak, the debt-asset ratio starts to decline only slightly in the late post-crisis period as the protracted process of deleveraging in the bust period is generally impeded by low net profits due to low nominal earnings and high interest expenses.

*Ratio of Total Debt to GDP.* A similar indicator for the degree of indebtedness both in domestic and in foreign currency, as well as for an economy's potential to repay

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31 For details on Tobin's $q$, see appendix A.
32 The debt-asset ratio is defined as the ratio of the sum of domestic and foreign debt to the sum of domestic and foreign assets.
debt burden, is the ratio of total debt to GDP which increases before, during, and after the outbreak of the crisis indicating increasing liquidity and solvency difficulties.

**Ratio of Debt to Market Value of Equity of Firms.** There is only a slight increase in the ratio of debt to market value of equity in the period before the burst of the asset price bubble as rising leverage is masked by an overcompensating increase in the market value of firms. After the burst of the asset price bubble, there is a sharp increase in the ratio due to a sharp decrease in the market valuation of firms revealing high corporate leverage. There is a further increase in the ratio during the post-crisis period due to a further decline in the market valuation of firms and due to a further rise in indebtedness. The debt to market value value of equity ratio peaks in the late post-crisis period and starts to decline afterwards.

### 3.4.6 An Assessment

The stylized behaviour of the 35 macroeconomic variables during episodes of financial crises can be summarized in the following eight propositions.

Firstly, business cycles being associated with financial crises are subject to much larger fluctuations in all macroeconomic variables than business cycles during tranquil times. Accordingly, financial crises are generally linked to extensive, and very often to excessive boom-bust cycles in goods and financial markets.

Secondly, the boom phase of business cycles giving rise financial crises often begins with a large exogenous positive shock to financial institutions (as e.g. financial liberalization, or increasing access to international financial markets) extending the access to domestic and international financing. Another source of excessive boom-bust cycles inducing financial crises, which has not been considered in the previous empirical analysis, is the emergence of new technology regimes which also lead to an increasing access to domestic and international financing due to actual and expected increases in productivity and profits.33

Thirdly, increasing access to domestic and international financing, as well as the introduction of new technology regimes, induce a rise in expected profits by lower actual, and lower expected interest rates, and by an expected rise in productivity. Both factors cause an investment boom, an acceleration of GDP growth, sharply rising stock market valuations of corporations and banks reflecting the expected rise in future profits, an increase in actual gross and net profits, cash flows, and net worth positions, giving rise to a further expansion in real economic activity. As a result, the boom phase is characterized by a cumulative upward process driven by, as outlined in section 2.2.4.3, demand-side, financial-accelerator induced, and supply-side induced cumulative processes.

Fourthly, the boom phase causes an increase in the overall debt-asset ratio, both by an increase in domestic and in foreign debt. On the supply side, the lending boom is fueled

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33 For example, the extensive boom phases of the business cycles having been associated with the Great Depression were not only driven by easy monetary and financing conditions, but also by the emergence of new information and communication technologies like radio, and by new mass production processes, as e.g. the introduction of assembly-line production in the automobile industry (Eichengreen and Mitchener 2003). In a similar way, the New Economy bubble of the late 1990s, having peaked in 2000, was also driven by the introduction of new information and communication technologies, as e.g. the internet, which were expected to generate an enormous rise in overall productivity and in profits.
by a general monetary expansion due to an increase in domestic bank lending being facilitated by easy monetary conditions, and due to large volumes of capital inflows. On the demand side, the lending boom is driven by profit expectations growing faster than actual profits (or retained earnings), so that investment growth has to be increasingly financed by external domestic and/or foreign debt. As short-term interest rates tend to be lower than long-term interest rates during the boom phase, there is an overproportional increase in short-term debt finance. Increasing debt-asset ratios are considered to be sustainable because profits are expected to rise to future levels which allow to repay debt, being reflected in a constant ratio of debt to market value of equity due to a compensating rise in stock market valuations. Accordingly, the longer the boom phase lasts, the more expectations rely on overall market sentiment, rather than on a rational observation of fundamentals, giving rise to an increasing stock market bubble.

Fifthly, there is a large and endogenous rise in financial instability during the upswing due to overborrowing and overinvestment, which are induced by cumulative demand-side and financial accelerator processes. Following the results of section 2.3, financial fragility increases owing to a decrease in the ratio of hedge finance units to speculative and Ponzi finance units, and owing to a decrease in the ratio of foreign hedge finance units to foreign (super) speculative and foreign (super) Ponzi finance units, being reflected in an overproportional rise in short-term domestic and foreign borrowing. Furthermore, financial instability increases due to excess volatility in asset prices, as GDP and investment growth are based on increasingly optimistic profit expectations which are much larger than actual values, giving rise to an unsustainable increase in the overall debt-asset ratio. Excess volatility due to rising inflation expectations is also possible, but not as significant as excess volatility due to overly optimistic profit expectations. The increase in financial instability due to unrealistic profit expectations, driving the economy into a state of “irrational exuberance”, is predominantly reflected in a steady increase in indebtedness and rising stock market valuations of firms and banks in the late boom phase, though overall net profits start to fall, signalling upcoming liquidity and solvency problems.

Sixthly, financial instability is revealed by large firms and/or banks becoming illiquid or insolvent due to a slow down in earnings, caused by an slow down in GDP growth, and due to rising interest rates. Both the slow down in GDP growth and rising interest rates, leading to a decline in net profits, are caused by a mixture of endogenous and exogenous mechanisms. Regarding endogenous mechanisms, net profits are reduced by rising input costs when the economy reaches the frontier of capacity utilization, inducing a rising real overvaluation of the domestic currency. Furthermore, net profits are reduced by endogenously rising debt costs due to an unsustainable increase in the debt-asset ratio leading to a rise in risk premia. Regarding exogenous mechanisms, central banks very often start to tighten monetary policy in the late boom phase to dampen the economy’s overheating, leading also to rising domestic interest rates, to a reduction in GDP growth, and to a decline in net profits; however, domestic contractionary monetary policy during the upswing can also be interpreted as an endogenous policy response to an endogenous debt-led, and expectations-led overheating of the economy. By way of contrast, foreign contractionary monetary policy, which leads to declining domestic net profits and large capital outflows owing to large foreign debt stocks, represents a purely exogenous event. Beginning failures of large corporations and/or banks generally trigger the burst of the asset price bubble and induce the downswing by demand-side, financial-accelerator induced,
and supply-side induced cumulative processes. Dropping stock market valuations, rising risk premia, increasing domestic and foreign interest rates, a real overvaluation of the domestic currency, large withdrawals of domestic and foreign debt, and a decline in real economic activity cause widespread bankruptcies among firms and financial institutions, ending up in a severe banking crises. In case foreign exchange reserves do not suffice to meet net capital outflows, a currency crisis follows which deepens the banking crises by high domestic interest rates, and by nominal appreciations of the foreign debt stock because of large nominal devaluations of the home currency.

Seventhly, the financial crisis is followed by a long-lasting recession, or even by a depression with deflationary spirals (see e.g. Japan in the late 1990s), as the process of deleveraging, i.e. the reduction in the overall debt-asset ratio, during bust phases of business cycles being associated with financial crises requires much more time than the deleveraging process during the downswing of tranquil time business cycles because of a much higher build-up of debt during the upswing.

Eighthly, financial crises are typically preceded by a large number of weak and worsening economic fundamentals. Financial crises where economic fundamentals were sound are very rare. Banking, currency and twin crises have common origins, where for twin crises economic fundamentals and financial instability tend to be worse, and lead, as aforementioned, to more severe recessions.

These eight propositions are going to be discussed in more detail in sections 4.3.2 and 5.3.2 in part II of the book by a theoretical description of different stages of a stylized business cycle giving rise to financial crises, where section 4.3.2 refers to financial crises in industrialized countries, and section 5.3.2 to financial crises in emerging market countries.

### 3.5 Standard Theory of Financial Crises and its Correspondence with the Stylized Facts

Standard theory of financial crises provides five main explanations for the causes of financial distress, being reflected in five classes of financial crisis models. Four classes of financial crisis models, which are labelled in the following as inconsistent macroeconomic policy models (section 3.5.1), self-fulfilling expectations models (section 3.5.2), asymmetric information models (section 3.5.3), credit constraint and balance sheet models (section 3.5.4), represent the mainstream approach to financial crises, arguing, as outlined in sections 1.1 and 2.4, that capitalist market economies are inherently stable and that financial crises can be only caused by large exogenous shocks to economic fundamentals, or by random exogenous shifts from optimistic towards pessimistic (rational) expectations which become self-fulfilling. The fifth class of models, being labelled in the following as endogenous financial crisis approach (section 3.5.5), and representing the minority of the financial crises literature, is often neglected in discussions on the causes of financial crises, mainly because endogenous financial crisis models argue that capitalist market economies are inherently unstable, and that financial crises are a “natural” outcome if there is no interventionist monetary and fiscal policy to prevent crises, or to dampen their adverse effects on the real economy. However, this model class is the only one which argues that financial crises are generally linked to business cycle fluctuations, and is therefore explicitly taken into consideration.
The following discussion provides a short overview of each class of models in sections 3.5.1 to 3.5.5, and compares the model results with the stylized facts having been elaborated in the previous sections. Section 3.5.6 summarizes the results and is going to show that no model class can provide a detailed explanation of the stylized facts, as already argued in the introductory section 1.1. The analysis is set out without references as sections 4.5 and 5.5 provide a much more detailed discussion of numerous approaches of each model class.34

3.5.1 Inconsistent Macroeconomic Policy Models

This class of models argues that financial crises are predominantly caused by overly expansionary monetary or fiscal policies, or by excessive contractionary monetary policies. Regarding banking crises, expansionary monetary policy, or money-financed fiscal deficits lead to rising actual and expected inflation which are reflected in rising interest rates, causing a fall in the nominal value of banks' assets side of the balance sheet which consists of bonds. As banks' debt side of the balance sheet only consists of non-interest bearing deposits which do not change in value in case of interest rate changes, excessive monetary policy ultimately lead to banks' insolvency. Another source of banking crises is overly contractionary monetary policy leading to deflation. In this case, banks' insolvency stems also from a fall in the nominal value of banks' asset side consisting of bonds, as there is a steady increase in bankruptcies of debtors due to debt deflation and rising real interest rates. Furthermore, banks' debt side, consisting mainly of deposits, is also subject to an enormous rise in real terms leading ultimately to widespread failures of banks.

Currency crises are caused by excessive expansionary monetary policies, or by money-financed fiscal deficits, leading to falling domestic interest rates, and thereby to large capital outflows which are "financed" by a depletion of foreign exchange reserves to stabilize the fixed exchange rate. However, when the stock of foreign exchange reserves is used up, or has fallen to a certain minimum threshold value, a speculative attack on the currency is unavoidable, leading to a sharp devaluation of the home currency.

Twin crises are also explained by overly expansionary monetary policies, or by large money-financed fiscal deficits which lead to a collapse of the fixed exchange rate system, and thereby to a domestic banking crisis, as banks' debt side is characterized by large amounts of foreign debt which are subject to a substantial rise by the devaluation of the home currency.

A comparison of the model results with the stylized facts shows that there are both common grounds and differences. Concerning the common grounds, there arise two similarities. Firstly, inconsistent macroeconomic policy models show that rising domestic interest rates, as well as deflation lead to a substantial increase financial fragility by deteriorating solvency positions which can cause domestic banking crises. Secondly, this

34 Apart from standard theory, there are also empirical approaches to the causes of financial crises, as e.g. empirical work by Meltzer (1995), Caprio and Klingebiel (1996), Goldstein and Turner (1996), Hausmann and Rojas-Suárez (1996), Lindgren et al. (1996), Sachs et al. (1996), Sheng (1996), Blejer, Feldman and Feltenstein (1997), Demirgüç-Kunt and Detragiache (1997), Garcia-Herrero and Balílio (1997), Kaminsky, Lizondo and Reinhart (1997), Eichengreen and Rose (1999), Hardy and Pazarbasioglu (1999), and Summers (2000), which are however based on standard models of financial crises. Hence, these empirical approaches generally identify similar factors causing financial distress like standard theory, and therefore are not going to be reviewed in the book.
model class is consistent with the fact that collapses of fixed exchange rate regimes are preceded by large capital outflows causing a devaluation of the home currency, which either engenders, or deteriorates a domestic banking crisis in case banks’ stock of foreign debt is comparatively high before the outbreak of the crisis.

Respecting the differences, there are three issues to be mentioned. Firstly, inconsistent macroeconomic policy models do not consider the link between business cycles and financial crises. Secondly, there is no explanation of the endogenous build-up of financial fragility during the boom phase by largely rising domestic and foreign debt stocks. Thirdly, this model class does not consider fluctuations in expectations of private agents driving asset prices and real economic activity during a financial crisis cycle.

### 3.5.2 Self-Fulfilling Expectations Models

This model class argues that financial crises are caused by random shifts in expectations of private agents, inducing a switch from a “no-crisis-equilibrium”, being characterized by a solvent financial sector and a stable fixed exchange rate regime, to a “crisis-equilibrium”, being characterized by insolvent banks and a breakdown of the fixed exchange rate regime. Expectations are self-fulfilling as optimistic ex ante expectations regarding financial sector and exchange rate stability do not induce bank runs or capital flight, and thereby lead to actual financial stability which validates optimistic expectations ex post. By way of contrast, arising pessimistic ex ante expectations regarding financial sector solvency and exchange rate stability induce bank runs and capital flight, and cause thereby banking, currency and twin crises which validate pessimistic expectations ex post. As the switch in expectations from the no-crisis to the crisis-equilibrium is generally assumed to be a random event being independent of the state of economic fundamentals, financial crises cannot be predicted as they are not preceded by deteriorating fundamentals.

Respecting the common grounds with the stylized facts of financial crises, there arise two similarities. Firstly, self-fulfilling expectations models validate the empirical fact that financial crises are associated with depreciation expectations of the home currency, and pessimistic expectations as to solvency positions of the financial sector, where tranquil times are associated with optimistic expectations. Secondly, this model class is consistent with the fact that expectations are a crucial determinant of financial stability and real economic activity, as expectations are at least partly self-fulfilling and induce cumulative processes. That is, boom phases are typically preceded by optimistic expectations being reflected in rising asset prices, whereas a financial crisis is preceded by collapsing expectations which are reflected in asset price busts before the outbreak of banking, currency, or twin crises.

Regarding the differences, there are three issues to be mentioned. Firstly, empirical data unequivocally indicate that financial crises are typically preceded by deteriorating fundamentals and a considerable rise in financial fragility, which is denied by self-fulfilling expectations models as they argue that financial crises are caused by sudden and random events which cannot be predicted. Secondly, this model class does not consider the link between business cycles and financial crises. Thirdly, though self-fulfilling expectations models explain financial crises by a switch from “good” to “bad” expectations, they do not explain the endogenous boom-bust cycle in expectations, as well as the boom-bust cycle in domestic and foreign indebtedness.
3.5.3 Asymmetric Information Models

This model class explains financial crises predominantly as a consequence of moral hazard, originating from implicit or explicit government guarantees to bail out both domestic, and foreign investors in case of default. The existence of government guarantees, e.g. to bail out troubled banks, or to defend a fixed exchange rate level, induces a rise in the expected return of insecure, risky investment projects, as losses are taken over by the government, and indirectly by the tax payer. This distortion in agents’ risk perception causes agents to engage in much riskier, and in much more investment projects than they would do in case guarantees were absent. Accordingly, implicit or explicit government guarantees lead to excessive risk taking, overinvestment, and to overborrowing both in domestic, and in foreign currency.

For financial crises to occur, there has to be an exogenous upper limit of government support which cannot be exceeded. For example, governments are going to suspend their guarantee to bail out troubled banks if the budget deficit reaches unsustainable levels causing e.g. high inflation, or high domestic interest rates. Moreover, governments’ guarantee to defend an exchange rate peg is going to be suspended in case the stock of foreign exchange reserves has declined to zero. Accordingly, in case losses are higher than the exogenously given upper bound of government guarantees, the government is going to suspend its guarantees, leading to banking, currency, and twin crises.

Respecting the triggering events of financial crises, moral hazard driven models argue that crises are caused either by exogenous shocks to fundamentals, or by self-fulfilling expectations, but deny an endogenous financial collapse in spite of an endogenous build-up of financial fragility, which is however due to exogenously given government guarantees. Concerning exogenous shock-driven moral hazard models, financial distress is caused by an adverse exogenous shock to fundamentals, as e.g. a decline in productivity, or a rise in interest rates, leading to a “bad” realized return of investment projects, and causing losses to firms and banks which induce a suspension of government guarantees, and thereby systemic financial crises. Regarding self-fulfilling expectations-driven moral hazard models, financial crises are explained by a shift from optimistic ex ante expectations regarding governments’ ability to fulfill guarantees, to pessimistic ex ante expectations, which induce bank runs and capital flight as the government is expected to suspend guarantees in the future. Actual failures of banks and declining foreign exchange reserves cause an actual suspension of government guarantees, leading to banking, currency and twin crises, and validating investors’ pessimistic ex ante expectations ex post. The switch from the “good” to the “bad” equilibrium is assumed to be a random event which cannot be explained, implying that financial crises are an unpredictable event.

Respecting the common grounds of asymmetric information models with the stylized facts, there arise four similarities. Firstly, financial crises are preceded by a boom phase, leading to overinvestment and overborrowing both in domestic and in foreign currency due to distorted, and overly optimistic expectations which do not correspond to actual fundamentals. Secondly, financial crises are associated both with a deterioration of fundamentals, and with collapsing expectations. Thirdly, especially self-fulfilling expectations-driven moral hazard models show that expectations are a crucial determinant of financial stability and real economic activity, as optimistic expectations lead to a prosperous macroeconomic environment, whereas the shift towards pessimistic expectations induces recessions, and in severe cases, systemic financial crises. Fourthly, especially exogenous-
shock driven models argue that financial crises are triggered by exogenous shocks, like e.g. rising foreign interest rates, or terms of trade shocks.

Concerning the differences, there are four issues to be mentioned. Firstly, according to moral hazard models, the build-up of financial fragility during the boom phase is only due to exogenously given government guarantees, while the stylized facts show at least partly an (endogenous) build-up of financial fragility, being independent of government guarantees owing to three reasons. The first reason concerns the empirical fact that other historical episodes of financial crises, as e.g. the Great Depression period during the interwar era (1913-1939), have shown that there is a build-up of financial fragility driven by overly optimistic expectations even in case government guarantees, as e.g. deposit insurance systems and effective lender of last resort interventions, are absent. The second reason refers to the stylized fact that tranquil and financial crisis business cycles take turns even in periods which are characterized by the existence of government guarantees which do not change over time significantly, as e.g. in the post Bretton Woods era. Accordingly, financial fragility and financial crises cycles cannot be solely induced by the existence of government guarantees. The third reason concerns the stylized fact that there is a very strong positive correlation between financial liberalization and financial crises, indicating that government guarantees are not the sole reason for a build-up of financial fragility, and that overly optimistic profit expectations are not solely driven by the existence of government guarantees. Secondly, moral hazard models argue that financial crises can be only triggered by an actual or expected suspension of government guarantees, whereas the stylized facts show that financial crises are triggered at least partly by an endogenous process of deteriorating fundamentals, being independent of an actual or expected suspension of government guarantees for two reasons. The first reason concerns, as aforementioned, the stylized fact that there were historical episodes of financial crises which occurred without any government guarantees, as e.g. in the Great Depression period. The second reason refers to the fact that there were crises which occurred in an environment with stable and credible government guarantees (as e.g. the Japanese banking crisis in the early 1990s, the Savings and Loan crisis in the U.S. in the early 1980s, or the Nordic banking crisis in the early 1990s) which were not abandoned despite enormous costs. Thirdly, especially self-fulfilling expectations-driven moral hazard models predict that financial crises are an unpredictable event, whereas the stylized facts indicate that crises are typically preceded by deteriorating fundamentals. Fourthly, moral hazard models assume that the build-up of financial fragility is sustainable as long as there arise no exogenous shocks or pessimistic self-fulfilling expectations, whereas the stylized facts show that there are at least partly endogenous mechanisms triggering financial crises due to an unsustainable build-up of financial fragility.

3.5.4 Credit Constraint and Balance Sheet Models

This model class argues that financial crises are caused by financial constraints becoming binding due to sharp drops in firms' net worth positions which lead to credit and liquidity crunches, and thereby to a collapse of investment and output. Credit constraint and balance sheet models are based on the theory of imperfect capital markets\textsuperscript{35}, and argue that external investment finance is constrained by borrowing ceilings which depend positively

\textsuperscript{35}For details, see section 2.2.2.2.
on firms' net worth position. Regarding models of financial crises in industrial countries, net worth is assumed to be predominantly influenced by the asset side of firms' balance sheet, i.e. net worth is assumed to depend positively on the level of asset prices. By way of contrast, models of financial crises in emerging market countries assume that net worth is predominantly influenced by the debt side of firms' balance sheet which is characterized by large stocks of foreign debt, i.e. net worth is assumed to depend negatively on the level of foreign debt, and negatively on the level of the exchange rate, as an increase in the nominal exchange rate, i.e. a nominal devaluation of the home currency, leads to an increase in the nominal value of foreign debt in domestic currency terms. Consequently, rising asset prices and decreasing exchange rate levels cause an increase in firms' net worth and a rise in the credit supply, inducing an increase in investment and output. On the contrary, a collapse of asset prices, or of the home currency causes a drop in firms' net worth and a credit or liquidity crunch, inducing a decline in investment and output.

According to credit constraint and balance sheet models, financial crises can be caused either by adverse exogenous shocks to economic fundamentals, or by a shift towards self-fulfilling pessimistic expectations. Exogenous shock-driven models argue that adverse exogenous shocks, as e.g. negative productivity or technology shocks, a deterioration of the terms of trade, or an increase in domestic or foreign interest rates, lead to a collapse of asset prices and to devaluations of the home currency, inducing a decline in firms' net worth and a credit crunch, which finally lead to banking, currency, and twin crises. By way of contrast, self-fulfilling expectations models argue that a shift from optimistic towards pessimistic (profit) expectations induces a collapse of asset prices and devaluations of the home currency, leading to banking, currency, and twin crisis, and validating ex post investors' pessimistic expectations. The shift in expectations is assumed, as in other self-fulfilling expectations models, to be a random and unpredictable event which cannot be explained by the model.

Regarding the common grounds of credit constraint and balance sheet models with the stylized facts of financial crises, there arise three similarities. Firstly, financial crises and subsequent recessions are associated with sharp reductions in the available amount of domestic and foreign credit, leading to widespread illiquidity and insolvency. Secondly, financial crises are preceded by deteriorating fundamentals, as e.g. rising interest rates, or deteriorating terms of trade as claimed by exogenous shock-driven models. Thirdly, expectations are a crucial determinant of financial stability and macroeconomic activity, as financial stability and macroeconomic expansions are generally associated with optimistic (profit) expectations, whereas financial crises and recessions are accompanied by pessimistic expectations.

Respecting the differences, there are five issues to be mentioned. Firstly, credit constraint and balance sheet models do not consider the link between business cycle fluctuations and financial crises. Secondly, credit constraint and balance sheet models do not explain the boom-bust cycle in profit expectations and domestic and foreign indebtedness. Thirdly, according to credit constraint and balance sheet models, financial instability and financial crises are not caused by an endogenous build-up of financial fragility during the boom phase, but by exogenous shocks or self-fulfilling expectations, contradicting the stylized facts. Fourthly, according to self-fulfilling expectations models, financial crises are an unpredictable event, being not associated with a deterioration of fundamentals which cannot be validated by the stylized facts. Fifthly, exogenous shock-driven models
argue that economic fundamentals can only deteriorate due to adverse shocks, whereas the stylized facts indicate at least partly an endogenous deterioration of fundamentals.

### 3.5.5 Endogenous Financial Crisis Models

This model class, representing the minority in the financial crises literature, argues that capitalist economies are inherently unstable, and that financial crises are an unavoidable and endogenous event, being inseparably linked to business cycle fluctuations. Endogenous financial crisis models, referring predominantly to closed economies and thereby to banking crises, argue that there is an unsustainable and endogenous build-up of financial fragility by overinvestment and overborrowing during the boom phase of a business cycle, driven by overly optimistic profit expectations. Financial crises are triggered endogenously at the upper turning point of the business cycle by rising interest rates and declining profits, stemming from an inelastic credit supply and rising labour and material costs. Collapsing asset prices and widespread illiquidity and insolvency reveal that expectations have been overly optimistic and induce an undershooting process by overly pessimistic expectations, leading to a severe depression accompanied by deflation and by a liquidity trap situation. There are no endogenous mechanisms which lead to a recovery of the economy. Thus, only expansionary fiscal policies can induce a macroeconomic expansion which possibly leads to a new systemic financial crisis.

Regarding the common grounds of endogenous financial crisis models with the stylized facts, there arise three similarities. Firstly, endogenous financial crisis models are consistent with the stylized fact that financial crises are inseparably linked to business cycle fluctuations. Secondly, endogenous financial crisis models argue that there is an endogenous build-up of financial fragility leading to an endogenous outbreak of financial crises by endogenously deteriorating fundamentals. Thirdly, financial crises are followed by severe recessions and collapsing expectations.

Respecting the differences, there are two issues to be mentioned. Firstly, endogenous financial crisis models argue that every business cycle leads to systemic financial crises and that economies are inherently unstable, contradicting the stylized fact that there are also tranquil business cycle fluctuations. Secondly, endogenous financial crisis models argue that there is a purely endogenous build-up of financial fragility during financial crises business cycles by overly optimistic expectations, whereas the stylized facts indicate that unsustainable financial fragility during financial crises business cycles is initially caused by an exogenous positive shock to expectations.

### 3.5.6 An Assessment

The discussion of the model results and their correspondence with the stylized facts demonstrates that standard approaches to financial crises are consistent with a series of empirical regularities, but also fail to explain important stylized facts which are necessary for understanding the propagation mechanisms of financial crises, and which could be used to predict and to prevent future crises. Summing up, there are four stylized facts which are not explained by standard theory. Firstly, financial crises are inseparably linked to business cycle fluctuations, where financial crisis cycles are induced by positive exogenous shocks, as e.g. financial liberalization shocks. In case of the absence of exoge-
ous shocks, economies tend to be cyclically stable, and exhibit tranquil business cycle fluctuations. Tranquil business cycles are also associated with an endogenous build-up of financial fragility during the boom phase, which however cannot induce systemic financial crises, but gives rise to “normal” economic downturns. Secondly, the emergence of financial crises cycles is a multi-period and long-run phenomenon which is interrupted by tranquil business cycles. Thirdly, both tranquil and financial crises business cycles are driven by endogenous changes in domestic and foreign indebtedness and by endogenous fluctuations in expectations, giving rise to endogenous fluctuations in macroeconomic activity and in financial stability. Fourthly, the rational expectations hypothesis does not hold in the short-run, as expectations tend to be additionally driven by market sentiments during the boom and bust phase of each business cycle. However, the change of expectations at the turning points, both during tranquil and financial crises business cycles, suggests the view that the rational expectations hypothesis holds at least in the long-run.

The aim of this work is both to overcome these deficiencies of standard theory, and to develop a synthetic approach to financial crises in part II of the book, combining the results of exogenous-shock driven mainstream models and of endogenous financial crisis models. Chapter 4 develops a nonlinear dynamic model of endogenous business cycle fluctuations and exogenous shock-driven financial crises in industrial countries under flexible exchange rates. The model uses an innovative expectation formation scheme which combines the rational expectations hypothesis with (Keynesian) market sentiment-driven expectation formation schemes, giving rise to dynamic interactions between chartists, fundamentalists and rational investors. Furthermore, the model develops endogenous debt and expectation dynamics, engendering endogenous fluctuations in macroeconomic activity and in financial stability, which, in case of positive exogenous shocks to expectations, can induce a typical financial crisis cycle leading to a systemic twin crisis. Chapter 5 develops a similar model of endogenous business cycles and financial crises in emerging market countries and considers explicitly the role of fluctuations in foreign debt, and the role of fixed exchange rate systems in the propagation mechanism of systemic financial crises. Chapter 6 develops a dynamic calibration model of financial crises in emerging markets in order to highlight the transitional dynamics of a large number of macroeconomic variables during financial crises business cycles which cannot be studied by the general function models in chapters 4 and 5. There is no explicit development of a dynamic calibration model of financial crises in industrial countries as the results of the emerging market case in chapter 6 can be easily applied to financial crises in industrial countries.
Table 3.6: Financial Crises Dates and Business Cycle Turning Points During the Gold-standard Era (1880-1913)

<table>
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<th>Date</th>
<th>Argentina</th>
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<th>Chile</th>
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Source: Bordo et al. (2001b), Web Appendix.
Table 3.7: Financial Crises Dates and Business Cycle Turning Points During the Interwar Period (1919-1939)

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Source: Bordo et al. (2001b), Web Appendix.
Table 3.8: Financial Crises Dates and Business Cycle Turning Points During the Bretton Woods Period (1940-1971)

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Source: Bordo et al. (2001b), Web Appendix.
Table 3.9: Financial Crises Dates, Business Cycle Turning Points and Beginning of Financial Liberalization During the Post Bretton Woods Era (1972-1998), Part I

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Note: The financial systems of Canada, Germany and the UK were largely liberalized during the entire post Bretton Woods era; the dates of financial liberalization in these countries indicate only the liberalization of the remaining parts of their financial systems.

Table 3.10: Financial Crises Dates, Business Cycle Turning Points and Beginning of Financial Liberalization During the Post Bretton Woods Era (1972-1998), Part II

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Note: The financial system of the U.S. was largely liberalized during the entire post Bretton Woods era; the date of financial liberalization indicates the liberalization of the remaining parts of the U.S.'s financial systems.