BANK OF GREECE
EUROSYSTEM

Economic Bulletin
ISSN 1105 - 9729 (print)
ISSN 2654 - 1904 (online)

SPECULATIVE ATTACKS ON THE DRACHMA AND THE CHANGEOVER TO THE EURO*

TASSOS ANASTASATOS
Eurobank EFG**

CONSTANTINA MANOU
Bank of Greece
Economic Research Department

I INTRODUCTION

When Greece joined Economic and Monetary Union (EMU) on 1 January 2001, competence for the pursuit of monetary and exchange-rate policy was handed over by the Bank of Greece to the Eurosystem. At the same time, the adoption of the euro and its circulation on 1 January 2002 marked the end of the historical course of the drachma as the country's national legal tender. For Greece, the benefits —but also the costs— deriving from this historic event are expected to extend across a rather long horizon, and thus their full evaluation will not be feasible before a considerable number of years have passed. It is estimated that among the major benefits are the elimination of exchange-rate risk in trade with the other euro area countries and the stabilisation of expectations as regards developments in nominal exchange rates vis-à-vis other currencies. A means to this end is the ECB's credibility and commitment to the maintenance of price stability in the euro area, through its interest-rate and other policies. This fact, combined with the ECB's substantial weight in world markets and its ability to sell large amounts of foreign reserves to defend the euro, practically eliminates for Greece the risk of exposure to speculative attacks against the currency. In the past, the country has paid a heavy price on account of such attacks, in the form of instability in foreign exchange and capital markets and the ensuing deceleration of real GDP growth. This price may possibly have been much greater had the Bank of Greece not implemented —successfully, as is commonly admitted— measures and policies of prevention and defence against such speculative attacks.

The international literature puts forward a pleiad of theoretical models that attempt to interpret speculative attacks on fixed exchange-rate regimes (or more flexible ones), the underlying mechanisms that cause them, and their determinants. As section 3 explains, the models do not agree on the existence of a single sequence of interdependent events that alter the dynamics of an economy —and in particular of the foreign exchange market— leading to speculative attacks. At the same time, empirical research cannot be characterised as generally successful in predicting upcoming crises. A small number of studies have dealt with the speculative pressures exerted on the drachma in various distinct circumstances.

This study aims at historically reviewing all speculative attacks against the drachma between 1960 and the introduction of the euro, empirically evaluating the determinants of these attacks and assessing the role of the Bank of Greece in responding to them. Indirectly, it also offers a measure of the respective advantages for Greece from the changeover to the euro. A dynamic analysis of attacks and pressures on the drachma in the post-war era is valuable for two reasons: it allows conclusions to be drawn on the nature of the internal macroeconomic and financial imbalances that triggered each attack, and also helps evaluate how the parameters attracting the interest of world markets have varied over time through the interaction between factors specific to

* The authors would like to thank G. Tavlas, G. Symigiannis, G. Hondroyiannis and, particularly, Heather Gibson for their valuable comments and assume responsibility for any errors that still remain. The views expressed in this study do not necessarily reflect those of the Bank of Greece.
** The study was prepared when T. Anastasatos served at the Economic Research Department of the Bank of Greece.

Greece and the international economic background. In a changing international environment characterised by constantly increasing interdependence and financial surpluses in search of investment and speculative opportunities, it is particularly interesting to investigate the possibility of an enhanced role played by expectations in the latest crises, and of contagion from international crises to an extent not justified by the level of fundamentals. The evaluation of these factors may be of particular interest to the new EU Member States wishing to join the euro area.

For these purposes, we use Limited Dependent Variable Models with many macroeconomic, financial and political indicators as independent variables. We investigate the existence of structural differences between these speculative attacks, depending on the type of macroeconomic and other imbalances that caused them, the time at which the crises transpired, their magnitude, and whether these attacks managed to force devaluation of the currency or were successfully repulsed by the Bank of Greece.

The study's central conclusion is that speculative attacks against the drachma up to the early 1990s are associated with the economy's competitiveness and monetary aggregates. Thereafter, efforts to meet the Maastricht criteria brought about a structural change in monetary policy, so that any shocks observed transpired rather due to contagion. In addition, devaluations are correlated with deeper structural imbalances, unlike pressures repulsed by the Bank of Greece, which rather emerged due to transient market expectations.

The study is structured as follows: after this first introductory part, Section 2 examines the Greek monetary policy framework and the drachma exchange-rate regimes in the period 1960-2000 and, in relation to the above, describes the various episodes of speculative pressures. Section 3 reviews the theoretical models and empirical approaches that have been employed to explain speculative attacks, with special reference to studies examining the case of Greece. Section 4 describes the methodology of our approach, the theoretical underpinnings of the variables used and the data analysed. Section 5 presents the major results and their sensitivity tests. Section 6 recapitulates and puts forward the conclusions drawn from our findings with respect to the pursuit of policy.

2 MONETARY POLICY, DRACHMA EXCHANGE-RATE REGIMES AND SPECULATIVE PRESSURES

This section reviews the Greek exchange-rate policy stance from 1960 to the country's entry into the euro area in 2001 within the more general framework of monetary policy pursuit, with special reference to the cases of speculative attacks on the drachma. Table 1 summarises the moments in time which —based on the following analysis of data collected from various sources— were classified as incidents of "speculative pressure" against the drachma, whether successful or not. On the basis of these instances we have also constructed an *ad hoc* indicator of crisis identification, which constitutes the starting point of the empirical analysis and a comparison measure for the crisis measuring indicators constructed by use of the data.

In 1953, the drachma was devalued by 50% and pegged to the US dollar at an exchange rate of 30 drachmas per dollar on joining the Bretton Woods system. According to Lazaretou (2009), this choice, combined with successful fiscal consolidation and restrictive monetary and economic policies, led to a stable environment of low and predictable inflation (averaging 2.4% with minor fluctuations over the period 1953-1973). This has stimulated investment and the maintenance of strong economic growth, combined in parallel with the deregulation of internal and external trade, which contributed to the improvement of the Greek economy's international competitiveness.

Table 1 Chronology of major exchange-rate events of the drachma

Period	Events in the foreign exchange market	Indicator's indication[1]
November 1963	Political instability, withdrawal of private deposits from commercial banks and bulge in demand for gold pounds.	SP
July 1964	Escalating tension in the Greek-Turkish relations, with consequences such as those of November 1963.	SP
August 1971	Collapse of the Bretton Woods system. Pegging of the drachma to the US dollar with an exchange rate of 30 drachmas per dollar.	C
March 1975	Detachment of the drachma from the dollar and pegging to a basket of currencies. Policy of fast or controlled (1980-1982) depreciation of the drachma.	C
January 1983	Devaluation by 16% vis-à-vis the US dollar and 15.5% vis-à-vis the ECU.	SP *
October 1985	Devaluation by 15% vis-à-vis the ECU under the two-year stabilisation programme.	SP *
1985-1987	Fast depreciation of the drachma (sliding).	C
March 1989	Depreciation expectations and pressures due to seasonal effects and the electoral results of June 1989 that disallowed the formation of an autonomous government. Sales of foreign reserves.	SP
March 1990	Pressures due to a further deterioration of macroeconomic imbalances and uncertainty during the elections run-up period, intervention by the Bank of Greece in financial markets and rise in interest rates.	SP
September 1992	Crisis of the European Monetary System (EMS), expectations of depreciation of the drachma, capital outflow abroad. The Bank of Greece raises banks' overdraft rates.	SP
October 1993	Pressures due to uncertainty in the elections run-up period and fiscal deficit excesses. The Bank of Greece raises interbank market rates.	SP
May 1994	Pressures in view of the deregulation of movement of capital. The Bank of Greece raises the (interbank market, intervention) rates.	SP
March 1995	Pressures in world markets. Short-lived acceleration of the drachma's depreciation vis-à-vis the ECU.	SP
November 1997	Pressures due to contagion of the crisis in SE Asia, deterioration in the current account deficit and the external debt, and market expectations of the drachma's participation in EMS's Exchange Rate Mechanism with a depreciation. The Bank of Greece raises overdraft rates and intervenes extensively in the foreign exchange market.	SP
March 1998	Rumours and pressures force the Bank of Greece to expedite participation of the drachma in the EMS's ERM with a central parity of 357 drachmas per ECU (i.e. devalued vis-à-vis the ECU by 12.3%) and a fluctuation band of ±15%.	SP *
August 1998	Capital outflows due to portfolio restructuring by foreign investors suffering losses from the financial turmoil in Russia. The Bank of Greece raises interbank rates.	SP
1 January 1999	Participation of the drachma in the ERM II with a central parity vis-à-vis the euro of 353.109 drachmas per euro and a fluctuation band of ±15%.	C
November 1999	Pressures due to doubts regarding the timely fulfilment of the inflation criterion as well as to uncertainty as to whether the drachma/euro central parity would be the conversion rate of the drachma at end-2000.	C
January 2000	Revaluation of the drachma's central parity rate by 3.5% (to 340.750 drachmas/euro) so as to limit the required depreciation.	C
January 2002	Euro cash changeover.	C

* These incidents ended in devaluation or a fast depreciation. In other "SP" cases, pressures were absorbed by the Bank of Greece.
1 "SP": Speculative Pressure, "C": Calmness (absence of attack or voluntary depreciation).

However, Greece did not avoid some episodes of pressures on the drachma during its participation in the Bretton Woods system. In this period, crises manifested themselves through massive withdrawals of private deposits from commercial banks and spilled over to the foreign exchange market through the ensuing jump in demand for gold sovereigns. The first such incident came about in November 1963 and lasted until January 1964. As noted by Alogoskoufis and Lazaretou (2002), the political instability that followed the electoral victory of the Centre Union ("Enosis Kentrou") party resulted in a lower rate of increase in deposits and in flights of capital abroad. The Bank of Greece was forced to sell roughly 3.4 million gold sovereigns in just one quarter. A second monetary crisis manifested itself between July

and October 1964, due to escalating tension in Greek-Turkish relations and the bombing of Cyprus by Turkey. The Bank of Greece, in order to support the drachma, sold 3.6 million gold sovereigns in the six months between May and October 1964.

The collapse of the Bretton Woods rule in August 1971 marked a shift in the world economy towards floating exchange rates, granting to each country's authorities independence in monetary policy pursuit. The drachma was unpegged from the US dollar and followed a regime of managed floating vis-à-vis a basket of currencies in March 1975. The steep rises in oil and other commodity prices in 1973 and 1979 caused inflation in Greece, as well as worldwide, to soar to two-digit figures. Yet, after the second oil crisis, whereas most industrialised countries set disinflation as a primary objective of their economic policy and managed to bring inflation down to one-digit figures by the early 1980s, Greece pursued an expansionary monetary policy up to early 1982 (see Bank of Greece *Annual Report for 1983*). As also mentioned by Garganas and Tavlas (2002), a strategy of monetary targeting (for M0 for the first time in 1975 and mainly for M3 since the early 1980s), while at the same time monitoring domestic credit expansion and the exchange rate, was not effective in lowering inflation. Thus, a simultaneous policy of allowing the drachma to depreciate fast became necessary in order to offset the effects of wage increases on the domestic economy's international competitiveness.

It should equally be pointed out that the effectiveness of monetary policy was also undermined by the inflexibility with which the financial system operated, as well as by the multiple restrictions on it. The financial system in Greece up to the early 1990s was rigorously controlled so as to serve specific objectives, such as allowing for public sector financing at low cost, providing incentives for the development of specific sectors of the economy —mainly agriculture— and, whenever deemed necessary, discouraging credit expansion. The main instrument of policy pursuit, alongside restrictions and selective granting of credit, was control over deposit and lending interest rates.

In the period June 1980 to end-1982, Greece opted for controlled depreciation of the drachma, so as to maintain its products' competitiveness without feeding inflationary pressures. However, inflation in the period 1980-1985 remained on average at 20%. The redistribution of income in favour of the population's weaker classes (set as a priority of economic policy) combined with excessive government borrowing led to large fiscal deficits and balance of payment disequilibria. In addition, the establishment of wage indexation in 1982 played a decisive role in keeping inflationary expectations up.

High inflation and the fact that the depreciation rate did not fully offset inflation differentials led to appreciation of the real exchange rate and loss in competitiveness. Under pressure, the government attempted to recover this loss through a 16% devaluation of the drachma vis-à-vis the US dollar and 15.5% vis-à-vis the ECU in early 1983. But the competitive disadvantage persisted and, as a result, the current account deficit reached 10% of GDP in 1985, while the economy showed symptoms of stagflation. Under these circumstances the drachma was devalued anew by 15% vis-à-vis the ECU on 11 October 1985, which improved competitiveness. Anticipating inflationary pressures due to the devaluation, the government announced an anti-inflationary policy implementing a two-year stabilisation programme, of which incomes policy formed a major part. Garganas and Tavlas (2002) consider that this programme helped improve the current account balance and reduce inflation.

It is obviously hard to conclude whether the aforementioned devaluations were forced or voluntary policy interventions. Perhaps, to some extent, they could be seen as preventive actions aimed at averting a more generalised attack, given the macroeconomic imbalances that rendered the level of the exchange rate

unsustainable. The economy's stabilisation programme was discontinued after 1987. At the same time, however, from early 1987 onwards, financial markets started to be gradually deregulated, allowing for the adoption of indirect instruments of monetary control. Expectations of depreciation of the drachma and pressure on the foreign exchange market resumed between March and April 1989, triggered by certain seasonal effects, namely, high balance of payments deficits observed in the first months of the year. Of course, the underlying cause was the country's persistent positive inflation differentials over its trade partners. Expectations of depreciation were further fuelled by the electoral results of June 1989, which disallowed the formation of an autonomous government. The Bank of Greece responded with massive sales of foreign reserves and higher policy rates, and managed to contain the depreciation of the drachma's average effective exchange rate for 1989 to around 7.1%, a level lower than inflation.

However, inflationary pressures resumed worldwide due to rising oil prices in 1990 and the economic recovery of industrialised countries. Domestically, macroeconomic imbalances worsened further and a climate of uncertainty prevailed during the run-up to the elections. As a result of all the above parameters combined, strong pressures on foreign exchange and financial markets also continued in the second half of March 1990. The Bank of Greece, according to the Annual Report for 1990, in order not to deviate from the restrictive monetary and credit targets it had announced in February 1990, proceeded to interventions in the financial markets with a view to controlling the banks' liquidity and credit expansion. The measures it adopted led to an increase of 1-1.5 percentage points in the interest rates on bank loans and helped alleviate the intense exchange-rate pressures.

Roughly at the same time, the Greek government and the Bank of Greece engaged in coordinated efforts to meet the criteria set by the Maastricht Treaty (signed in February 1992 and put into force in November 1993), first for joining the European Monetary System (EMS), and then for adopting the single currency. The measures were mainly geared at lowering inflation, fiscal deficits and public debt.

The EMS crisis in September 1992 affected Greece as well, but not to the point of dragging it into a collapse of its exchange rate. The expectations of depreciation of the drachma that emerged resulted in considerable capital outflows abroad and correspondingly limited liquidity. The Bank of Greece, with a view to containing pressures on the foreign exchange market, raised the interest rate on banks' overdrafts from their current accounts held with the Bank of Greece from 30% to 40%. Finally, pressures in all European countries diffused with the widening of the EMS fluctuation band from ±2.5% to ±15% in August 1993.

Pressures on the drachma's exchange rate appeared anew in September and October 1993, on account of the uncertainty prevailing during the run-up to the elections, as well as the large excesses in the public sector's borrowing requirements compared with the respective provisions in the State Budget. Once more, the Bank of Greece resorted to increases in interbank rates in order to contain these pressures, as mentioned in the Annual Report for 1993.

Nevertheless, the measures taken for meeting the Maastricht criteria ultimately bore fruit. The combined effect of restrictive incomes policy and moderate growth (GDP grew at an average rate of 1%) contributed to a drastic decline in inflation from 20% to 11% in the period 1991-1994. Zonzilos (2000) empirically showed that the inflation process underwent a structural change in the first half of the 1990s. This transition to a lower inflation regime may have curbed the intensity of pressures on the drachma, but does not seem to have averted the accumulation of real appreciation. The reason for this is that, within the context of anti-inflationary policy, the Bank of Greece, in

cooperation with the government, set as an exchange-rate policy objective from January 1991 onwards that the drachma's depreciation rate should not fully offset the domestic inflation's differential over the inflation of the EU countries (Alogoskoufis and Lazaretou, 2002).

Pressures on the drachma resumed on May 1994, as the final date of 1 July 1994, set by the EU for full deregulation of the movement of capital, was drawing nearer. The government's privileged borrowing from banks had already been abolished in early 1994, according to the requirements of the Maastricht Treaty. But the market expected that full deregulation would be accompanied by a faster depreciation of the drachma, or even a one-off devaluation, considering that real appreciation had accumulated and now had to be eliminated for the drachma to join the EMS at a competitive exchange rate. Questions also arose concerning the government's ability to service its rising external debt. As a result, capital outflows were observed. To deal with this phenomenon, the authorities proceeded without warning to a full deregulation of capital movement on 16 May 1994. The Bank of Greece fended the pressures off by drastically increasing its intervention rate and imposing an additional daily charge of 0.4% on the financial institutions' cost of borrowing through overdrafts on their current accounts held with the Bank of Greece. The imposition of this additional daily charge brought the respective annual overdraft rate to 180%, making borrowing in drachmas quite unprofitable. These measures were successful and resulted in capital inflows, while soon afterwards interest rates returned to the levels seen before the crisis and the depreciation caused by the pressure exerted until mid-June was more than offset.

In 1995, the Bank of Greece announced for the first time a quantitative target on an annual basis for the drachma's exchange rate, namely depreciation of around 3% between the beginning and the end of the year. Using the exchange rate as an "anchor" for monetary policy became official and known as the "hard drachma" policy. Abrupt fluctuations in the course of 1995 were avoided, but March saw an acceleration of the currency's depreciation. According to the Bank of Greece *Annual Report for 1995*, this fact was due to the particularly strong pressures that appeared in international foreign exchange markets, arising from the political uncertainty that prevailed in Europe with respect to the starting time of monetary union. Also, the fiscal consolidation process was meeting with some resistance because of its real effects on the economies, stemming from the insufficient economic convergence of fiscal aggregates between certain Member States. Nonetheless, pressures were short-lived and left no trace on the data.

The outburst of the crisis in SE Asia in 1997 marked the start of persistent speculative pressures on the drachma that lasted for 10 months, resulting in considerable capital outflows. Brissimis *et al.* (2002) argue that the domestic market had already begun to foster expectations regarding an overvalued drachma from mid-1997. Such expectations had been fuelled by the appreciation of the real exchange rate, the high current account deficit (4% of GDP in 1997) and the country's high external debt (public gross external debt, on its own, amounted to 24% of GDP in 1997) in combination with the high rate of wage increases. Thomopoulos (2004) notes that some investment banks were publishing estimates that the drachma was overvalued by as much as 28%. The same author estimates the real appreciation accumulated during the previous three years due to the "hard drachma" policy and the simultaneous persistence of long-lasting differentials between the domestic and foreign levels of prices at around 10%, taking into consideration the Balassa-Samuelson effect and other factors. In any case, against this background, it became necessary for the Bank of Greece to take measures similar in form and extent to those it had taken during the crisis of 1994, in order to cope with the pressures. But contagion from the Asian crisis demonstrated the emerging importance

of financial linkages and interdependencies. Several foreign financial institutions proceeded to a liquidation of their positions in Greek government bonds and other investments to cover losses in the Asian market.

However, rumours and pressures persisted even after normalisation in Asia. The reason, according to Voridis *et al.* (2003), was that the country's objective to join the euro area by 2001 set May 1998 as a deadline for the drachma's entry into the ERM. Part of the markets expected that ERM participation would be accompanied by a devaluation of the drachma so as to correct the competitiveness deficit stemming from the accumulated overvaluation. To diffuse tensions in the foreign exchange market, the government finally had to expedite (Voridis *et al.*, 2003) the drachma's entry into the ERM, which took place on 16 March 1998, with the central parity set at 357 drachmas per ECU and the fluctuation band at ±15%. The central parity represented a 12.3% devaluation of the drachma vis-à-vis the exchange rate determined at the end of transactions on the penultimate day before ERM participation. This adjustment put an end to the period of speculative pressures and capital outflows and was considered as a necessary and sufficient condition for ensuring that the drachma's inclusion in the ERM would neither cause a slowdown of economic growth in Greece nor place the balance of payments at risk. Garganas and Tavlas (2002) estimate that a parallel banking crisis was only avoided thanks to the overall good condition of the Greek banking sector, and attribute this banking soundness to the prudent regulatory and supervisory activity of the Bank of Greece.

In May 1998, the discount rate ceased to exist, when this means of refinancing was abolished, as there was no corresponding practice within the Eurosystem. Garganas and Tavlas (2002) note that the drachma's participation in the ERM restored calmness in the markets and led to considerable capital inflows that increased the country's foreign exchange reserves in US dollars. The central bank, in its effort to limit these inflows, implemented an excess liquidity absorption policy through interventions in the interbank market. At the same time, it allowed the drachma to remain overvalued compared with its central exchange rate in the ERM, within a band in the order of 6.5-9%. Garganas (2008) emphasises that inflationary pressures or potential recession after the devaluation that accompanied ERM participation were avoided thanks not only to the credibility the ERM had already acquired, but also to the country's fiscal and labour market policies that were consistent with ERM participation.

However, the crisis in Russia in end-August 1998 came to disrupt calmness and to bring about a temporary rise in interbank rates and a decline in the drachma's appreciation relative to its central rate to 4% (Brissimis *et al.* 2002). The Bank of Greece, in its *Monetary Policy Interim Report* (November 1998) estimates that this crisis had an effect on liquidity in the Greek capital markets, although to an extent smaller than that after the crisis in Asia, but nonetheless giving rise to a large increase in the volatility of returns. Capital outflows were recorded again by foreign investors who restructured their portfolios so as to compensate for losses suffered in the Russian market.

On 1 January 1999, the drachma joined the ERM II with a central parity of 353.109 drachmas per euro, and a fluctuation band of ±15%. At year-end, however, pressures on the foreign exchange market resumed —as noted also by Garganas and Tavlas (2002)— although not as intensely as before the drachma's participation in the ERM. They were triggered by doubts with respect to the timely fulfilment of the inflation criterion, as well as by uncertainty as to whether the drachma/euro central parity would be the drachma's conversion rate at the end of 2000. On 14 January 2000, the drachma was 6% higher than its central exchange rate. To avoid the inflationary consequences of the required depreciation back to the central parity within the year, on 17 January 2000, less

than two years after the drachma's entry into the ERM, the central parity was revalued by 3.5%, to 340.75 drachmas per euro, which limited the required depreciation to 2.6% (from 6% that would have been necessary otherwise). On 19 June 2000, the ECOFIN Council approved the inclusion of Greece into the euro area as of 1 January 2001, followed by the introduction of euro banknotes and coins, replacing the drachma, on 1 January 2002.

3 THEORETICAL AND EMPIRICAL LITERATURE

An exchange-rate crisis can be defined as a case of extreme speculative pressure on the foreign exchange market as a result of a sudden and sizeable change in the composition of the portfolios of private citizens who try to gain benefits or avert losses from: (a) an anticipated change in the currency's exchange rate, or (b) changes in the exchange rates of other currencies in which they have holdings. Such pressure is often followed by an abrupt devaluation/depreciation of the exchange rate, but may sometimes be repulsed by the central bank, which, in its effort to defend the currency, proceeds to dramatic interest rate increases and/or sales of foreign reserves.

The international literature offers various different interpretations of the nature of speculative attacks and the mechanisms that link them to key economic and political aggregates. These mechanisms also determine an attack's success probability, as well as the severity of its impact. Crises vary in time as to their symptoms and the imbalances ascribed to them. The review by Flood and Marion (1998) shows that most traditional models interpret the particularities of specific episodes that gave birth to the development of each model.

The point of departure are the "First Generation Models" (hereinafter FGMs).[1] These support that the basic cause of all crises is the inconsistency between an expansionary domestic policy and rigid exchange-rate targets. In more detail, crises are provoked by the priority a government gives to strictly abiding by an exogenously set policy target. In the initial model by Krugman (1979), the primary objective is the servicing of a steadily widening fiscal deficit. Financing the deficit through money issuing by the central bank, combined with the need to maintain total money supply unchanged, leads to a gradual depletion of foreign reserves. Speculators predict the inevitability of a devaluation and attack before the exhaustion of foreign reserves, to prevent capital losses. Although the framework is deterministic, it may allow for a rotation of attacks and confidence restorations, if there is uncertainty as to the volume of foreign reserves governments would be willing to sell to defend the currency.

"Second Generation Models" (hereinafter SGMs)[2] indirectly correlate the emergence of a crisis with the soundness of an economy's macroeconomic aggregates. In more detail, as also in FGMs, unusually high values of certain variables may urge governments to implement an expansionary monetary policy and thus place the fixed exchange rate at risk. The difficulty of maintaining a regime of fixed exchange rates lies in the market's low confidence as to the achievability of this objective because of the inherent inconsistency of the policies followed. Inflationary expectations are incorporated into wages and negatively affect the macroeconomic aggregates. This enhances the impact of any adverse shock to demand, thus strengthening the government's incentives to devalue. This bidirectional interaction entails that the cost of defending the exchange rate depends on endogenous variables as well. By consequence, any equilibrium is "fragile", because expectations may be self-fulfilling, and multiple balance equilibria become feasible. It

1 Salant and Henderson (1978) used Hotelling's (1931) model on the pricing of exhaustible resources to study attacks on the price of gold set by the government. Krugman (1979) applied this principle to fixed exchange-rate values. Flood and Garber (1984) improved his model further. See Agenor *et al.* (1992) for a review.

2 SGMs are based on expansions of the monetary policy time inconsistency models elaborated by Kydland and Prescott (1977) and Barro and Gordon (1983). Perhaps most representative is the one by Obstfeld (1994).

is therefore deduced that not all crises can be characterised by a single sequence of events. Any variable (e.g. higher short-term real interest rates, unemployment, changes in government, etc.) may operate as an alarm signal to synchronise expectations, spark off expectations of devaluation and consequently create a crisis, as long as the market considers that this variable is relevant. Even a seemingly insignificant event may change market perceptions and constitute the trigger of a speculative attack, if seen as the culmination of some long-lasting economic and/or political problem.

The so-called "Third Generation Models" (hereinafter TGMs) place emphasis on the interaction between exchange-rate crises and financial markets. Recent episodes, and particularly the Asian crisis of 1997-1998, have made evident the connection between these two and have brought to the fore notions such as "moral hazard" and "adverse selection".[3] The imperfections of financial markets combined with the provision of explicit or indirect government guarantees to banks may lead to excessive and unsecured borrowing. By consequence, exogenous shocks (e.g. a major bankruptcy, recession, stock market crash, political instability, or banking panic) may evolve into a generalised financial disruption and then spill over to foreign exchange markets.

All the aforementioned theoretical approaches perceive exchange-rate crises as cases of discontinuity in the foreign exchange market, but interpret any abrupt movements observed during the crises as consistent with the behaviour of forward-looking speculators. A potential rejection of the theoretical framework concerning the emergence, extent, time and contagion of the crises by empirical analysis would cast doubt on the validity of the rational expectations hypothesis and the treatment of the exchange rate as an asset price. Unfortunately, empirical research has yet to document a convincing relationship between crises and economic fundamentals. This has supported views that markets are dominated by instincts and self-fulfilling expectations. If this is true, it may be practically impossible to predict the exact time crises appear, but perhaps a vulnerability zone may be traceable.[4] Empirical findings can thus be seen as a test of the validity of theoretical predictions, while at the same time providing an instrument for predicting, managing and repulsing crises.

Identification of exchange-rate crises is hard, since the whole process varies in each different episode and involves several macroeconomic indicators. This diversity of external features, which has spawned different theoretical approaches, casts doubt on the existence of a satisfactory degree of similarity among the structural parameters underlying a crisis. Nevertheless, successfully predicting future crises depends heavily on answering the question of whether all crises are characterised by common drivers, so that generalisations based on previous experience may be feasible.

Answering the above question calls for an empirical approach that systematically examines the nature of the relationships linking the crises with macroeconomic aggregates in a common pattern, and quantifies the degree to which crises are similar and, by consequence, predictable. The first empirical studies, such as those by Blanco and Garber (1986) or Cumby and van Wijnbergen (1989), do not fulfil this criterion, since they analyse the collapse of specific fixed exchange-rate regimes. These episodes are not necessarily representative of the underlying populations of significant devaluation episodes, which in turn are not representative of the total population of successful or unsuccessful speculative attacks on various exchange-rate regimes (e.g. some fixed exchange-rate regimes are abandoned without having suffered any attack).

3 These notions had formerly been used by authors such as Mishkin (1992, 1996), Calvo and Mentoza (1997) and Caplin and Leahy (1994), in the broader context of asymmetric information models.

4 In such a case we could also predict the intensity of the blow a crisis would bring about in different countries, as a function of their sensitivity to disruptions such as a global decline in confidence.

Closer to our goal is the "indicators approach",[5] which records unusual deviations of a series of macroeconomic aggregates and respectively signals an upcoming crisis. However, more rigorous scholarly efforts employ binary Limited Dependent Variable (LDV) models, applied to a panel of data from many countries.[6] LDV methods have the advantage of summarising all underlying relationships under a single measure of likelihood. But although this methodology limits the episode selection bias, the above studies indirectly assume the existence of homogeneity among the various crises without proceeding to formal tests. The typically average performance of the empirical models has usually been attributed to the loose links between macroeconomic aggregates and crises, overlooking the possibility of it stemming —at least partly— from inherent differences among the episodes under study.[7] While it has been understood that episodes of different scale and impact are characterised by heterogeneity, the latter has not been documented through formal tests of the existence of structural differences. The studies focusing on the drachma are no exception with respect to the above observations.

3.1 STUDIES OF SPECULATIVE PRESSURES ON THE DRACHMA

The relatively limited literature on the drachma[8] acknowledges the impossibility of explaining all events relying on a single rationale of causalities and event sequences. On account of this, these studies tend to focus on limited time periods. The incidents examined exhibit by and large the features described by FGMs. Consequently, all these studies —except the one by Apergis and Eleftheriou (2002)— empirically test the predictions of specific FGMs.

All such studies converge to the estimate that crises were associated with external and fiscal imbalances and nominal rigidities that created inflation differentials over other advanced countries. These factors, combined with the reduction in the depreciation rate after 1985 in order to contain inflationary pressures, were leading to concerns about the eventuality of the drachma being overvalued and were fostering expectations of further depreciation. However, the emergence of episodes of turmoil in the foreign exchange market became possible —if not even more frequent— due also to the deepening and deregulation of financial markets. The worse scenario of a twin parallel banking crisis is thought to have been avoided thanks to the Greek banking sector's sound economic aggregates.

Flood and Kramer (1996) attempt a qualitative analysis of the drachma crisis in May 1994. Although not providing a formal econometric test, the authors argue that a FGM following Flood and Garber (1984) can adequately explain the episode, as it delineates the basic inconsistency between the policy of financing the public debt by monetary means and the "hard drachma" policy. The latter —albeit more flexible than full pegging— led to an accumulated real appreciation of the drachma. The eventual failure of the attack is attributed to the rise in interest rates brought about by the Bank of Greece. This increased the cost for speculators to such an extent that a depreciation of 40-50% would have been required for speculative activity to be profitable – a percentage far too high relative to market expectations.

Kalyvitis (1993) calculated the drachma's depreciation probabilities in the period 1987-1992, applying the FGM of Blanco and Garber (1986) under reasonable initial assumptions. His findings support the view of Gar-

5 Kaminsky *et al.* (1997).
6 Among others, Eichengreen *et al.* (1995, 1996), Klein and Marion (1997), Frankel and Rose (1996), Moreno (1995) and Gibson (2003).
7 An opposite example is offered by Eichengreen *et al.* (1995), who find that, while appreciations reflect analogous previous depreciations, changes in exchange-rate regimes (from fixed exchange rates to freely floating) are, to a large extent, unpredictable. Nevertheless, these authors used *ad hoc* definitions of the crises instead of gleaning them from the data. Such practice is questionable as to the objectivity of the selection. Moreover, it renders the method inappropriate for predicting purposes, since such definition can only be given *a posteriori*.
8 This category should include studies such as the one by Gibson and Tsakalotos (2005), which focuses on Greece and some countries of similar economic characteristics (Spain, Portugal).

ganas and Tavlas (2002) that market expectations regarding the eventuality of depreciation were very high in the period 1987-1990, when Greece was characterised by economic and political instability. However, the implementation of the stabilisation programme over the next two years limited these expectations. Similarly, Apergis and Eleftheriou (2002) calculate indicators of exchange-rate pressure on the drachma and of the respective intervention by the Bank of Greece to diffuse it. Yet, they employ a methodology similar to Weymark's (1995) in the context of a small open economy. This approach is empirically founded and does not rely on any specific theoretical model. Their calculations show that the drachma suffered the greatest depreciation pressures between 1974 and 1989. But at the same time they calculate that interventions by the Bank of Greece were intensive and managed to absorb 97% of these pressures.[9] The authors conclude that the proactive exchange-rate management policy pursued by the Bank of Greece in 1992-1998 succeeded in imposing the "hard drachma" policy and limiting exchange-rate volatility.

Karfakis and Moschos (1999) and Karfakis (2002) take as a theoretical basis the FGM of Sachs *et al.* (1996) and analyse the relationships between crises and economic aggregates over rather lengthier periods. Karfakis and Moschos (1999) examine the period up to 1995. Their empirical test suggests that the extent of the drachma's real appreciation compared with its long-term value, the adequacy of foreign reserves relative to domestic liquidity, the net capital account and the net position of the current account can help predict an upcoming crisis.[10] Disruptions in the first three variables explain most of the volatility of the speculative pressure indicator.

Karfakis (2002) focuses on the period between January 1990 and March 1998 to examine whether the increasing openness of the Greek economy has changed the way economic aggregates affect the probability of an exchange-rate crisis. This question is quite interesting, given Greece's growing interconnection with the international environment and the emerging importance of international crisis contagion. However, this higher openness is proxied in an *ad hoc* fashion, by splitting the sample into sub-periods before and after the lifting of restrictions on capital movements in May 1994. His findings provide evidence of a statistically significant link between drachma crises and the real exchange rate, the adequacy of foreign reserves, the net capital account, domestic borrowing, the terms of trade and the rate of credit expansion, although this latter appears with a negative sign. They also confirm that capital movement liberalisation caused the factors affecting the ability to predict speculative attacks on the drachma to change.

4 METHODOLOGY

The methodological basis for an empirical test is provided by Limited Dependent Variable Models. A technical description of these models can be found in Annex 2. The "Binary Response Model" (hereinafter BRM) includes a dependent variable, broken down into two eventualities —"crisis" (1) and "calmness" (0)— and correlates the probability that a crisis will emerge with the behaviour of the explanatory variables. With respect to the dependent variable, two basic types are used: (a) an ad hoc indicator that traces events on the basis of the historical course of the drachma;[11] and (b) a composite indicator, constructed by use of the empirical data. According to the definition of speculative pressure

9 These numbers should not be taken as binding, due to the model's simplifying assumptions as to the nature of the interventions by the Bank of Greece (only consumption of reserves) and the definition of pressure in general. This perhaps also explains the seemingly paradox fact that the crises of e.g. September 1992, May-June 1994 and October 1997 have left no trace on the indicator of speculative pressure, despite the recorded intensive interventions.

10 The crisis is proxied by an indicator construed similarly to the one used in this study. It is calculated as the sum of percentage change in the nominal effective exchange rate and percentage change in foreign reserves.

11 In binary models, the indicator's categories "SP*" and "SP" as they appear in Table 1, i.e. devaluations and repulsed attacks respectively, jointly constitute the eventuality "1": crises.

given earlier, the indicator is constructed as the weighted sum of changes in the exchange rate, interest rates (used by the Bank of Greece to defend the currency) and the negative of changes in foreign reserves (i.e. losses). The indicator is constructed with a view to tracing all speculative attacks, including those successfully repulsed by the central bank. As a second step, all observations at least 1.5 standard deviation greater in size than the sample's average are traced and defined as a "crisis" (1), whereas all other observations constitute "calmness" (0). A comparison of the two basic indicators allows the identification in the empirical data of events historically recorded as crises, as well as —less high-profile— instances of volatility in the foreign exchange market.

A variation of the indicator constructed by use of the data records only those cases where forced exchange-rate devaluations were both sizeable and sufficiently unusual. These models overcome the difficulties and partial subjectivity inherent in capturing repulsed attacks. But most importantly, they help answer the main question posed by this study, i.e. whether successful attacks are structurally different from unsuccessful ones. Comparison with the models that employ the composite indicators offers some first evidence in this respect.

A more rigorous evaluation of this question is achieved by use of the distinct Multiple Response (or Multinomial) Models. In these, the eventuality of crises is dichotomised into two sub-eventualities: (a) attacks that forced devaluation; and (b) speculative pressures repulsed by the Bank of Greece. Crises are identified in the data by use of the composite indicator, to maximise objectivity in the process of selecting the episodes to be studied. Thereafter, the two eventualities are directly juxtaposed within the same model, which allows for the existence of structural differentiation between the two types of attacks based on their relationship with the determining factors of the crises. This is achievable since the model estimates two different sets of coefficients for the explanatory variables, one for each sub-eventuality.

4.1 DEFINITION OF THE EXPLANATORY VARIABLES

The selection and construction of the explanatory variables is determined by the requirements of the theoretical models, while taking into consideration the availability of data. Unusual fluctuations in these variables have been observed prior to most crisis episodes. The economic variables can be broken down into three broader groups: those reflecting competitiveness, monetary and credit aggregates and variables that measure growth prospects. In addition, account is taken of contagion from international crises, political parameters and the exchange-rate regime. In what follows we analyse how our variables relate to the theoretical models and the regularities empirically observed, and consequently, what effect they are expected to have.

Measuring competitiveness

Accumulated deviation of the *Real Exchange Rate* (RER). An overheated economy combined with a system of fixed or managed floating exchange rates leads to real appreciations. A freely floating exchange rate may come into conflict with the current level of economic activity in the presence of market imperfections. In addition, capital inflows based on expectations may lead to appreciations even when there is no real interest rate differential. As a measure of appreciation we test a simple indicator of the RER, as well as the percentage cumulative deviation of the RER over a period of 24 months.[12] This second measure attempts to cover the case of a lagged recovery to an aligned (competitive) exchange rate.

12 The logic of accumulation is tested more broadly in the other variables as well. It is useful to test if at least some of the coefficients have a significant effect only in the case that they deviate for a long period of time, or if different variables operate in different time horizons before an attack. Some theoretical models offer examples of influences that take place only when there is accumulation, such as gradual accumulation of excess financing or external sector deficits.

Empirical studies have shown that this lag may last two years or more. Any previous appreciation (rise in the RER indicator) increases the probability of an attack.

We also include a variable relating to the manifestation of low competitiveness: the *current account* deficit as a percentage of GDP. This variable may reflect the different policies countries implement in their external sector, faced with a given appreciation, as well as differences in the relative prices of tradeable and non-tradeable goods, not captured by the RER. The effect of this variable is expected to be negative.

However, even if the economy's real and expected growth stand at high levels, *wage increases* exceeding these levels may be perceived by the market as a loss in competitiveness, which will be addressed at some point by depreciation. This variable is central in Obstfeld's (1994) analysis, as it reflects the inflationary expectations of market participants that affect the exchange rate.

The cost of a loss in competitiveness is positively associated with the degree to which the economy is open (openness). However, an open economy implies that a given depreciation has a greater effect on the price level and consequently a greater cost for the monetary authorities. This factor is expected to limit the incentive to abandon a regime of fixed exchange rates. The *economy's openness* is proxied by the ratio of exports plus imports to GDP.

Expectations of depreciation driven by competitiveness problems lead to capital outflows. Thus, we include a dummy variable for the existence of *restrictions on movements of capital*.[13] If the central bank is credible and economic aggregates are considered sound, this measure may be considered sufficient to avert short-lived capital outflows, so that speculators may shift their focus elsewhere. The effect of this variable therefore should be negative.

Monetary and credit aggregates

Monetary expansion. All models predict that monetary expansion —used either to moderate the pressure exerted on financial organisations and on the real sector of the economy or to cover a fiscal deficit— will at some point lead to higher prices. In this case, the maintenance of competitiveness and foreign reserves can only be achieved through a change in the exchange rate. However, attacks are caused only if the rate of monetary expansion considerably exceeds the depreciation rate allowed by the exchange-rate regime. Otherwise, the loss in competitiveness brought about by inflation can only be offset through a relatively smooth and predictable depreciation rate. This study measures monetary expansion as a percentage change in M1.

Given that the money supply process involves lags and seasonalities, monetary expansion is sometimes better captured by directly measuring total inflation, i.e. change in the CPI. In this case, the CPI is preserved within the model along with the unemployment rate so as to take account of possible trade-offs as present in the Phillips curve.

In addition, we use a variable measuring the equivalent of monetary expansion: the *increase in domestic credit* (as a percentage of GDP). We also include the cause of monetary expansion according to Krugman's (1979) model: the *fiscal deficit* (as a percentage of GDP). The importance of this factor is exaggerated on account of the unrealistic assumption that there is no access to international capital markets. In modern open economies —and Greece, at least in the later years of the sample, can be thus characterised— the central bank has sufficient international credit lines available. Consequently, the significance of this variable is rather expected not to be decisive. Finally, we also include another variable, the

13 It must be noted that the constructed variable is subject to limitations, as central banks also impose on movements of capital obstacles not explicitly provided for, and consequently, untraceable in the official administrative acts.

increase in bank credit to the private sector as a percentage of GDP, as an indication of the potential for excessive and risky investment and the existence of a vicious "boom and bust" cycle. Financial "bubbles" undermine the soundness of the banking sector and the financial crisis that accompanies the subsequent bust leads to abrupt and massive capital outflows, dragging the exchange rate down. This phenomenon, described by Dooley (1997), can also come about in the case of sound macroeconomic aggregates and a lack of incentives for the government to undertake expansionary policies in the future (low unemployment, strong growth). It may even worsen if there are "bandwagon effects". The variable is expected to have a positive effect.

Incentives for expansionary policies

Both *lack* of growth (as proxied by the rate of change in GDP) and *low expectations of growth* provide an incentive to abandon a system of fixed exchange rates or more generally to adopt a more expansionary policy.

According to SGMs, the existence of high *unemployment* rates constitutes a strong incentive for the adoption of a Keynesian type expansionary policy with a view to stimulating demand, and therefore may be linked to the emergence of crisis episodes. Addressing unemployment through policies on the supply side, such as abolishing minimum wages or deregulating the labour market, entails a long-lasting political process, and consequently cannot avert speculative attacks.

Political parameters

Victory or defeat in parliamentary elections. According to the theoretical framework of SGMs, the government's political commitment is considered crucial for the sustainability of the exchange-rate regime. *Elections and changes in government* can foster expectations of a breach of this commitment and therefore entail opportunities for speculation or even herd behaviour. Furthermore, swings in the political cycle can lead to a relaxation of monetary and fiscal policies. We initially use a dummy variable indicating when elections are held, which is then substituted in subsequent models with two twin dummy variables, of victory by the governing party (or coalition) and change in power. These latter may capture expectations of a loosening or tightening of monetary and fiscal policy by a new government, and the lowering of the reputation cost brought about by an abandonment of the fixed exchange-rate regime in an outgoing government.

Contagion of international crises

We construct a dummy variable that takes the value of 1 if a crisis transpires (according to the specific underlying dependent variable used in each model) in the same month in some "advanced country", according to IMF's classification; or 0 otherwise.[14] The variable is expected to capture herd behaviour phenomena, as well as all the structural factors described in SGMs. More specifically: (1) trade links (comparative disadvantage due to depreciation in a major partner or competitor, as in Gerlach and Smets 1995); (2) macroeconomic similarities (markets consider that countries of similar economic structures and problems will react similarly to an attack, as in Buiter *et al.* 1996); and (3) financial links (change in the investors disposition to take on exchange-rate risk due to holdings in depreciating currencies). In interpreting the results, attention must be paid to the fact that the variable may not be expressing a net contagion of crisis, but only non-observed common shocks (monsoonal effects).

14 "Crisis" in advanced countries is proxied in a similar manner, i.e. using the indicator of foreign exchange market pressure (EMP). Greece was included among emerging markets by some organisations even until the eve of its entry into the euro area. However, based on political and geostrategic criteria, it has always formed part of the block of advanced countries, and for this reason markets did not treat it as similar to e.g. the block of non-aligned countries. In any case, even some advanced countries suffered consequences from contagion of crises that transpired in developing countries (NA Asia, Russia), so that these effects are reflected in the indicators of crises in advanced countries and also taken into account in the crisis contagion dummy variable used.

The exchange-rate regime

FGMs and SGMs describe attacks on regimes of fixed exchange rates. The possibility of applying them to more flexible regimes, such as regimes of administratively set or more freely floating exchange rates, has to be tested empirically. It is possible that the degree of flexibility allowed by each regime and other relevant institutional factors affect the synchronisation problem speculators face by changing expectations concerning the future objectives of the monetary authorities as regards the exchange-rate policy. For this reason, we include a dummy variable of the exchange-rate regime constructed according to the classification of Reinhart and Rogoff (2003). This is based more on *de facto* than on *de jure* definitions, and consequently offers a more realistic picture of the existing regime.[15] Including this variable within the models helps ensure that the evidence regarding heterogeneity of the crises provided by our other models is not associated with the existence of various different exchange-rate regimes within the sample.

4.2 DATA ORGANISATION

The empirical test period stretches from 1960 to the end of 2000, when the euro replaced the drachma in book-entry form. We opted for a monthly frequency of the data, mainly for two reasons: (a) to trace all shorter and smaller attacks, mainly repulsed ones, the impact of which had soon been reversed and therefore left no trace on lower frequency data; and (b) to maximise volatility within the sample and thus facilitate the drawing of conclusions. The data, collected from many different sources, have been extensively tested for errors, omissions and comparability. Their detailed description can be found in Annex 1. For some variables for which monthly data were not available throughout the sample, we use the corresponding quarterly data and repeat their respective values for three consecutive months. The underlying assumption is that market participants use the latest published information to form expectations and take action. The decreasing fluctuation that stems from this repetition is more than offset by the richness of information obtained on a plethora of variables updated on a monthly basis.

5 EMPIRICAL FINDINGS

5.1 BINARY RESPONSE MODELS[16]

As an introduction to the econometric analysis, we proceed with a charts analysis along the lines of an event study. Chart 1 presents the path of one key variable from each group of variables, namely real exchange rate, inflation and unemployment, for each of the three cases of devaluation of Table 1. It can be discerned that in all three cases the variables follow a pattern consistent with theory. The real exchange rate appreciates a few months before each crisis, depreciates during the crisis (as a result of the crisis), and continues to appreciate thereafter, although at somewhat lower rates, due to the accumulation of inflation differentials over the country's trade partners. As for inflation, it can be seen that it followed a constant upward path in all three cases. As regards unemployment, we are interested in its absolute rate (as an incentive for expansionary policies) and not its rate of change (which is much slower compared with that of financial variables). Indeed, the three depreciations coincide with an unemployment rate considerably higher than the sample's average (about 5.5%), which in fact in two of the three cases is on the rise.

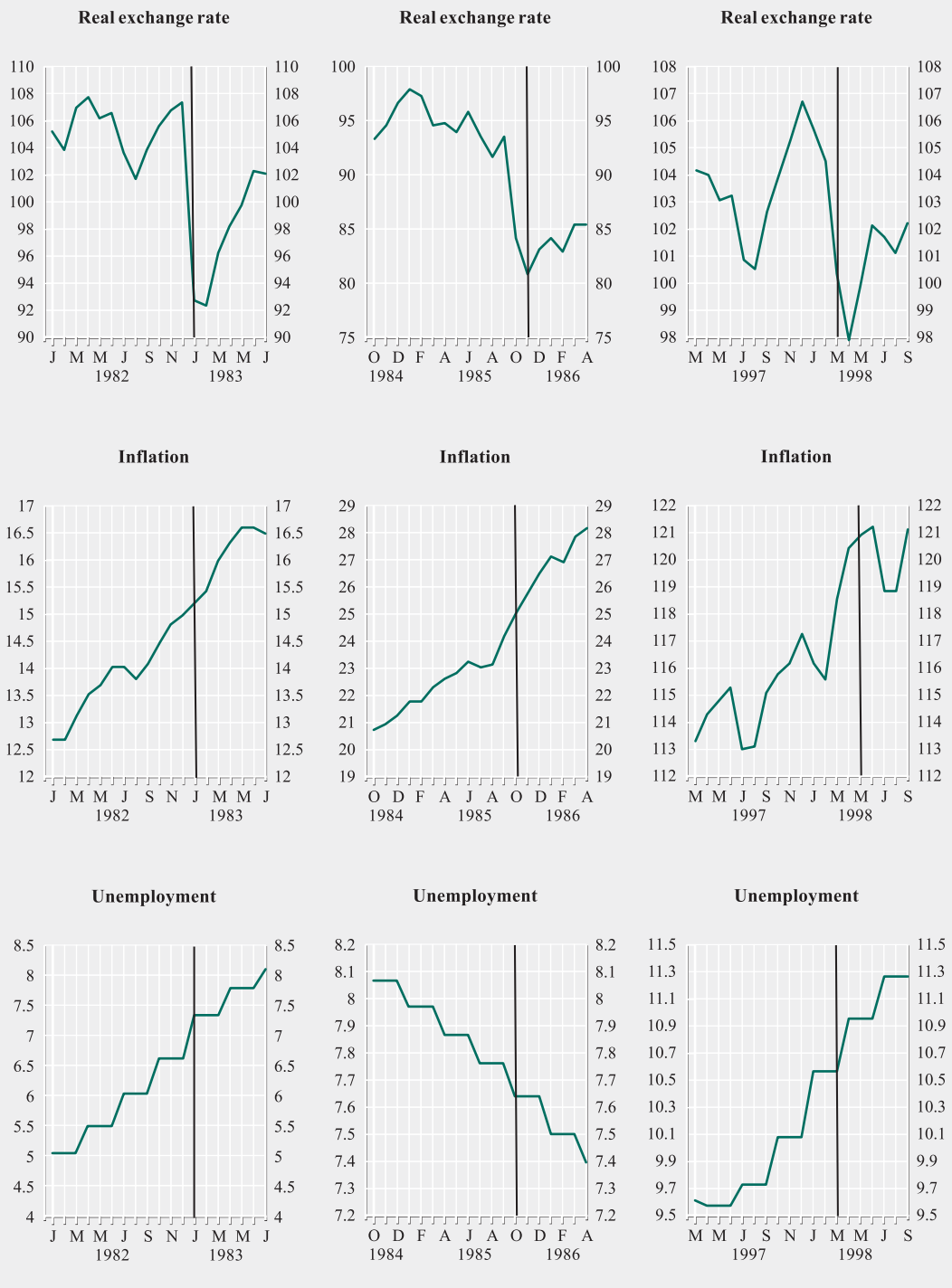
Chart 2 compares developments in the levels of unemployment and the cumulative real

15 In the dummy variable, all regimes of freely floating and managed floating exchange rates, as well as brief periods of floating, are categorised as "floating". All types of monetary areas and exchange-rate pegs (announced, *de facto*, and rolling) fall under the category of "rigid and intermediary exchange-rate regimes".

16 By including numerous explanatory variables of a comparable economic content we run the risk of increasing the multicollinearity within the model, and limiting the significance of individual variables. For this reason, from each specification we eliminate the variables that proved to be statistically insignificant.

Chart 1 Behaviour of variables in specific crises

(course of variables 12 months before and 6 months after each devaluation)

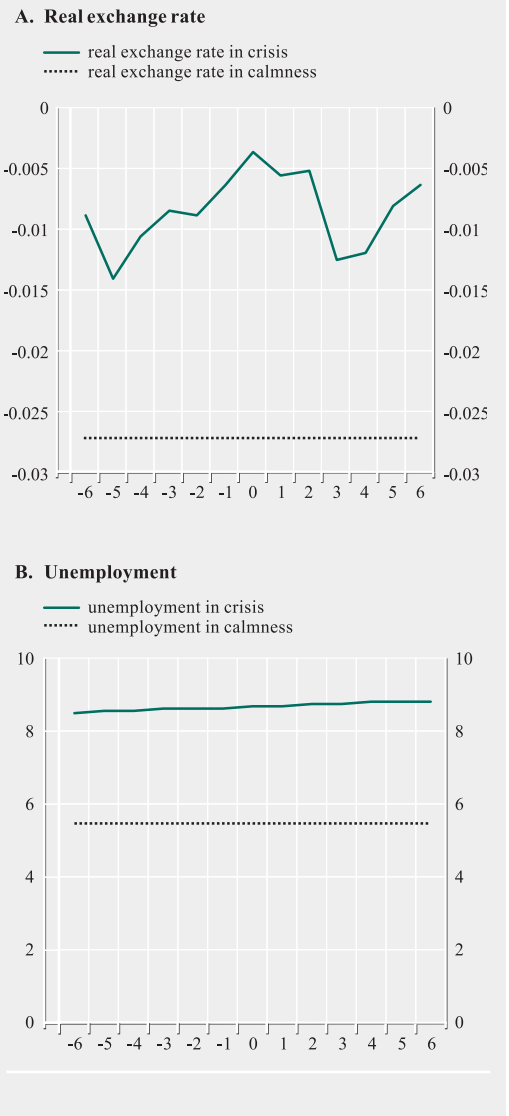


exchange rate in "crisis" periods with the corresponding levels in periods of "calmness". For this comparison we use the average of the two variables for all the cases of successful attacks and repulsed pressures of Table 1, and the average of all other observations.[17] The Charts clearly indicate that crisis periods are characterised by accumulation of appreciations compared with the average development of the real exchange rate in calmness periods. Such appreciations are reversed by the crisis itself. Also, the unemployment rate is considerably higher in periods of turmoil in the foreign exchange market than in calmness periods.

The charts analysis, albeit quite illuminating, captures the variables' behaviour a few months before the crisis, but is unable to capture the effect of long-term cumulative deviations. More importantly, this analysis is bivariate and therefore cannot take into account as well any possible interactions or complementary action between the explanatory variables. Thus, confirmation of the initial conclusions necessitates an estimation of the multivariate econometric models.

In specifying the models, we use cumulative changes in the real exchange rate and the rate of change in the level of prices (30 and 24 months respectively).[18] This choice is dictated by the monthly frequency of the data. As regards the real exchange rate, given that several cases of turmoil in the foreign exchange market last more than one month, it is often the case that, at the moment the indicator defines a "crisis", the exchange rate is already overvalued and the model captures the first results of the crisis, i.e. devaluation or depreciation. Thus, using contemporaneous values of the RER variable results in the appearance of a negative correlation between appreciation and crisis, a conclusion that is misleading. Market short-time dynamics and psychology suggest a continuing course of the currency in this direction. However, the use of cumulative variables shows in the longer run that, if a real appreciation has accumulated over a considerable period and in a considerable size, it con-

Chart 2 Behaviour of variables on average in crises and in calmness periods



17 Presenting the average inflation for all these —most likely dissimilar— cases is pointless, if it is not compared with the average rates of inflation in the country's trade partners, and is therefore omitted. The information is effectively included in the development of the real exchange rate.

18 For the variables that appear as simple rates of change we use twelfth differences to limit the effect of seasonal factors. Estimation with first or third differences showed that the key quality features of the crises-fundamentals relationships are not altered. We also estimated models that use cumulative forms for all variables. But given that cumulative variables operate as an average of many short-lived and possibly counteracting effects, these models fail to capture the exact time the crises transpired and therefore their performance is low. For this reason they are omitted from the presentation.

stitutes an important factor for the emergence of crises. This finding confirms the hypothesis of a lagged return to the exchange-rate level that restores purchasing power parity and has appeared in other studies as well. With respect to inflation, an incentive for devaluation is the constant accumulation of inflation differentials compared with the country's trade partners, which undermine competitiveness, and not a momentary rise in the level of prices possibly attributable to seasonal or conjunctural factors.

Model 1 in Table 2 uses the *ad hoc* crisis indicator. It may be discerned that the relationships coincide with the predictions of theory. The performance of the model, as measured by the Akaike Information Criterion,[19] is satisfactory enough, but its ability to correctly classify eventualities is only average.[20] This was expected, as we use a long time series that incorporates many dissimilar incidents, as was also demonstrated in the qualitative analysis. More generally, the monthly frequency incorporates much of the noise that characterises the foreign exchange market (exchange rate volatility is much greater than that of fundamentals) and thus obscures the longer-term relationships between crises and macroeconomic aggregates. In practice, this translates into some sensitivity of the results as regards the significance of the variables in each model.

Nevertheless, several variables are significantly correlated with attacks on the drachma. The existence of a considerable current account deficit, as well as of a high unemployment rate, increases the probability of a crisis to a statistically significant extent. Accumulated real appreciation appears to be positively correlated with the probability of a crisis, even if only with marginal statistical significance. Also, contagion effects of crises that originated in other advanced countries are relatively significant and complement, if not substitute, internal imbalances.[21]

Model 2 uses the composite indicators of the emergence of successful and repulsed crises constructed by use of the data. It must be noted that several of the crises captured by the composite indicator coincide with those of the *ad hoc* indicator, even though some may be shifted one month before or after the broadly accepted date. However, several cases differ. More specifically, a larger volume of "crisis" observations appears after 1980, when foreign exchange market volatility was greater. It may be discerned that the performance of Model 2 falls short compared to that of Model 1.

Model 2 highlights the importance of accumulated inflation differentials and of the rate of wage increases as factors correlated with the crises. Unemployment still appears to be positive and statistically significant. The real exchange rate once more has the theoretically anticipated sign, but loses its level of statistical significance. Contagion still appears to be significant, although the coefficient is somewhat smaller in size. An important new finding is highlighted by this shift of the "crisis" observations is the statistically significant positive effect of the exchange-rate regime on the probability of a crisis transpiring. Given the way in which the variable is defined, this implies that the probability of a crisis is higher in regimes of more fixed exchange rates. This feature confirms the predictions of theory that intermediary exchange-rate regimes (between free floating and monetary union) are more vulnerable to the emergence of speculative attacks when markets deem that the monetary authorities' target exchange rate deviates from that consistent with the fundamental macroeconomic aggregates.

Model 2B is specified exactly as Model 2, but has been estimated using data for the period

19 The Akaike Information Criterion was selected as it is not affected by the number of variables and the specialisation of the model and therefore can be used for comparing non-nested models. Higher values of the criterion imply lower performance of the model.

20 The use of lagged explanatory variables so as to be able to describe the model as "predictive" reduces the model's performance without altering the quality of the relationship. In any case, "prediction" has no meaning when studying a currency that no longer exists.

21 It is recalled that the variable may record disruptions common to all the countries examined and not an authentic contagion of crises through macroeconomic and trade linkages or through herd behaviour on the part of investors.

Table 2 Binary models

	Model 1	Model 2A	Model 2B	Model 3
Restrictions to the movement of capital	0.205			
	(0.8378)			
International contagion of crisis	**2.235**	**1.668**	1.051	0.265
	(0.0254)	*(0.0974)*	*(0.2934)*	*(0.7914)*
Elections	1.217	0.858	1.359	
	(0.2234)	*(0.3911)*	*(0.1741)*	
Current account (% of GDP), lnx_t	**-1.791**	-0.619	-0.575	-1.231
	(0.0733)	*(0.5358)*	*(0.5651)*	*(0.2182)*
Inflation, lnx_t-lnx_t-12, *(cumulative)*		**2.268**	**2.051**	**2.017**
		(0.0233)	*(0.0403)*	*(0.0437)*
Rate of GDP growth, lnx_t-lnx_t-12	0.024	-0.333	0.157	
	(0.9808)	*(0.7388)*	*(0.8753)*	
Openness, lnx_t	-0.967			**-2.082**
	(0.3335)			*(0.0373)*
Loans to the private sector/GDP, lnx_t-lnx_t-12	0.570			**1.646**
	(0.5690)			*(0.0989)*
Real exchange rate, lnx_t-lnx_t-12 *(cumulative)*	**1.653**	1.376	**2.083**	0.135
	(0.0986)	*(0.1688)*	*(0.0372)*	*(0.8928)*
Unemployment, lnx_t	**2.317**	**2.773**	**2.397**	**2.327**
	(0.0205)	*(0.0056)*	*(0.0165)*	*(0.0200)*
Exchange-rate regime	-0.275	**2.041**	**2.532**	0.877
	(0.7831)	*(0.0412)*	*(0.0113)*	*(0.3806)*
Wages, lnx_t-lnx_t-12		**1.902**	**2.488**	1.412
		(0.571)	*(0.0129)*	*(0.1580)*
Constant	1.096	-1.124	-1.356	-0.625
	(0.2729)	*(0.2611)*	*(0.1752)*	*(0.5319)*
	0.37797	0.59213	0.87509	0.50564

Note: *Model 1:* $y_{i,t}$= ad hoc indicator, covering the period from January 1960 to December 2000.
Model 2: $y^*_{i,t}$= EMP indicator, crisis (y=1) if obs>1.5 σ+μ, covering the period from January 1960 to December 2000.
Model 2B: as Model 2 but covering the period from March 1975 to December 1990.
Model 3: $y_{i,t}$: crisis if: $\Delta s_{it} > 1{,}75\ \sigma_i^{\Delta s}$ και $\Delta s_{it} > 1{,}5$, covering the period from January 1960 to December 2000.
Coefficients statistically significant at the level of 10% appear in bold characters. P-values in parentheses, i.e. P[|Z| > z].

from March 1975 (when the drachma was unpegged from the US dollar and started floating vis-à-vis a basket of currencies) up to end-1990 (when the implementation of policies for meeting the Maastricht criteria is considered to have started). Comparison between the two models highlights a number of quite interesting elements. In general, it confirms that the crises of this period exhibit the features described by FGMs. This view can be summarised by the fact that the real exchange rate variable is now strongly significant, whereas it was insignificant when the same model was estimated over the entire sample. Conversely, the fact that the crises of this period can be explained more easily by internal imbalances, in particular by competitiveness and monetary aggregates, is reflected in the fact that international contagion is statistically insignificant, whereas it was significant during estimation with the entire sample.[22] In addition, the model's ability to correctly classify crisis observations increases significantly, a token of the stronger relationships of the

22 A more rigorous evaluation of the increasing role played by expectations and international contagion in the latest crises, as well as of the respective decrease in the role of internal imbalances due to policies related to euro area entry, would require the model to be estimated with data of the period 1990-2000. Unfortunately this is not possible, due to the small number of "crisis" observations in this sub-period and the ensuing unreliability of the findings.

crises of this period with deviations in domestic fundamentals. In all other respects, Model 2B reproduces the findings of Model 2.

Model 3 uses the indicator that captures in the data sizeable and unusual devaluations of the drachma.[23] Although the general causalities are in the same direction as in the previous models, devaluations appear to be correlated rather more intensely with internal fundamental imbalances compared with repulsed attacks. This is reflected in the fact that international contagion is insignificant. Moreover, the model highlights for the first time the statistically significant negative effect of the economy's openness on the probability of crisis. Openness seems to increase the effect that a possible devaluation exerts on the level of prices and therefore reduces the authorities' incentive to devalue. Apart from all this, devaluations are related significantly to the accumulation of high inflation rates, increased bank loans to the private sector and a high unemployment rate.

5.2 MULTIPLE RESPONSE MODEL

Model 4 in Table 3 is a multiple response logit for non-classified eventualities (multinomial logit). This model allows for a direct comparison between crises that forced devaluation and those successfully dealt with by the Bank of Greece, in terms of correlating the crises with their determinants. The cases of devaluation are captured in terms of the indicator that uses the exchange rate exclusively. Speculative pressures repulsed by the Bank of Greece are defined as these cases where the composite indicator indicates a "crisis", but the indicator that uses the exchange rate exclusively does not indicate devaluation. The model calculates two different sets of coefficients for the independent variables.

Isolation of the two eventualities allows for certain interesting features to be highlighted. For-

23 Results come with a health warning, due to the small number of "devaluation" observations within the sample.

Table 3 Multiple response models

	Model 4A: Repulsed attacks	Model 4B: Depreciation
International contagion of crisis	**1.687**	**0.580**
	(0.0916)	*(0.5618)*
Elections	0.984	0.000
	(0.3249)	*(1.000)*
Current account (% of GDP), lnx_t	-0.482	-1.373
	(0.6300)	*(0.1699)*
Inflation, lnx_t-lnx_t-12, *(cumulative)*	**2.597**	0.854
	(0.0094)	*(0.3931)*
Openness, lnx_t	1.394	-0.459
	(0.1852)	*(0.6459)*
Real exchange rate, lnx_t-lnx_t-12 *(cumulative)*	1.350	**1.672**
	(0.1771)	*(0.0935)*
Unemployment, lnx_t	**2.313**	1.133
	(0.0207)	*(0.2573)*
Exchange-rate regime	**2.095**	-0.254
	(0.0362)	*(0.7997)*
Constant	-0.722	0.708
	(0.4704)	*(0.4789)*

Note: *Model 4A:* repulsed attack if: for the EMP indicator ($y^*_{i,t}$) obs>1,5σ+μ *and* [$\Delta s_{it} < 1{,}75\ \sigma_i^{\Delta s}$, $\Delta s_{it} < 1{,}75$], covering the period from January 1960 to December 2000.
Model 4B: depreciation if: $\Delta s_{it} > 1{,}75\ \sigma_i^{\Delta s}$ και $\Delta s_{it} > 1{,}75$, covering the period from January 1960 to December 2000.
Coefficients statistically significant at the level of 10% appear in bold characters. P-values in parentheses, δηλαδή P[|Z| > z].

eign exchange market incidents that ended in devaluation are correlated with competitiveness problems, as these are recorded in the significance of the variable of the cumulative real exchange rate.[24] In contrast, the real exchange rate is not significant for repulsed attacks. Moreover, international contagion is significant for repulsed attacks, but not for devaluations. This is an indication that devaluation requires more than factors linked with international expectations. Similarly, the accumulation of high inflation rates and a high level of unemployment are significant parameters for the coordination of expectations of devaluation and ensuing speculative pressures, but do not suffice on their own to bring about devaluation. Finally, it is confirmed that an intermediary exchange-rate regime (more rigid than free floating, but more flexible than monetary union) attracts more speculative pressure.

6 CONCLUSIONS AND IMPLICATIONS FOR POLICY PURSUIT

The changeover to the euro on 1 January 2001 was an event of decisive importance for Greece's economic history and delineated a range of discussions concerning the short- and long-term benefits. The present study has attempted to contribute to this dialogue by focusing on an important aspect of Greek monetary history, the pressures on the drachma in the period between 1960 and 2000. Aside from its historical usefulness, this discussion highlights the first evident benefit from entry into the euro area, namely, exemption from monetary crises and the strong negative effects these entail in terms of stability and growth. Our analysis confirms the conclusion of the literature that for small open economies, such as Greece, the available choices as regards the exchange-rate regime are the two opposite extremes, i.e. either fully floating or entry into a monetary union. Regimes characterised by an intermediary degree of flexibility are less likely to be sustainable, since they tend to invite speculative attacks. For countries in a phase of transition to EMU this constitutes an extremely useful criterion to guide conduct.

As regards the relationship between crises and fundamentals, the pivotal conclusion is that not all events can be explained based on a single rationale of causalities and event sequences. The long period covered by empirical analysis incorporates many changes in the exchange-rate regime and the monetary policy framework. Nevertheless, a more general conclusion may be deduced, namely that speculative attacks on the drachma up to the early 1990s are linked significantly with macroeconomic imbalances, particularly those associated with the economy's competitiveness and monetary aggregates. After the structural change in monetary policy brought about by the need to meet the Maastricht criteria, the observed shocks have resulted more from contagion from international crises within an increasingly interconnected international environment. In addition, the cases where speculative attacks ended in devaluations were typified by deeper structural imbalances, in contrast to pressures repulsed by the Bank of Greece, which were rather the outcome of transient market expectations.

The policy pursued by the Bank of Greece for averting exchange-rate crises, taking into consideration the partial independence it enjoyed up to 1994 and its weight within the international financial environment, cannot be deemed but successful. Comparisons of the costs paid in terms of economic growth and financial system disruptions by countries with similar structural problems that suffered attacks prove the validity of this claim.

The ECB's increased credibility and its commitment to policies oriented towards stability —according to its Statute— as well as its much

24 Similarly, external imbalances are more significant for devaluations, although the variable loses its level of statistical significance. More generally, we should take into account that the small number of "crisis" observations within the sample may have led to the underestimation and sensitivity of the coefficients applying to each eventuality.

greater ability to intervene in support of the currency, offer a measure of the long-term advantages from the country's entry into the euro area. Monetary stability is particularly important on account of: (a) the Greek economy's increasing interconnection with and opening up to the international economic environment; and (b) the increasing mobility of international financial capital and the inherent tendency of mutual fund shareholders to analyse in detail any profitability opportunities arising from existing and/or potential weaknesses of economies. Finally, we should also take into account the change in "economic culture" that the new institutional structure may bring about.

ANNEX I

DATA SOURCES

- Average monthly exchange rates: IMF, International Financial Statistics (IFS line rf).

- Total foreign reserves excluding gold: IMF (IFS line 1ld).

- Short-term interest rate: discount rate from January 1961 until May 1980 (IFS line 60)[25] and interbank market rate on overnight placements[26] from June 1980 (since the series became available) until December 2000, Bank of Greece.

- Real effective exchange rate: European Commission, DGFIN. A rise is equivalent to appreciation, quarterly data, with values repeated for the 3 months of each quarter until 1969. From January 1970 onwards, real effective monthly exchange rate from the OECD's Main Economic Indicators database. For all data the base year was set to 1995 and comparability was tested.

- Current account surplus/deficit: Monthly Statistical Bulletin, Bank of Greece.

- Fiscal surplus (+) or deficit (-): IMF (IFS line 80).

- Nominal GDP: IMF (IFS line 99bc).

- Domestic credit: IMF (IFS line 32).

- Loans to the private sector: IMF (IFS line 32d).

- Wages, index (1995=100): IMF (IFS line 65 or 65ey).

- Imports and exports in US dollars: IMF (IFS line 70d and 71d respectively).

- Broader money supply M1: IMF (IFS line 34).

- Consumer Price Index: IMF (IFS line 64).

- Unemployment rate: Datastream (OECD), conversion from quarterly data, seasonally adjusted.

Victory or defeat of the governing party or coalition: incidents collected from Keesing's Record of World Events and classified according to the change/continuance of the governing coalition in power. Consequently, they do not include local government elections or presidential elections in countries where the president has no essential powers. Respectively, a significant change in the composition of a governing coalition is classified as a change, even when one or more parties of the previous coalition remain in power.

The dummy variable indicating the existence of controls on capital movements was constructed on the basis of information included in the IMF's annual report *Exchange Arrangements and Exchange Restrictions.*

25 The discount rate used up to 1980 was administratively set and did not fully record the conditions prevailing in the market. However, given the overall stability that characterised that period, as also recorded in the *ad hoc* indicator, losses in effectiveness are small.

26 Average of the interest rates on all overnight operations in the interbank market. Operations conducted between the Bank of Greece and other banks (drawing or providing liquidity), but also between other banks among them. By changing the interbank market interest rate the Bank of Greece also offered guidelines as to the level of the interest rates with which banks cover liquidity needs among them.

ANNEX 2

METHODOLOGY

The Binary Response Model (hereinafter BRM) is derived once we assume an underlying variable of response y_i^*, defined by the linear regression relationship with a vector of explanatory variables:

$$y_i^* = x_i\beta + \varepsilon_i \qquad (1)$$

In this application y_i^* is an indicator of "speculative pressure" (βλ. below) and is considered to be non observable. Instead we observe a binary variable y —here the result "crisis"— defined by the relationship:

$$\begin{cases} y_i = 1 & \text{if } y_i^* > \tau \\ y_i = 0 & \text{otherwise} \end{cases} \qquad (2)$$

where τ is a "threshold". The variables' coefficients and the probability of the event are estimated through maximum likelihood methods. The hypothesis that ε_i follows the accounting or the regular cumulative distribution yields the logit and probit models respectively. In the binary case, the two models are the same after conversion of their coefficients' value into a common scale, so that probit models can be used throughout the study for reasons of comparability and statistical tests.

The construction of the indicator of speculative pressure y^* for the identification of the existence of an exchange-rate crisis is complicated by the multifaceted symptoms appearing in the various episodes (capital flow reversal, excessive volatility in capital markets, bankruptcies of banks, government rescue measures, abrupt deceleration of GDP growth after the crises, etc.). Furthermore, Meese and Rogoff (1983) and Mussa (1979), among others, proved that structural models are unable to measure the excessive demand for money and predict the exchange rate. Consequently, a "crisis" has to be proxied by an *ad hoc* construction of "speculative pressure". Expanding the model by Girton and Roper (1977), excessive demand for foreign exchange appears through three non-mutually excluding channels, i.e. depreciation, sale of foreign reserves, and/or rise in interest rates. A weighted average of these is the "underlying" variable yi^*. In following Eichengreen *et al.* (1995, 1996) we refer to this indicator as the foreign "Exchange Market Pressure" (EMP).[27] Consequently,

$$EMP_t = [(\alpha\, \Delta s_t) + (\beta\, \Delta int_t) - (\gamma\, \Delta r_t)] \qquad (3)$$

where s is the nominal bilateral exchange rate vis-à-vis the US dollar, int is the short-term interest rate and r the ratio of international foreign reserves —excluding gold— to money supply (usually M1). All the variables are in natural logarithms, the Δ symbol indicates the rate of change (typically first differences), the subscript t indicates the month and year of the observation and α, β and γ are positive constants used as weights, namely the reverses of the volatilities of each component. Many authors apply similar weights so that the volatilities of the three series are "equalised" and no component dominates on the indicator.

To define the crisis, we set the threshold τ of the relationship (2) as $(\delta\, \sigma_{EMP} + \mu_{EMP})$, where μ and σ are the average and the standard deviation of the EMP indicator respectively and δ is a positive constant, here 1.5. This approach constitutes our launching pad, as it is consistent with the spirit of the theoretical models, but also able to identify attacks on exchange-rate regimes less rigid than the regimes of fixed exchange rates.

To avoid double counting of a crisis in case this lasts more than one month, we remove observations before and after each value "1" of the

27 Eichengreen *et al.* (1995, 1996) also tested the calculation of the variables as surpluses over those of Germany, selected as reference country due to the post-war monetary stability that characterised it. Anastasatos and Davidson (2006) proved that on monthly data this weighting does not substantially differentiate results, and therefore is omitted. Similar non-weighted indicators were also used by Sachs, Tornell and Velasco (1996) and Frankel and Rose (1996).

indicator. Thereafter, we do the same with the values "0", so as to avoid an overwhelming majority of "calmness" observations over "crisis" ones, which would thwart any causal relevance between crises and fundamentals. As a result of this practice (exclusion window), common in international literature, likelihood indicators derived from the models do not accurately correspond to crisis probabilities.

The construction of the EMP indicator involves two issues of subjectivity in selecting its elements and in defining what "speculative pressure" is *per se*. First, factors such as the setting of interest rates by the authorities, the existence of controls on capital movements, and risk premia, lessen the effect of the interest rate differential on the anticipated depreciation rate.[28] Second, changes in foreign reserves may not record fully interventions in the foreign exchange market, as they overlook or insufficiently reflect factors such as non-balance-sheet transactions, third-party interventions, auxiliary credit lines and liabilities abroad. The imposition of capital controls could perhaps constitute an equally informative indication of speculative pressure accumulation, but the quantification of capital controls —so as to be usable as a monotonic element in the indicator— is a problem of no evident solution. Furthermore, even capital controls may be circumvented through practices such as transfer pricing and black-market trading, which slowly erode the foreign exchange position and undermine the monetary authorities' ability to maintain a fixed exchange rate. Finally, if capital controls (existing or threatened) offer an indication of crisis, the adequacy of reserves could respectively be used as an explanatory variable. Such hesitations as regards the direction of the examined causalities generate methodological and economic questions and cast doubt on the correct specification of the model as a whole. Frankel and Rose (1996) suggested the use of lagged variables so as to moderate the problem of interdependence. Nonetheless, this solution has no theoretical underpinnings and furthermore does not explain how basic underlying relationships interact.

The difficulty of defining and tracing an attack, especially an unsuccessful one, raises the question of whether one should examine attacks, or merely actual episodes of depreciation. Many authors opt for exploring the second avenue. This is the practice followed here as well, except that, in order to maximise objectivity, instead of defining ad hoc the episodes to be studied we have allowed the sample to select them itself. In this case, the criterion aims at tracing only the "actual" episodes of exchange-rate collapse and therefore is exclusively a function of the exchange rate:

$$\Delta s_{it} > \varkappa\, \sigma_i^{\Delta s}\, \varkappa\alpha\iota\, \Delta s_{it} > \lambda \qquad (4)$$

where $\sigma_i^{\Delta s}$ is the standard deviation of Δs and $\varkappa$ and λ are positive constants. Frankel and Rose (1996) and Goldfajn and Valdes (1997) have used variations of this criterion. Its logic lies in tracing incidents where the depreciation is on the one hand unusual, after taking inflation into consideration, and on the other hand significant enough to markedly reduce the currency's purchasing power. This fact implies a short-term change in the real exchange rate e, offering an alternative definition of what a crisis is.

The Multinomial Logit Model (MNLM) can be presented as:

$$Pr(y=y_m|x) = exp(\beta_m^{\tau} x_i) \Big/ \sum_{j=1}^{j} exp(\beta_j^{\tau} x_i) \qquad (5)$$

where $\beta_1 = 0$

An assumption is made that the underlying structural equation has an independent identically distributed (i.i.d) error term, which follows the extreme value distribution and reflects

28 In particular for Greece, Karfakis and Moschos (1999) emphasise that interest rates were used as policy instruments for repulsing speculative pressures after the liberalisation of capital flows in May 1994, a date close to the end of our sample. We may add that, during the early years of the sample, interest rates were largely determined by the Bank of Greece according to the needs of macroeconomic policy and did not fully reflect market conditions. Besides, financial markets were still at a fledgling phase and lacked the sufficient maturity and depth in order to play such a role. Therefore, there is a strong case in favour of omitting the interest rates from the EMP indicator.

the heterogeneity of the observations. The $\beta_1=0$ limitation is required for the identification of the model, with $j=1$ corresponding to "calmness" in this application. The major feature of the MNLM is that it allows the vector of the variables' coefficients to differ for each response (eventuality), so as to be able to capture the probability of structural differences between the determining parameters of each eventuality.

REFERENCES

Agenor, P.R., J.S. Bhandari and R.P. Flood (1992), "Speculative attacks and models of balance of payments crises", NBER Working Paper, 3919, November.

Alogoskoufis, G. and S. Lazaretou (2002), *The drachma (in Greek)*, Livanis publications.

Anastasatos, T.G. and I.R. Davidson (2006), "An Empirical Characterisation of Speculative Pressure: A Comprehensive Panel Study Using LDV Models in High Frequency", *Journal of Economic Integration*, 21 (3), September, 619-656.

Annual Reports for 1983, 1990, 1993, and 1995, Bank of Greece.

Apergis, N. and S. Eleftheriou (2002), "Measuring Exchange Market Pressure and the Degree of Exchange Market Intervention for the Greek Drachma", *International Economic Journal*, Vol. 16 (no 3), 135-145.

Barro, R. and D. Gordon (1983), "A positive theory of monetary policy in a natural rate model", *Journal of Political Economy,* 91, 589-610.

Blanco, H. and P.M. Garber (1986), "Recurrent depreciation and speculative attacks on the Mexican peso", *Journal of Political Economy,* 94, 148-66.

Brissimis, S.N., N.S. Magginas, G.Th. Symigiannis and G.S. Tavlas (2002), "Issues in the Transmission of Monetary Policy" in R.C. Bryant, N.C. Garganas and G.S. Tavlas (eds), *Greece's Economic Performance and Prospects* , Athens, Bank of Greece & The Brooking Institution.

Buiter, W., G. Corsetti and P. Pesenti (1996), "Financial Markets and international Monetary co-operation", Cambridge, Cambridge University Press.

Calvo, G. and E.G. Mendoza (1997), *Rational herd behaviour and the globalisation of securities markets*, unpublished, University of Maryland, November.

Caplin, A. and J. Leahy (1994), "Business as usual, market crashes and wisdom after the fact", *American Economic Review,* 84, 548-565.

Cumby, R.E. and van S. Wijnbergen (1989), "Financial policy and speculative runs with a crawling peg: Argentina 1979-81", *Journal of International Economics,* 27, 111-27.

Dooley, M. (1997), "A model of crises in emerging markets", NBER Working Paper 6300.

Eichengreen, B., A.K. Rose and C. Wyplosz (1995), "Exchange Market Mayhem: the antecedents and aftermath of speculative attacks", *Economic Policy,* 21, 249-312.

Eichengreen, B., A.K. Rose and C. Wyplosz (1996), "Contagious currency crises", *Scandinavian Journal of Economics*, 98 (4), 463-84.

Flood, R.P. and P. Garber (1984), "Collapsing exchange-rate regimes: some linear examples", *Journal of International Economics,* 17, 1-13.

Flood, R.P. and C. Kramer (1996), "Economic Models of Speculative Attacks and the Drachma Crisis of May 1994", in G.S. Tavlas (ed) *The Collapse of Exchange-rate regimes: Causes, Consequences and Policy Responses*, Kluwer Academic Publishers.

Flood, P.R. and N.P. Marion (1998), "Perspectives on the recent currency crisis literature", IMF Working Paper WP98/130.

Frankel, J.A. and A.K. Rose (1996), "Currency Crashes in Emerging Markets: An Empirical Treatment", *Journal of International Economics,* 41 (3-4) (November), 351-66.

Garganas, N.C. and G.S. Tavlas (2002), "Monetary regimes and inflation performance", in R.C. Bryant, N.C. Garganas and G.S. Tavlas (eds), *Greece's Economic Performance and Prospects*, Athens, Bank of Greece & The Brookings Institution.

Garganas, N.C. (2008), "Exchange-rate regimes in the course to EMU: lessons from the experience of Greece", in N.C. Garganas, *Challenges for monetary policy in an interdependent world (in Greek)*, Athens, Bank of Greece.

Gerlach, S. and F. Smets (1995), "Contagious speculative attacks", European *Journal of Political Economy,* 11, 90-107.

Gibson, H. (2003), "Realignment probabilities and reputation effects in the EMS", Oxford Economic Papers 55, 314-335.

Gibson, H. and E. Tsakalotos (2005), "EU enlargement, ERM II and lessons from the southern European countries", *South Eastern Europe Journal of Economics*, 1, 41-78.
Girton, L. and D. Roper (1977), "A monetary model of exchange market pressure applied to post-war Canadian experience", *American Economic Review*, 67, 537-548.
Goldfajn, I. and R. Valdes (1997), "Are currency crises predictable?", IMF working paper WP/97/159.
Hotelling, H. (1931), "The economics of exhaustible resources", *Journal of Political Economy,* 39, 137-175.
Kalyvitis, S. (1993), "Depreciation probabilities of the drachma", unpublished, Athens University of Economics and Business, October.
Kaminsky, G., S. Lizondo and C.M. Reinhart (1997), "Leading indicators of currency crises", IMF Working Paper WP/97/79.
Karfakis, C. (2002), "Predicting the crisis of the Greek drachma", *Review of Development Economics*, 6(3), 329-336.
Karfakis, C. and D. Moschos (1999), "Searching for indicators of foreign exchange market pressure: evidence from Greece", *International Journal of Finance and Economics*, 4: 63-73.
Klein, M. and N.P. Marion (1997), "Explaining the duration of exchange-rate pegs", *Journal of Development Economics*, 54 (2), 387-404.
Krugman, P. (1979), "A model of balance of payments crises", *Journal of Money, Credit and Banking*, 11, 311-325.
Kydland, F. and E. Prescott (1977), "Rules rather than discretion: the inconsistency of optimal plans", *Journal of Political Economy*, 85, 473-491.
Lazaretou, S. (2009), "Strategies and instruments of monetary policy in Greece" in Th. Kalafatis and E. Prontzas (eds), *Economic history of the Greek State* (in Greek), Vol. II, Economic functions and performance, Ch. 7, Piraeus Group Cultural Foundation (mimeo).
Meese R.A. and K. Rogoff (1983). "Empirical exchange rate models of the seventies: do they fit out-of-sample?", *Journal of International Economics,* 14, 3-24.
Mishkin, F. (1992), "Anatomy of a financial crisis", *Journal of Evolutionary Economics*, 2, 115130.
Mishkin, F. (1996), "Understanding financial crises: A developing country perspective", NBER Working Paper 5600.
Moreno, R. (1995), "Macroeconomic Behaviour during Periods of Speculative Pressure or Realignment: Evidence from Pacific Basin Countries", Federal Reserve Bank of San Francisco, *Economic Review*, 3, 3-16.
Mussa, M. (1979), "Empirical regularities in the behaviour of exchange rates and theories of the foreign exchange market", Carnegie-Rochester Conference Series on Public Policy, 11, 9.
Obstfeld, M. (1994), "The logic of currency crises", *Cahiers Economiques et Monetaires*, 43.
Persaud, A.D. (1998), "Event Risk Indicator Handbook, Global Foreign Exchange Research: Technical Series", unpublished.
Reinhart, C.M. and K.S. Rogoff (2003), *The Country Chronologies and Chart Book Background Material to a Modern History of Exchange Rate Arrangements: A Reinterpretation.*
Salant, S. and D. Henderson (1978), "Market anticipation of government policy and the price of gold", *Journal of Political Economy,* 86, 627-48.
Sachs, J., A. Tornell and A. Velasco (1996), "Financial crises in emerging markets: the lessons from 1995", Brookings Papers on Economic Activity, The Brookings Institution, Vol. 27, 147216.
Thomopoulos, P. (2004), "Anti-inflationary exchange rate policy in Greece in the 1990s", Discussant Paper, Euro-Mediterranean Seminar, Naples 14-15 January 2004.
Voridis, H., E. Angelopoulou and I. Skotida (2003), "Monetary policy in Greece 1990-2000 through the publications of the Bank of Greece", Bank of Greece, *Economic Bulletin*, No. 20.

Weymark, D.N. (1995), "Estimating exchange market pressure and the degree of exchange market intervention for Canada", *Journal of International Economics,* 39 (3-4), 273-295.
Zonzilos, N. (2000), "Testing for Unit-Roots and Structural Breaks in the Greek Inflation Process", unpublished, Bank of Greece.