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THE DETERMINANTS OF FIRM SURVIVAL IN THE ATHENS EXCHANGE*

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I INTRODUCTION

The identification of the factors that explain firm survival in an economy is an issue that has drawn economists' attention for many decades. The relevant studies, in their majority, beginning with Altman (1968), focus on the estimation of the probability of a firm's financial distress or bankruptcy by applying "bankruptcy prediction models" that use financial data taken from the published financial statements of a sample of firms.

In the more recent literature alternative models, called "survival models", have been used, which, despite their theoretical similarity to "bankruptcy prediction models" (in that they, too, require the estimation of a hazard function), tend to differ in terms of the sample and the variables they use. In typical bankruptcy prediction models, the fundamentals of two samples of firms, one that includes firms which have gone into bankruptcy and another that includes firms which have not, are examined and non-financial factors that may be connected with the non-survival of a firm are left out. In reality, a firm may not survive in a market even if its fundamentals do not foreshadow its bankruptcy.

In general, a firm may not survive on account of one of the following:[1] (i) negative reasons (e.g. bankruptcy as a result of its inability to meet its obligations permanently), (ii) the intentional dissolution of the firm in its legal form, not necessarily because the firm is not profitable,[2] and (iii) an acquisition or merger, which may not be the result of the firm's bad performance but occurs for other reasons, e.g. efforts to achieve economies of scale, the expansion into new markets or the creation of synergies.[3]

Moreover, bankruptcy prediction models are based exclusively on financial statement data, whose quality may generally be affected by accounting practices ("creative accounting"[4]), and mainly use financial indicators that are correlated with one another. By contrast, survival models mainly use qualitative (non-financial) variables. Finally, bankruptcy prediction models are based on the empirical observation that financial indicators worsen as the bank-

1 For a detailed analysis see, indicatively, Hensler *et al.* (1997) and Macey *et al.* (2005).
2 For example, intentional dissolution may occur because the owner sells the firm's assets in order to engage in another activity or because of age- or health-related retirement.
3 Without ruling out the possibility of mergers and acquisitions stemming from a market for corporate control. In an economic system where shares with voting rights are negotiated freely in stock markets, the concept of the market for corporate control refers to the process in which the control and ownership of a firm are transferred from a group of investors and managers to another. In this way, the management of firms is monitored for its efficiency, in the sense that instances of management that do not conform with the rules of sound corporate governance become an acquisition target. In this case, the acquisition is seen as a means of "value conservation".
4 The way that creative accounting impacts on the financial aggregates of firms is a phenomenon that in the last few years has strongly occupied the regulatory authorities, investors and more generally the users of firms' financial statements globally. Indicatively for Greece, Caramanis and Lenox (2008), Koumanakos (2007) and Spathis *et al.* (2002) have criticised on the quality of financial statement data.

ruptcy date draws closer, unlike survival models, whose assumptions are established on the theory of industrial organisation that studies firms' strategic behaviour and dynamics, the structure of the market and the possible interplay between these factors.

Up until today, empirical studies in Greece mainly involved bankruptcy prediction models, i.e. they tried to assess the probability of firm bankruptcy using financial data (see e.g. Doumpos and Zopounidis, 2007). By contrast, the findings of studies which involve survival models, i.e. models that examine factors other than financial ones (see Fotopoulos and Louri, 2000) are very limited in number.

This study is, to the best of our knowledge, the first to apply survival models on data from firms listed on the Athens Exchange (Athex) and to approach the issue of survival from a different angle than that of bankruptcy prediction models. In particular, in line with relevant studies on other capital markets (see e.g. Hensler *et al.*, 1997, and Macey *et al.*, 2005), the criterion for non-survival is exit from the stock exchange, which has a twofold meaning. In the narrow sense, the exit of an Athex-listed company is considered to occur when its shares are suspended from trading for a period of over six months, after which it is delisted (which essentially is an administrative act). In the broader sense, exit includes firms placed under surveillance. As regards the determinants of non-survival, with the exception of leverage,[5] these are based on non-financial data, e.g. size, sector, corporate governance and other characteristics connected with the environment in which these firms operate. Moreover, in order to minimise the possibility of bias in the estimates, a number of alternative (parametric and non-parametric) models are also used.

The study is structured as follows: Section 2 sets out the theoretical background and reviews the literature that focuses on the determinants of firm survival. Section 3 presents the data and the methodology used and Section 4

reports the empirical results. Finally, Section 5 concludes.

2 THE DETERMINANTS OF FIRM SURVIVAL

The determinants used in the econometric models of empirical studies internationally are typically selected based on the availability of data and the relevant research questions. Generally, they can be categorised into firm-specific and environment-specific determinants, the latter referring to the sector and the broader macroeconomic framework.

2.1 FIRM-SPECIFIC DETERMINANTS

2.1.1 Leverage

The studies of Modigliani and Miller (1958, 1963) on how the financial structure affects the worth of a company have triggered a number of relevant studies regarding the optimal capital structure and its determinants.[6] Based on the general conclusions of these studies, the value of a company shows a positive correlation with its leverage, due to the tax advantage that the latter creates. However, an increase in the leverage translates into a higher risk of bankruptcy, creating a "bankruptcy cost" (Altman, 1984).

An additional cost for a company, which is connected with its capital structure, is the "agency cost"[7] between shareholders and management (Jensen and Meckling, 1976). This is the cost borne by a company's shareholders, when they try to control the choices of its management as far as they can. According to agency theory, if a company's leverage is high, its free cash flows[8] are reduced, thus the company's man-

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5 This is the only financial factor used in the study, as it is entirely or almost entirely unaffected by creative accounting.
6 See Athanasoglou *et al.* (2006) for details on the capital structure and the determinants of Athex-listed firms and for a review of the related literature.
7 In other words, the cost that arises from conflicts of interest.
8 Free cash flows are the flows that are not paid to the shareholders in the form of dividends but finance investment, whose present value is not necessarily positive.

agement is more careful when handling its capital and avoids risky investments. Based on this rationale, leverage is used by the company as a tool for value creation, thus reducing the possibility of failure but increasing the cost to shareholders.[9]

The empirical results that review the relationship between leverage and exit from the market are rather inconsistent.[10] We may indicatively mention Opler and Titman (1994) and Altman (1984), who show that, in the US market, companies with high leverage lose market share (indirect bankruptcy cost). Fotopoulos and Louri (2000) come to a similar conclusion for the Greek market, finding that the higher the leverage the higher the probability of firm failure. By contrast, Wruck (1990) and Whitaker (1999) conclude that high leverage is not in itself a negative factor for the company, and Audretsch *et al.* (2000) support that leverage is not a determinant of firm survival.

2.1.2 The "liability of smallness" hypothesis

A key hypothesis in the international literature on firm survival is the "liability of smallness" hypothesis,[11] wherein size is defined variably, using, for example, turnover, the value of assets or the number of employees.[12]

According to the above hypothesis, larger firms have a higher probability of survival compared with smaller ones, since they enjoy the privilege of economies of scale, are granted easier and more favourable access to money and capital markets and, on average, employ better quality staff.

There are, however, arguments to the contrary. For example, because their hierarchy is complex, large companies bear increased agency costs, leading to the principal-agent problem, which can be set out as follows: the maximisation of value for shareholders need not coincide with the maximisation of value for the management. When this problem arises, the profits of the said firms may decline, a development that might consequently hinder their

survival. Besides, the complex structure of large companies may create problems of hierarchical control of subordinate staff in respect to the targets they are assigned, resulting in a reduced sense of responsibility for staff when performing their duties.

In their majority, empirical studies that measure company size using its size in the first year of its operation (initial size) corroborate the view that the initial size and the duration of survival are positively correlated, irrespective of the country, the sector and the age of the company (see e.g. Audretsch *et al.*, 2000, Honjo, 2000, Agarwall and Audtresch, 2001, Mata and Portugal, 2002).

2.1.3 Corporate governance

Corporate governance is the reaction to a situation where ownership is separated from the control of a firm and refers to the framework which shareholders-investors use to ensure the efficiency of their investment. From this perspective, the role of corporate governance is summed up in achieving reduced agency costs.[13]

The shareholders, who finance an investment, need a capable management that can effectively manage the funds entrusted to it, so that they can yield future cash flows. The management also needs shareholders to finance its business plans. In this framework, sometimes the management takes decisions motivated by the maximisation of their own personal gains, by contrast to investors who are interested in the efficiency of their investment.

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9 Essentially, the optimum financial structure for a company is defined as the point at which the tax advantage is maximised and the bankruptcy cost on account of conflicts of interest is minimised.

10 Most of these studies are based on bankruptcy prediction models.

11 The acceptance of the liability of smallness hypothesis is also connected with the passive learning theory (Jovanovic, 1982), according to which companies are better starting off small in size, due to the uncertainty that surrounds their future development.

12 The size of a company, according to the law (Regulation EC 70/2001 as amended and currently applicable), is defined initially by the number of its permanent employees. In their majority, empirical studies in the European area define the size of a company based on this principle.

13 For a detailed review of the relevant literature, see Shleifer and Vishny (1997).

In the event of a company with a broad shareholder base, the effective control of management by shareholders-investors is a difficult task. Each minor shareholder alone may not afford the cost of controlling management decisions, thereby accepting that some other minor shareholder will deal with the control of management decisions and meet the relevant costs (free rider problem).

This particular agency problem can be solved if shares are concentrated in major shareholders who thus gather enough voting rights to impose their will on the company's management, reducing the agency costs and increasing the company's chances of survival.

However, concentration also has some serious disadvantages. The most important of these is that the interests of major shareholders are not always in line with the interests of minor shareholders, the management or the employees. For example, major shareholders may impose the payment of additional dividends, depriving the company of necessary cash flows that could be used for its further development or they may take advantage of relationships with other firms in their control. The higher risk premium for the negotiation of shares with privileged voting rights[14] is an indication of the cost created by the conflict of interest between major and minor shareholders (Zingales, 1994).

The results of empirical studies confirm the existence of these problems. In some studies, the number of those involved, directly or indirectly, in the management of a firm is positively correlated with the period of the latter's survival (Hensler *et al.*, 1997, Peristiani and Hong, 2004), whereas others show there is no statistically significant relationship between them (Jain and Kini, 1999).

A large share of empirical studies on agency costs (e.g. Jensen and Meckling, 1976) do not take account of the different role of the Board of Directors and the Managing Director or of their distinct role in the future performance of the firm and the different impact that their corresponding decisions may have on its survival. The Board of Directors is the body vested with the mission of controlling the actions of the Managing Director, solving agency problems that arise from the separation of management and control. The degree to which the Board of Directors may affect the development of the firm depends on its ability to influence important decisions or even request the replacement of the Managing Director (Dowell *et al.*, 2006). Thus, the closer the relationship of the Board of Directors with the company, i.e. the larger the number of shares that its members hold, the more motivated the Board is to perform its duties with diligence, exerting control over the actions and the decisions of the Managing Director (Shivdasani, 1993).

However, the participation of the Managing Director in the shareholder base is strong motivation too for the implementation of a strategy for mitigating the hazard of a firm's non-survival. According to Tosi *et al.* (1999), the Managing Director's direct participation in the share capital of a firm is more effective than other systems of indirect reward (e.g. stock option plans) at aligning his interests with those of shareholders. Even if the Managing Director's participation in the share capital of a firm can change over time, after the company's entry to a stock market, the initial percentage he holds has been found to significantly affect the course of the company (Fisher and Pollock, 2004).

In the context of controlling the decisions of a firm's management, the role of institutional investors is of importance, as they are considered the most active shareholders in terms of monitoring the firm's operation. They participate actively in the Board of Directors and in the general meeting of shareholders and demand, at regular intervals, to be briefed on

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14 Shares with privileged voting rights should not be confused with Greek "preferred shares". In Greece, holders of preferred shares usually have increased rights on the profits, but seldom have voting rights.

the course of the company, giving at the same time advice on its strategic planning.

Empirical studies have indeed shown that the participation of institutional investors positively influences the company's probability of survival (Jain and Kini, 2000). There are however cases of firms with a broad shareholder base or of family businesses where the cost of communication and coordination between institutional investors and owners is high (Tosi *et al.*, 1999), resulting in this factor's negative impact on the firm's probability to survive.

Finally, the rules of sound corporate governance ensure shareholder control of management not only through control mechanisms but also through the market for corporate control. For example, in Britain, Denis and Sarin (1999) have concluded that there is a positive correlation between bad corporate performance and a change of ownership brought about by mergers and acquisitions. This relationship does not seem to be confirmed fully (see indicatively Franks and Mayer, 2001, Heiss and Koke, 2004) in the case of German corporations and is rejected for Greek ones (Tsagkanos, 2008, Tsagkanos *et al.*, 2008).

2.1.4 The "liability of newness" and "liability of adolescence" hypotheses

A second basic parameter connected with the survival of a company is how long it has been operating in a market. According to the prevailing view, a firm's exit from a market is inversely related to the duration of its presence in it (Freeman *et al.*, 1983, Mitchell, 1994, Mata and Portugal, 1994).This is also known as the "liability of newness" hypothesis.[15] The passive learning model (Jovanovic, 1982) and the active learning model (Ericson and Pakes, 1995) also move along this line.

A primary characteristic of the first model is that the cost for new entrants is not only random but differs from one firm to another. In other words, a firm that enters a market for the first time cannot be certain of its prospects for success and its initial size is necessarily small until it has ascertained that it can gain a satisfactory share of the market. If the firm proves efficient at a later date, it stands a better chance of remaining in the market and developing further; otherwise, it will shrink and probably exit the market. Because of the exit of weak companies from the market, the average efficiency of the firms that remain improves over time, without this improvement stemming from a change in their fundamentals, thus reducing the probability of their exiting the market. Alternatively, the probability of exit remains constant and independent of time.

According to the second model, new entrants generally "learn" from their presence in a market, thereby improving their administration and production methods, which results in a reduced probability of exit. In other words, the probability of exit is not constant and falls with time.

There are, nonetheless, arguments in favour of the view that firms with a relatively small period of activity in a market may have better growth and survival prospects compared to those that have been in the market for longer periods of time. For example, it is possible that "older" firms use obsolete technology. The productivity of a factory is defined, to a certain degree, by the year in which it was established. New firms establish factories that use state-of-the-art technology and produce correspondingly state-of-the-art products. Older firms have either difficulty incorporating new technologies into their production process or a disadvantage when it comes to innovative methods. Both result in obsolete products and services.

By contrast, new firms venturing to acquire a market share are more innovative and adop-

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[15] Even though the analysis of this particular hypothesis applies mostly to newly established firms and not to new entrants in a stock market, our analysis includes elements that are relevant to the latter case too.

tive of new technologies, taking market share away from older firms. Moreover, relatively older and larger firms are faced with operational difficulties when trying to restructure themselves (inertia): about 70% of these firms wishing to adopt new technologies or change staff relations fail to achieve the desirable outcome (Georgopoulos, 2004).

With particular regard to listed firms that have been operating for many years prior to their entry in the stock market, the "liability of newness" hypothesis, keeping its key features, is referred to in the literature (e.g. Hensler *et al.*, 1997) as the "liability of adolescence" hypothesis. According to this, a new entrant in a stock market may survive in the first years of its presence by using up the funds from its public offering. Thus, the risk of exiting the market is small in the first years, but then it peaks and finally starts to fall.[16]

Even though a significant number of empirical studies examine the relationship between survival and age, the findings are rather controversial. For example, the studies of Amburgey *et al.* (1993), Olzak and West (1991), Mata and Portugal (1994) and Audretsch *et al.* (2000) confirm the validity of the "liability of newness" hypothesis, in contrast with the studies of Barron *et al.* (1994) and Ranger-Moore (1997). Among studies that examine listed firms, Audretsch *et al.* (1999), Perez *et al.* (2004) and Kaniovski and Peneder (2007) conclude that the "liability of adolescence" hypothesis cannot be rejected.

2.1.5 The "window of opportunity" hypothesis

Assuming that, as outlined in section 2.1.3 above, a firm's management does not always have the interests of minor shareholders in mind, the question is how firms manage to raise considerable funds through their public offerings, in which minor investors also participate, without a commitment that the funds invested will receive a minimum guaranteed return.

A possible explanation refers to the overoptimism of investors, which is mainly affected by the current environment and announcements of the firm's positive business developments and prospects. Based on this hypothesis, which is also known as the "window of opportunity" hypothesis, investors participate in a public offering not based on the future long-term yields of the firm's investments, but on the expectation of a short-term increase in its share price (Shleifer and Vishny, 1997). This hypothesis has been explored in the literature which concludes that public or secondary offerings are systematically overpriced (see indicatively Ritter, 1991, Pagano *et al.*, 1998, Teoh *et al.*, 1998).

These studies also reach the conclusions that: (i) public offerings take place during the upward phase of the stock exchange cycle; (ii) the firms' long-term returns are smaller than expected; and (iii) the profitability in the year prior to the public offering is likely to be affected by creative accounting. Furthermore, high sector valuations (as measured by the ratio of market to book capitalisation) represent an incentive for marginal firms to enter a stock market, expecting that due to investor overoptimism they will be able to attract funds relatively more easily. In these cases, high sector valuations have a negative effect on the firms' survival duration.

Nonetheless, high sector valuations may come as the result of positive expectations about the growth prospects of firms (see, indicatively, Pagano *et al.*, 1998; Jain and Kini, 1999). Consequently, high sector valuations in this case have a positive effect on the firms' survival duration. Which of the two hypotheses is valid is clearly an empirical issue.

2.2 THE SECTORAL IMPACT

According to Hensler *et al.* (1997), firms in the same sector may not themselves be the same

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16 This reduction may be attributed to the fact that less effective firms exit the market.

but surely have a similar probability of survival, since they apply like production methods, use the same factors of production and the sector's growth prospects shape their individual ones. Their individual probabilities of survival, therefore, are interrelated.

Based on industrial organisation theory, cross-sectoral differences are moulded by the degree of competition across sectors. In sectors with low competition, a firm may set prices that yield abnormal profits, if there are barriers to market entry and a high degree of co-operation among incumbent firms (Bunch and Smiley, 1992). Additionally, the probability of a firm's survival is also connected with the business cycle, which fosters high growth rates in its upward phase, facilitating new entry without causing existing firms to resort to retaliation (Mata *et al.*, 1995).

A typical measure of the degree of competition in a sector is the degree of concentration: usually, a high degree of concentration is positively related to significant barriers to entry. It is possible, however, that the degree of concentration remains stable at a relatively high level without creating barriers to entry, as is the case when new entrants replace exiting firms (Baldwin, 1995). Also, the extent to which firms enter a sector may not depend on the size of entry barriers but on the sector's growth prospects (Jain and Kini, 1999). The conclusions of empirical studies on the impact of the degree of concentration are mixed, since in some cases the degree of concentration is positively correlated to the probability of a firm's survival (Li, 1995) and in others this relationship appears to have no statistical significance (Mata and Portugal, 1994, Heiss and Koke, 2004, Jain and Kini, 1999).

Another dimension of the degree of competition in a sector is captured by an index of new entrants. According to the population ecology theory (Hannan and Freeman, 1989), the survival of a new entrant is negatively related to the rate of new entrant into the sector, as any

new firm has to face competition not only from existing firms but also from other new entrants. Therefore, a firm exhibits an increased probability of survival if the index of new entrants is not very high (Audtresch *et al.*, 2000). An alternative version based on industrial organisation theory comes to the same conclusion, albeit for different reasons. Barriers to entry may also become barriers to the exit, to the degree that an investment which discourages new entrants also discourages the exit of existing firms, leading to the recording of higher exit rates from sectors that favour new entrants (Mata and Portugal, 2002, Fotopoulos and Louri, 2002).

However, the index of new entrants may be high if the sector is in a development phase. In such a case, the survival of firms is easier, as their growth rate is not a result of capturing market share from rival firms, but of the sector's high growth rates. Business expectations on the possible success of the investment are higher, thus the initial size of firms is larger.

2.3 THE EFFECT OF THE MACROECONOMIC ENVIRONMENT

Empirical studies in their majority, with only a few exceptions, examine the factors that affect a firm's survival, which are connected with both individual, firm-specific characteristics and sectoral characteristics. However, the survival probability of a firm depends also on the phase of the business cycle, which means that the cyclical effect should also be taken into account. For example, a negative economic conjuncture may hurt new entrants more than firms already operating for some time. Studies that take the cyclical effect into account approach it in a number of ways. Audtresch and Mahmood (1995), for example, have used unemployment and real interest rates, to no effect, whereas Buehler *et al.* (2006) use GDP growth and conclude that the probability of survival increases in upward phases of the cycle, as does the probability of mergers.

3 DATA AND METHODOLOGY

3.1 DATA[17]

The inability to find the appropriate (non-financial) data for inclusion as determinants in the estimation of hazard functions has been a factor that has limited empirical studies especially for Greece. For this reason, in this study, we use data (including available non-financial data) on Athex-listed firms. More specifically, the database used in the estimation of the empirical model was put together as follows:

Initially, through the press releases of the Athex, we located the public offerings of Greek commercial and industrial firms for the period 1993-2002 along with cases of firms whose shares on the Athex were suspended until end-2006, which is the cut-off date of this study. We then collected the necessary data on the shareholder composition of these firms through the Athex and public offering press releases for the periods before and after the initial public offering (IPO). The total number of public offerings examined, for which there is a full set of data meeting the requirements of this study, is 196 (see Table 1). At the same time, we enriched the database with data from the published balance sheets of these firms and with macroeconomic data from the National Statistical Service of Greece (NSSG).

3.2 VARIABLES

Based on the theoretical background detailed in section 2, we use the variables set out in Table 2.

Survival duration (SD), which is the main (dependent) variable under examination, is measured as the number of years between the year a firm was initially listed on the Athex and either 2006, for firms whose shares are traded continuously (censored observations), or the year when the share was suspended. Suspension in the narrow sense refers to firms whose shares were suspended for periods of over six months (21 firms) and, in the broad sense, to

Table 1 Sectoral classification and number of firms

No.	ICB Super-sector Code	Sector	Number of firms in the sector
1	0500	Oil & gas	3
2	1300	Chemicals	7
3	1700	Basic resources	11
4	2300	Construction & materials	6
5	2700	Industrial goods & services	19
6	3500	Food & beverages	24
7	3700	Personal and household goods	29
8	4500	Healthcare	7
9	5300	Retail	10
10	5500	Media	16
11	5700	Travel & leisure	17
12	6500	Telecommunications	5
13	7500	Utilities	3
14	9500	Technology	31
15	8700	Other sectors	8
Total firms			**196**

firms whose shares were placed under surveillance (32 firms in total).

As regards the explanatory variables, leverage (LEV) is calculated as the ratio of the firms' total short- and long-term obligations to their total capital in the first year of their listing on the Athex. As a measure of firm size (SIZE) we use the logarithm of its employees in the first year after its listing on the Athex.[18] To estimate the influence of corporate governance, the variables MD and BOD were used, which reflect the participation of the Managing Director and of the members of the Board of Directors,

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[17] The following analysis refers to data referring to the year when the firm is listed on the Athex; this data is not time-dependent. Notwithstanding the fact that the collection of annual data for some variables presents difficulties, the basic reason why this particular time-frame is used can be traced to the industrial organisation theory, which puts particular emphasis on the condition of firms at the beginning of the period over which they are examined (which in this study coincides with the listing of their shares on the Athex).

[18] In the empirical literature, a number of variables for calculating the size is used, although the most commonly used is the number of employees. As mentioned in fn. 12, according to Regulation EC 71/2001 and previous Regulations, the size of a firm is defined by the number of permanent employees. Finally, Cabral and Mata (2003) observe that the size of existing firms, measured by the logarithm of their employees, approximates the normal distribution.

Table 2 Model variables

Variable	Description	Average	Fluctua- tion
SD*	Survival duration (years)	6.897	2.767
LEV	Total leverage to total liabilities in the first year of the initial public offering (IPO)	0.418	0.195
SIZE	Logarithm of permanent employees in the first year of trading	4.956	1.275
BOD	Percentage of shares held by members of the Board of Directors after the completion of the IPO excluding shares held by the Managing Director	0.225	0.220
MD	Percentage of shares held by the Managing Director after the completion of the IPO	0.308	0.250
INST	This variable equals 1 if institutional investors participate in the share capital after the IPO	0.168	0.375
SCNW	Median of annual sectoral capitalisation to total net worth in the first year of the IPO	3.503	1.395
NEWE	Logarithm of new entrants in the sector	2.793	0.619
AV-NEWE	Logarithm of the average size of new entrants in the sector	5.478	0.894
IND*	Industrial production index[1] (2000=100)	93.895	5.358

* Time-dependent variable.
1 The NSSG Industrial Production Index covers all activities listed in Sections C to E (Mining-Quarrying, Manufacturing and Electricity-Gas-Water Supply). For more information see www.statistics.gr

respectively, in the share capital of the firm after the completion of the public offering. In order to avoid problems arising from possible multicollinearity between these two variables, the percentage of shares held by the Managing Director is subtracted from BOD. Moreover, in respect to the shareholding composition, the variable INST is included, which equals 1 if there are institutional investors with holdings of at least 5% in the share capital after the public offering.

Furthermore, the "one share one vote" principle is not always applied in Greece. For example, holders of preferred shares enjoy more privileges compared with holders of common shares (priority rights when the dividends are distributed or when the share capital is increased, etc.), but usually have no voting rights in the general meeting of shareholders; thus they do not take part in the decision-making process. When there is such a distinction in a firm's share capital, the percentage of shares without voting rights is not taken into consideration.

Additionally, in order to assess whether overoptimistic expectations of investors about the sector are a motive for the entry of mar-ginal firms, we use the ratio of the annual sectoral capitalisation to total net worth (SCNW) in the first year of listing on the Athex.

Turning to the sectors under examination, we use the 15 sector categories of the ICB classification of the Athex (a classification adopted by many major stock markets globally).[19] Table 1 summarises the number of firms under examination in each sector.

The degree of competition in each sector can be assessed by a concentration index (e.g. the Herfindahl index). However, because in some sectors the number of participating firms is relatively small, an alternative measure of competition is used: the index of new entrants in the sector and their size (NEWE and AV-NEWE, respectively).

[19] According to this method, which is detailed on the website of the Athex (www.ase.gr), firms are categorised either as per their final product or as per the production process they apply, which is believed to reflect more accurately the conditions that prevail in the sector. For example, the activities of the company PLAISIO SA include the trading and partial assembly of PCs, whereas INFO-QUEST is the representative of a well-known maker of PCs and also has an assembly line for PCs. The first company would be classified under SIC 52 (retail trade) and the second under SIC 72 (computer and related activities). According to the ICB classification, however, both companies belong to the same sector (computers), on the grounds that, if the outlook for sales of PCs is positive, then the outlook for the growth of these two companies cannot be but positively correlated.

Table 3 Expected effect of individual factors on the duration of survival

Individual firm characteristics	Sectoral characteristics	Macroeconomic environment	Expected effect on the survival duration
Indebtedness			-
Initial size			+
	Rate of new entrants		-
	Initial size of new entrants		+
Managing Director			+
Board of Directors members			+
Institutional investors			+/-
	Index of firms' market-to-book value		+
		Industrial production	+

Note: A positive sign means that the variable reduces the probability of a firm's exit and increases its survival duration. Alternatively, a positive sign implies a hazard ratio (HR) less than 1 and a time ratio (TR) greater than 1.

Finally, for the assessment of the impact of the macroeconomic environment on the survival of firms, the index of industrial production (IND) is used. Table 3 summarises the variables under examination and indicates the expected signs of the estimated coefficients.

3.3 METHODOLOGY

3.3.1 Key concepts

All studies that focus on the probability of firm survival estimate the hazard function (see equation 1), which allows the estimation of the conditional probability[20] of a firm not surviving beyond a specific time (t):

$$\lambda(t) = f(t)/1\text{-}F(t) \tag{1}$$

where $\lambda(t)$ is the hazard function, $f(t)$ is the probability of non-survival of the firm at time t, i.e. the probability function, and $F(t)$ is the probability of non-survival of the firm up to and including time t, i.e. the cumulative probability function.

A key feature of a hazard function, apart from estimating the probability of survival, is the time horizon of the observation. In more detail, the survival duration (T) is defined as the period between the first observation for the firm (the date of the public offering in this study) and either the occurrence of the event (exit of the firm from the market) or the end of the observation period $(\overline{T})$. If in the course of the period under review the firm does not exit the market, then the observation is considered right-censored. Chart 1 depicts these concepts of period and censorship for three hypothetical cases of firms. The first and third firms are right-censored, since they continue to survive beyond $\overline{T} > 0$, which is the censoring time, whilst the second firm exits the market prior to $\overline{T}$, and is thus uncensored.

These features of a hazard function do not allow the application of classical econometric methods, such as the method of least squares, since not all observations for the survival duration (the dependent variable) are available (given that some of them are censored). If e.g. the least squares method is applied with survival duration (or its logarithm) as dependent variable and the initial size of the firm as explanatory variable, the exclusion of the censored observations from the sample would result in a biased estimator of the coefficient

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[20] Meaning that the hazard function can take only positive values (0.1 and beyond). See also section 3.3.2.
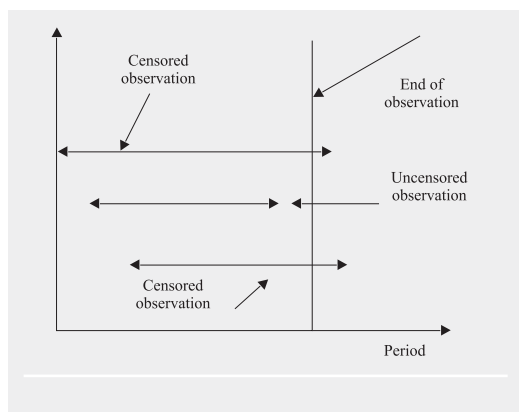
on size. Similarly, bias would ensue if the censored observations were included in the sample, since it is assumed that the firms corresponding to those observations have not survived beyond the censoring time.

3.3.2 Estimating hazard functions

In the relevant literature, hazard functions are estimated using mainly three approaches: (i) life tables, (ii) semi-parametric methods and (iii) parametric methods. The first approach, which is the simplest to apply, since it does not presuppose some kind of estimation, has the basic disadvantage that the influence of several explanatory variables is difficult to include in the hazard function.

One of the models that has been widely used in survival studies and minimises the problems noted in the previous section is the continuous time hazard model of Cox (1972),[21] which takes the following basic form:

$$\lambda(t,X) = \lambda_0(t) \, exp(X'\beta), \; 0 \leq \lambda \qquad (2)$$

where $\lambda(t,X)$ is the hazard function of a firm, which can be interpreted as the instant hazard rate of a firm between $(t, t+\Delta t)$, with $\Delta t \rightarrow 0$, $\lambda_0(t)$ baseline hazard function, i.e. the instant hazard when all explanatory variables are zero, and $(X'\beta)$ the vector of the

model's explanatory variables, which explains the observed heterogeneity between firms.[22]

The use of the exponential logarithm in function (2) is necessary to ensure that the estimated hazard $\lambda(t)$ does not take on negative values even if there are negative values in the vector of explanatory variables.

A key feature of model (2) is the assumption of proportionality, i.e. that the relative hazard between two firms, also known as hazard ratio or HR, is constant and time-invariant. The proportionality of the hazard ratio is calculated as follows:

$$\lambda(t,X_i)/\lambda(t,X_j) = exp[(X_i'-X_j')\beta] \qquad (3)$$

Consequently, the explanatory variables in the model shift the baseline hazard function; thus, the estimation of the hazard function essentially amounts to measuring the relative hazard compared to the baseline hazard, which does not allow for its estimation.

The above analysis can be better understood through an example: suppose that the vector of explanatory variables in the hazard function includes the size of the firm and the sector, whose value is 1 for firms in the technological sector and 0 for firms in any other sector. Based on the HR, we can examine the relative hazard of firms in the technological sector. If e.g. the coefficient β for the technological sector is estimated as 0.18, then exp(0.18)=1.20. Thus, the hazard rate for firms in the technological sector (with Xi=1), *ceteris paribus*, is 20% higher than that for firms in other sectors. By contrast, if the coefficient on the technological sector is -0.18, then exp(-0.18)=0.83, i.e. the hazard for the firms in the technological sector (Xi=1) is 17% smaller than for firms in other sectors.

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[21] In the said model, duration is considered a continuous random covariate. Because the expected survival duration is relatively large, it is considered that estimations of the continuous time variant of the hazard function are not significantly different compared to a discrete time model (see also Siriopoulos and Lalountas, 2008).

[22] For more information on the explanatory variables used in this study, see section 3.2.

Initially, the estimation of model (2), both in the narrow and in the broad sense of survival, will be undertaken using the method of maximum likelihood, where the baseline hazard function is estimated non-parametrically thus generating a very flexible baseline hazard (hence it is a semi-parametric model).

Apart from semi-parametric models, parametric models have also been used in the literature. The latter models assume that the baseline hazard function follows a specific distribution.[23] In this way, it is possible to examine whether the estimations of a hazard function are sensitive to the applied methodology. For this reason, in this study we have used alternative parametric models, which we detail in the Appendix. These models assume that the baseline hazard function follows either the Weibull, loglogistic or lognormal distribution.

3.3.3 Model assessment and selection process

We apply a specific method to assess and select between the above models. In more detail, the initial assumption is that the survival duration is a constant random variable that does not follow a specific distribution. Restrictions are then applied gradually and the constancy of the parameters is checked through the various specifications.

For general optimisation criteria, we use the Akaike criterion[24] and the Likelihood Ratio (LR),[25] through which the overall significance of the parameters in the model is tested. Moreover, this particular test has also been used to control for unobserved heterogeneity.[26]

Finally, we use the Cox-Snell residuals test (1968) for a more general comparison between models (both parametric and non-parametric).

4 EMPIRICAL RESULTS

4.1 BASIC STATISTICAL DATA

The basic descriptive statistics of the variables

offer a measure that enables the comparison of Greek market data with that of foreign markets. If we compare our sample with samples from empirical studies on other countries, it is interesting to focus on the initial size and the age of firms before the public offering.

Over the whole sample, the average age of firms before the initial public offering was 13 years,[27] i.e. significantly higher than in US initial public offerings, where the average age is 8.6 years (Hensler *et al.*, 1997), but closer to the European average (of 11.6 years in Germany (Audretsch and Lehman, 2004) and 19 years in the Netherlands (Roosenboom *et al.*, 2003)).

Turning to size, the average value of the sample (the median) is 556 (137) employees, which is smaller than similar European firms,[28] for which e.g. Pagano *et al.* (1998) estimate a median of 1,447 (759) employees. However, despite the fact that Greek firms with Athex-listed shares are smaller than their European counterparts, their average size is larger by far than that of other Greek firms (Barbosa and Louri, 2005).

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23 The application of parametric models yields more accurate estimations of the parameters. However, the assumption of an incorrect parametric form for the baseline hazard leads to biased estimations; by contrast, the semi-parametric method does not have this disadvantage.

24 This criterion is: $-2\log L + 2(k+c)$, where k is the number of explanatory variables in the model and c the number of parameters in the baseline hazard function.

25 LR is calculated as follows: $-2(\log L - \log L_0)$, where LogL is the logarithm of the likelihood and LogL0 is the corresponding logarithm under the specific restrictions.

26 By analogy to the simple classical linear model, heterogeneity may be the result of e.g. the researcher's inability to quantify the variables that should be included in the model according to theory, or the omission of explanatory variables or a weakness in theory that makes it impossible to define fully the explanatory variables in the sample. The consequences of unobserved heterogeneity for the estimation of the hazard model are significant. It is well-known that in the standard linear model, the omission of significant variables affects the estimated coefficients only if the omitted variables are correlated with other explanatory variables in the regression. This does not apply to the hazard model. Even if the omitted variables are not correlated with the other explanatory variables, the estimated coefficients are biased. For these reasons, the control of unobserved heterogeneity is an essential part of the empirical analysis of survival models.

27 From a corresponding sample of 110 public offerings in the Athens Exchange (Koumanakos, 2004), the average age of firms before the initial public offering was 15 years.

28 Koumanakos (2007) comes to the same conclusion, using the accounting value of the firm's assets for size.

Table 4 Estimation of hazard models

| Variable | Semi-parametric model[1] | | Parametric models[1] | | |
| | | | Survival duration in the narrow sense | | |
	Survival duration in the narrow sense[2]	Survival duration in the broad sense[2]	Model 1 Weibull	Model 2 Loglogistic	Model 3 Lognormal
LEV	15.705***	6.380**	0.257**	0.268**	0.254**
SIZE	0.603***	0.797	1.301**	1.278**	1.224*
BOD	0.401	0.486	1.621	1.437	1.714
MD	2.049	2.416	0.723	0.716	0.723
INST	2.060	1.799	0.707	0.694	0.710
SCNW	1.018	1.115	0.974	0.964	0.944
NEWE	3.233**	2.475**	0.559**	0.567**	0.572**
AV-NEWE	0.780	1.437	1.113	1.174	1.227
IND	0.893	0.945	1.070*	1.069*	1.069*
σ			0.470***	0.433***	0.856***
LogL	-85	-144	-57.72	-57.86	-57.43
LR test	22.69	19.90	24.36	23.84	24.36
AIC			139.45	139.72	138.87
Number of observations	1,352	1,352	1,352	1,352	1,352

Note: *, **, *** imply statistical significance at the level of 10%, 5% and 1% respectively.
1 The estimations of the semi-parametric model refer to hazard ratios calculated from equation (3), and the estimations of the parametric models 1-3 refer to time ratios calculated from equation (8) in the Appendix, respectively.
2 The survival duration in the narrow sense includes firms whose shares' trading has been suspended for a period of over six months. In the broad sense, it also includes firms whose shares have been placed under surveillance.

4.2 ESTIMATION RESULTS

The results of estimating the hazard models of section 3.3 and the Appendix are presented in Table 4. Estimates for the semi-parametric model, which refer to hazard ratios, are presented in the first two columns and estimates of the parametric models, which refer to time ratios, are presented in the last three columns. The main result derived from observing the statistical significance and the size of the coefficients is that these estimations are minimally affected by the sample selected. This result strengthens the empirical findings. Moreover, leverage, size, sector and duration (as represented by the estimate of the baseline hazard) are found to be statistically significant.

More specifically, if we examine the first two columns of Table 4, which show the hazard ratios – HR – as estimated using equation (3), bearing in mind that the interpretation of the estimated coefficients relates to whether they are greater than or less than 1,[29] we can draw the following conclusions:

Firstly, leverage (LEV) seems to significantly increase a firms' hazard ratio, a finding which is in concordance with those of Fotopoulos and Louri (2000). Thus firms with relatively high leverage face a greater hazard of not surviving. This is made more comprehensible through the following example: If we use the coefficient LEV (15.705) derived from the semi-parametric model (first column of Table 4) and we assume that a firm's leverage ratio is 0.50, its

29 Recall that, based on the analysis set out in section 3.3, the semi-parametric model essentially estimates the relative hazard between two firms given the baseline hazard function.

hazard ratio is exp(log(15.705)*0.50)=3.96. Thus, if the leverage ratio is increased by 10 percentage points, to 0.60, then the firm's hazard ratio will be exp(log(15.705)*0.60)=5.21, i.e. an increase of about 30%.

Secondly, as regards the relationship between size and a firm's hazard of exiting the capital market, it appears that large firms face a significantly lower hazard than smaller firms, since the coefficient is less than 1 (e.g. SIZE=0.603 in the first column of Table 4).

In a similar example, supposing that a small-medium firm has 50 permanent employees and a large (by Greek standards) firm has 150 employees, then the hazard ratio of the first firm (0.14)[30] is almost double that of the second (0.08).[31] Therefore, small-medium firms face a hazard (0.14/0.08=1.75), *ceteris paribus*, of not surviving almost double that of larger firms.

Alternatively, the analysis of the results of parametric models shows that the survival duration of big firms is greater than that of small firms. E.g. the coefficient on size in the Weibull model (SIZE=1.301), as calculated on the basis of equation (8) in the Appendix, implies that the survival duration of large firms is 30% higher than that of small firms.

The coefficient on size, nonetheless, is statistically significant only in the narrow sense of exit, i.e. when there is a suspension of the trading of shares. In the broad sense, i.e. including firms with shares placed under surveillance, the estimated coefficients are not statistically significant.[32] This difference can possibly be attributed to the fact that surveillance aims at the creation of forecasting mechanisms for the protection of the Athex market and its investors, without this necessarily translating irrevocably into doubts about the smooth operation of the market.

Our estimation of the hazard on the basis of the semi-parametric model (0.603) is lower than that (0.81) of Fotopoulos and Louri

(2000),[33] but not significantly different from estimations in other empirical studies. E.g. the size coefficient of the hazard ratio is in the area of 0.57 for the US market (Jain and Kini, 1999) and 0.65 for the Portuguese market (Mata and Portugal, 2002).

In order to examine the influence of corporate governance, by contrast to other empirical studies (Peristiani and Hong, 2004, Hensler *et al.*, 1997, and Jain and Kini, 1999), the role of the management (insiders) has been separated into the individual roles of the Managing Director, the Board of Directors and the institutional investors. Results show that agency theory alone cannot explain the factors affecting the survival of firms on the Athex, as the relevant coefficients are not statistically significant.[34] Theoretically, a statistically significant relationship between the percentage of shares owned by the Managing Director, the members of the Board of Directors and the institutional investors, on one hand, and the survival duration of a firm, on the other, would be expected. However, such a relationship is not observed. Thus the corporate governance system in Greece does not seem to allow for high agency costs that could significantly affect firm survival.

In any case, even if for the moment we ignore the statistical significance of the coefficients and examine only the signs of the estimated coefficients, we observe that the interests of the active shareholders (i.e. participants in the Board of Directors) do not necessarily coincide with the interests of the Managing Director. In the first case the coefficients take values of less than 1 (lower hazard) and in the second case greater than 1 (greater hazard). Even when the

30 Exp(log(0.603)*log(50))=0.14.
31 Exp(log(0.603)*log(150))=0.08.
32 It can be noted that parametric models have also been taken into consideration; in these, the survival duration is defined in its broad sense. The results show no significant differences, which is why they are not presented in Table 4.
33 In this study, the initial size is measured differently.
34 It is noted that statistical insignificance of similar variables has been reported in other studies (e.g. Audretsch and Lehman, 2004). However, there are findings for Greek firms that suggest a positive relation between concentration of ownership and efficiency (Kapopoulos and Lazaretou, 2007).

Managing Director has holdings in the firm, he has the incentive to take on excessive risk and transfer it, at least in part, not only to other shareholders but to creditors too (Shleifer and Vishny, 1997). Moreover, the coefficient on the INST variable provides only weak indication that the participation of institutional investors in the initial public offering increases the hazard ratios for firms, since that coefficient is not statistically significant either.

These findings give rise to a number of questions, because, although they could be attributed to a certain extent to the hypotheses on which the representation theory is based, corporate governance in Greece abides by different rules from those prevailing in the Anglo-Saxon system of corporate governance. According to La Porta *et al.* (1999), the majority of firms with Athex-listed shares maintain the traditional family business structure, thus it is not easy to separate management from ownership, which results in lower agency costs. Generally, there is evidence that the concentration of shares leads to excessive risk and to the transfer of this risk by the Board of Directors to the other partners and creditors. However, an alternative interpretation of the results could be that the goal of small and middle firms is not exclusively the maximisation of the company's worth.[35]

Regarding institutional investors, even though through their participation in the Board of Directors they play an active role in the management of the firm, the cost of communication and co-ordination with the owners of a family business is high. It is possible that institutional investors as well as the businessman himself cannot understand the business opportunities that arise from the environment in which the firm operates and thus hesitate to finance business plans they think will not yield good expected profits or they consider that the risk involved by the business plan is disproportionate to the expected cash flows (Randoy and Goel, 2003).

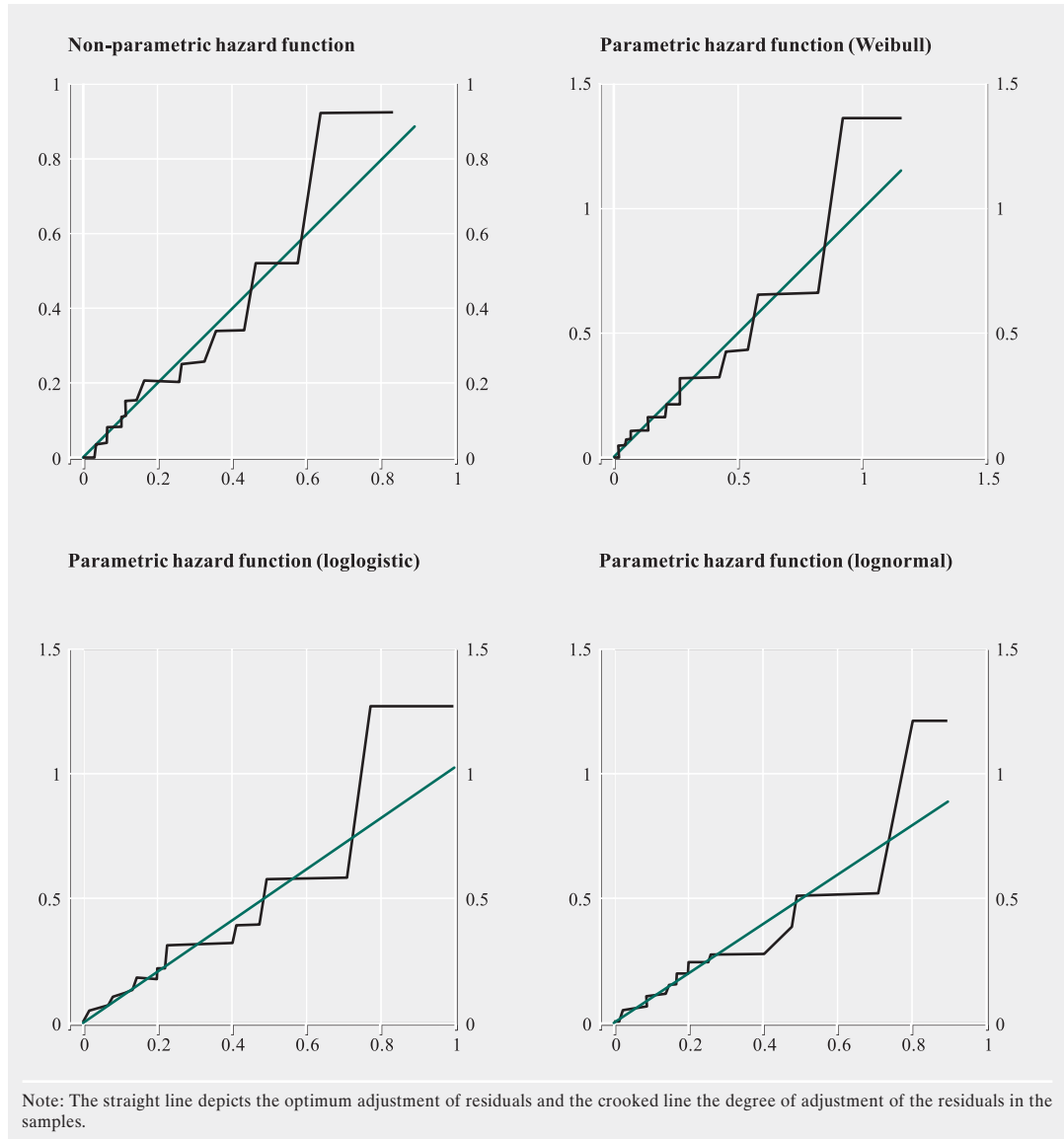As regards competition in the sector, recall that, according to the population ecology the-ory, the survival duration is reduced when new entrants increase due to retaliation by existing firms; the opposite happens when the number of new entrants is small. Industrial organisation theory reaches the same conclusion, albeit for different reasons. The increased rate of new entrants implies fewer barriers to entry. Higher barriers to entry come as a result of large-scale investment which is necessary for the smooth operation of the firm. In turn, high barriers to entry become high barriers to exit.

The rate of new entrants to the sector (variable NEWE) is one of the determinants of the survival duration. Based on the results of the semi-parametric model, an increase in the number of new entrants leads to an increase in the hazard ratio. More specifically, the coefficient 3.233 implies that the entry of a firm into a particular sector, *ceteris paribus*, doubles, in logarithmic scale (3.233-1=2.333), the hazard of non-survival relative to the existing firms in the sector. This conclusion is in line with the findings of the empirical studies of Mata and Portugal (1994 and 2002), Mata *et al.* (1995) and Fotopoulos and Louri (2000). Moreover, the fact that the coefficient on the variable AV-NEWE is less than 1 indicates (note that the factor is not statistically significant) a reduction in the hazard ratios of new entrants with high average initial size, making the probability of exit for negative reasons less likely. The variable that tests the "window of opportunity" hypothesis (SCNW) is insignificant even though the value of the coefficient serves as indication of a positive relation between this factor and the degree of hazard.

Macroeconomic factors do not seem to have a statistically significant influence on survival duration, a finding common to other relevant studies. The insignificance of the variable IND in the semi-parametric estimations may possibly be the result of the fact that the time span of the study does not suffice to establish a relationship of interdependence between the macroeconomic and the microeconomic envi-

Chart 2 Comparison between models using the residuals test

Non-parametric hazard function

Parametric hazard function (Weibull)

Parametric hazard function (loglogistic)

Parametric hazard function (lognormal)

Note: The straight line depicts the optimum adjustment of residuals and the crooked line the degree of adjustment of the residuals in the samples.
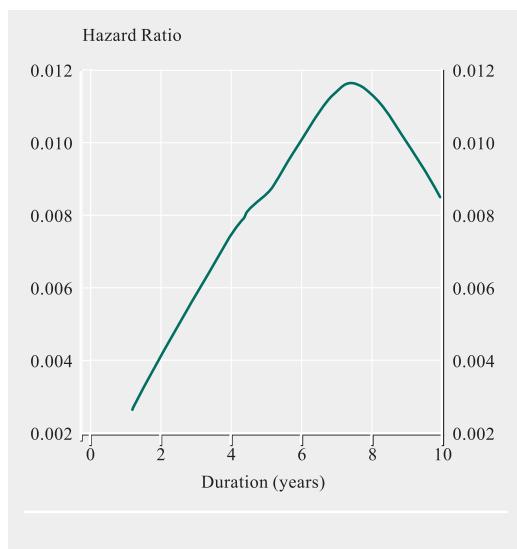
ronment at firm level, especially if we take into account that, even in the longest time span covered by the study, the business cycle was only in its upward phase. A second possible explanation is that changes in the index of industrial production do not have the same influence on all sectors. Last but not least, IND, by contrast to other variables, is time-dependent and thus affected by the form that the baseline hazard function takes (Meyer, 1990). That is, if an

erroneous parametric model is applied, the coefficients on the time-dependent variables will be biased. Indeed, if we examine the last three columns of Table 4,[36] we observe that this variable, contrary to what has been observed in the semi-parametric model, is statistically sig-

[36] These columns contain the results of the estimations of the parametric models detailed in equations 4-6 and interpreted on the basis of equation 8 (see Appendix).

Chart 3 Estimation of the hazard function

Hazard Ratio

Duration (years)

Chart 2, it appears that, apart from the fact that deviations are stronger when the survival duration increases, which is expected given that a lengthier duration makes the forecast more difficult, the semi-parametric model seems to fit the data better.

Taking the above into consideration, the hazard function is estimated using the semi-parametric model. A graphic representation of this baseline hazard is provided in Chart 3.[39] This indeed confirms that the form of the baseline hazard is non-monotonic. The "liability of adolescence" hypothesis is confirmed, as the values of the baseline hazard function are relatively low in the first years and are then increased to reach the maximum value in around the 7th year. This implies that in the beginning, the firm's hazard of exit is small, because the new entrant may survive in the first years by using up the funds from the initial public offering. In the period that follows, the hazard increases significantly before turning downwards. This is true both in the narrow and the broad sense of exit. Thus, the longer the period that a firm operates on the Athex, the smaller the probability of its exit from it, which means that the hazard is reversely proportional to the survival duration, which is an indication of the significance of a long-term investment horizon.

nificant, thus implying a positive relation between a favourable macroeconomic environment and the probability of survival.

Turning to the estimates of the parametric models (see Appendix), besides confirming the findings of the semi-parametric model, they also give additional significant information on the shape of the baseline hazard through the coefficient σ. These estimates shed light on the "liability of adolescence" hypothesis. Of particular relevance to testing the hypothesis are the results of those models that assume either a loglogistic or lognormal distribution for the baseline hazard since they allow the baseline hazard to be non-monotonic in contrast with the Weibull distribution which restricts the baseline hazard to be monotonic. Hence, even though in the Weibull model the value of σ shows that the hazard function is increasing monotonically, thus rejecting the "liability of adolescence" hypothesis, the results from the other two parametric models generate a σ of less than 1 (0.433 and 0.856 respectively),[37] providing support for the "liability of adolescence" hypothesis.

If we compare the alternative models using the Cox-Snell residuals test (1968)[38] as done in

Even though there is considerable disagreement in the literature regarding the relationship between survival duration and the hazard function, the findings of this study are in line with the literature on public offerings. For example, Hensler *et al.* (1997) concur with our conclusion, using data from the US stock market, even though the hazard function in that study takes on its maximum value at 4.7 years.

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37 A confirmation of this estimation is provided in Chart 3.
38 It can be noted that the direct comparison of the estimations of the parametric models with the corresponding non-parametric Cox model is not possible due to the fact that the estimations of the first are in accelerated form, by contrast to the analogue form of the estimations of the Cox semi-parametric model.
39 The hazard function has been estimated using the method of the Epanechnikov kernel (see Kalbfleisch and Prentice, 1997).

5 CONCLUSIONS

This study, building on the theoretical background of the standard bankruptcy prediction models, has reviewed a series of factors that may affect the survival or the exit from the stock market of firms with shares listed on the Athex after 1993. In particular, in the light of the existing literature, we examined the following factors: leverage, initial size, corporate governance, sector and macroeconomic conditions.

According to our findings, the form of the baseline hazard function is non-monotonic. This implies that the hazard of exiting the capital market is initially small, increases, peaks after approximately 7 years and drops back thereafter. This corroborates the view that investment in the stock market must have a long-term character, as the hazard of exit is reduced with time. Firms with high leverage face proportionally greater hazard to be put under surveillance or to exit altogether from the Athex, in relation to firms with low lever-

age. Firms in sectors with a high rate of new entry face a proportionally greater hazard to be placed under surveillance. Another determinant is the firm's initial size. Between two firms with high leverage, which are active in a particularly competitive sector, the one that is smaller will have almost double the probability of exiting the market.

In contrast to the above, factors such as corporate governance and the macroeconomic environment do not seem to have a statistically significant effect, except in the cases where the baseline hazard is specified parametrically when the macroeconomic environment is found to play some role.

This study may become the basis for further research in at least two directions: (i) the question whether the effect of the initial characteristics remains constant or change over time; (ii) in the context of corporate governance, whether the family business structure affects firm survival.

APPENDIX

PARAMETRIC METHODS FOR ESTIMATING THE HAZARD FUNCTION

Apart from estimating the baseline hazard using semi-parametric methods, we also test parametric specifications of the hazard function to establish whether the results are sensitive to the applied methodology, i.e. we assume different distributions for the baseline hazard.

In more detail, we initially assume the Weibull distribution (2), which takes the following form:

$$\lambda(t,X) = 1/\sigma_t^{1/\sigma-1}exp(X'\beta) \qquad (4)$$

where $1/\sigma_t^{1/\sigma-1}$ is the baseline hazard function, σ the parameter of duration-dependence, $(X'\beta)$ the vector of the explanatory variables that account for the observed heterogeneity between firms and β a vector of unknown parameters.

According to equation (4), apart from the coefficients on the explanatory variables (β), the parameter σ, which indicates the form of the baseline hazard is also estimated. If $\sigma=1$, the probability of survival is constant and independent of duration. But if $\sigma>1$ ($\sigma<1$), the probability of survival decreases (increases) with duration. The main feature of the Weibull specification is that it constrains the hazard to be monotonic thereby excluding the case of an increase at the beginning and a fall thereafter or vice versa. This limitation leads to alternative specifications for the baseline hazard that are subject to less limitation. E.g. the loglogistic specification allows the baseline hazard to take on both monotonic and non-monotonic forms.

The loglogistic specification of function (2) takes the following form:

$$\lambda(t,X) = \frac{1}{\sigma} \cdot \frac{(exp(X'\beta)^{1/\sigma}(t)^{1/\sigma-1}}{1+(exp(X'\beta)t)^{1/\sigma-1}} \qquad (5)$$

where σ is the parameter of duration-dependence and $(X'\beta)$ the vector of explanatory variables that account for the observed heterogeneity between firms. When $\sigma\geq1$, the baseline hazard is monotonic, as in the Weibull case; when $\sigma\leq1$, the baseline hazard is non-monotonic (an inverted U-shape).

Finally, we examine the lognormal specification of equation (2), which can be expressed as:

$$\lambda(t) = \frac{1}{\sigma_t\sqrt{2\pi}} \cdot \frac{exp[-1/2\{z(t)\}^2]}{1-\Phi[z(t)]} \qquad (6)$$

where $z(t)=[log(t)-X'\beta]/\sigma$ and $\Phi[z(t)]$ is the distribution function of the standardised normal distribution.

It can be noted that in the cases where the baseline hazard is parametric, model (2) loses its analogue capacity (although in the Weibull specification the analogue interpretation is also possible) and its factors are interpreted slightly differently (accelerated model).

Accelerated models take on the following general form:

$$logT=-X'\beta^*+u?log[T\,exp(-X'\beta^*)]=\sigma w \qquad (7)$$

where the expression $exp(-X'\beta^*)$ operates as a time scale, having the following practical significance: If $exp(-X'\beta^*)>1$, the time scale for the observation with X features changes more rapidly and accelerates the non-survival of that particular observation by $T^*exp(-X'\beta^*)-T$. By contrast, if $exp(-X'\beta^*)<1$, the time scale for the observation with X features slows down non-survival by $T^*exp(-X'\beta^*)-T$.[40]

β^* parameters in model (7) are interpreted with the help of the time ratio–TR. This ratio is calculated as follows:

$$TR = exp(-\beta^*) \qquad (8)$$

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[40] For more information on these samples see Lancaster (1990).

Values greater than 1 mean an increase in duration and values less than 1 mean a reduction in duration. E.g. if the ratio took on the value 1.224, it would mean an increase in the survival duration by 22.4%; if it took on the value 0.25, it would mean a decline in the survival duration of 1-0.25=75%.

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FOREIGN DIRECT INVESTMENT IN GREECE: PRODUCTIVITY AND TECHNOLOGY DIFFUSION*

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1 INTRODUCTION

In recent years international capital flows in the form of foreign direct investment (FDI) have increased considerably. Indicatively, from 2002 to 2006 intra-euro area FDI inflows (among the 12 oldest countries) recorded an increase of the order of 20%. Also indicatively, intra-euro area FDI stocks amounted to 29% of euro area GDP in 2006, compared to 22% in 2002.[1]

For Greece, the degree of inward foreign direct investment, mainly in comparison with other member countries of the European Union (and the euro area), appears particularly low. The inward FDI stock originating from countries of the euro area in 2006 was only 4.3% of the Greek GDP (in 2002, this percentage was 3.8%).[2]

The effects of FDI on the host country is one of the most important issues in international economics. The large increase in international capital flows in FDI has renewed interest in these issues. The main questions economic research is concerned with are: (a) the direct and indirect (through technology diffusion) effects of FDI on domestic productivity and (b) the cost to domestic firms from new market entrants.

The aim of this study is to investigate the impact of FDI on the productivity of the Greek economy. More specifically, what are the direct and indirect effects of foreign presence on domestic productivity?

It must be stressed that FDI exerts an effect on the productivity of the domestic economy via two different channels. The first (direct) channel is related to the average productivity of the economy. If the whole economy consists of M foreign firms and N domestic ones, where for-eign firms have a higher productivity, a marginal increase (to M+1) in the presence of foreign firms leads to an increase in the average productivity of the economy. The second (indirect) channel is related to the marginal increase in economic activity that results from an increased foreign presence, i.e. a marginal increase (to M+1) in the presence of foreign firms may lead to an increase in the productivity of other X firms through the concept of "technology diffusion" (the concept will be analysed below).

There are a number of stylised facts that relate to the productivity of firms:

– Export firms are more productive than firms which produce only for domestic consumption.

– Multinational firms are more productive than domestic and exporting firms and invest more in research and development (R&D).

The explanation of the above facts is fairly straightforward. Export firms face greater competition than domestic firms. If they are not productive enough, they will not survive as export firms. Multinationals, besides competition, also face large sunk costs associated with the establishment of subsidiaries. In order to meet these costs, they have to be more productive. Furthermore, multinationals are usually characterised by higher technological

intensity in their production and possess a more effective organisation and a more efficient distribution system.

The present study is structured as follows: The second section analyses further the concepts of the direct and indirect productivity effects stemming from FDI and presents briefly a survey of the international empirical literature. The third section presents the relevant literature and empirical findings for Greece and describes the data used in this study. In the fourth section the theoretical and empirical model employed is explained. The fifth section reports the main results of the study. The last section concludes.

2 EMPIRICAL INDICATIONS

2.1 DIRECT EFFECTS ON PRODUCTIVITY

There are several empirical indications that FDI firms are more productive than domestic firms. Consequently, they have positive direct effects on the average productivity of the domestic economy.

Using firm-level data for the US, the United Kingdom and Italy, Conyon *et al.* (2002) and Criscuolo and Martin (2004) show that multinational firms (and consequently FDI firms) are more productive than domestic firms.[3] In the United Kingdom, for instance, data show that multinational firms are twice as productive as domestic firms (Criscuolo and Martin, 2004). A survey article by Alfaro and Rodríguez-Clare (2004) shows that the same is also true for developing economies.

Generally, the assumption that multinational firms are more productive than domestic firms enjoys strong empirical support. Behind this result is the now well-established theory of multinational firms (Caves, 1996, Markusen, 2002, Helpman *et al.*, 2004), according to which, if there is a specific cost for a firm to become multinational (e.g. the sunk cost of setting up a subsidiary), then, in equilibrium, only

the most productive firms will operate as multinationals.

2.2 INDIRECT EFFECTS ON PRODUCTIVITY

The literature investigating the indirect effects of FDI on the domestic economy is more voluminous, mainly for two reasons: First, because these effects are of a more complex nature and, second, because the results concerning indirect effects on productivity are controversial and contradictory.

Multinational firms, in relation to domestic ones, usually possess certain intangible assets such as: better knowledge of technology, better marketing and managerial skills, closer ties to exporters, more coordinated contacts with suppliers and customers, as well as a better reputation in the market. These intangible assets can be transferred to a subsidiary and some of them can be transferred to domestic firms.

For instance, multinational firm employees can acquire specialised knowledge in their firms. When changing workplace, they transfer this knowledge to their new jobs. Furthermore, when domestic firms are exposed to new products as well as new production and marketing methods, they can imitate some of them. Finally, by establishing business relations with the foreign multinational firm, either as suppliers or purchasers of intermediate products, domestic firms may acquire technical support, as well as knowledge of production methods, staff management and marketing. Hence, foreign firms can exert a positive impact on the productivity of domestic firms by diffusing the technology and knowledge they possess.

Consequently, there are many reasons to believe that FDI firms can have a positive impact on the productivity of host country firms. However, there may also be negative

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3 A firm is defined as multinational when it has some sort of production in another country through FDI. Consequently, a firm characterised as FDI firm is part of a multinational one.

effects. Indeed, the entry of foreign firms may have negative effects on domestic firms. Once the former have penetrated the market as competitors, they can, through a lower marginal cost of production, increase their production and capture market shares from domestic firms. This causes domestic firms to reduce their production. Given that domestic firms have a certain sunk cost, they are obliged to cover this cost by reducing the quantity of their production. This implies lower productivity.

The aforementioned indirect effects can be more easily understood by means of a chart. Chart 1 shows the effects that the presence of FDI firms may have on domestic firms.

At first, technology/know-how diffusion has a positive impact on domestic firms and the average cost curve (AC) shifts from AC_0 to AC_1. However, further competition forces the domestic firm to reduce its production and moves it back along the new average cost curve. In the case presented in Chart 1, the net result for a given level of labour inputs is a reduction in productivity.

As it appears, the indirect effects of FDI on domestic firms' productivity are complex. Thus, it is not surprising that the results of empirical studies investigating technological diffusion are mixed and do not provide strong empirical support for positive indirect effects of FDI.[4]

In general, studies based on industry-level data point to a positive correlation between foreign presence and average value added per employee in the sector.[5] By contrast, studies employing firm-level data exhibit mixed results. Certain studies, such as those of Haddad and Harrison (1993) on Morocco and Aitken and Harrison (1999) on Venezuela, find negative indirect effects on domestic productivity, owing to the presence of foreign firms. Other studies, such as those of Djankov and Hoekman (2000) on the Czech Republic, Konings (2001) on Bulgaria, Poland and Romania, Braconier *et al.* (2001) on Sweden and Girma and Wakelin

Chart 1 Changes in domestic firms' production due to the presence of FDI firms
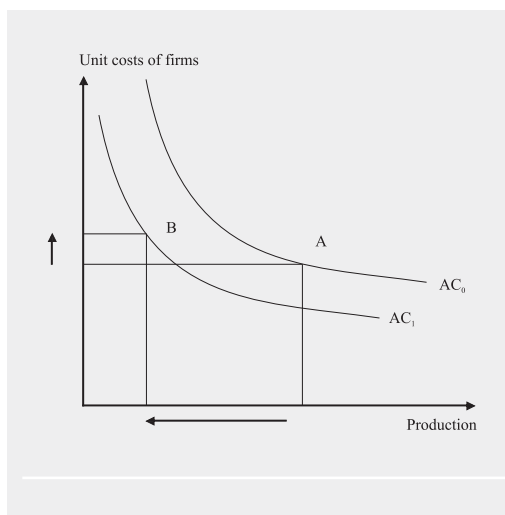
(2001) on the United Kingdom, find doubtful or zero indirect effects on domestic productivity, while the studies of Haskel, Pereira and Slaughter (2007) on the United Kingdom, Griffith, Redding and Simpson (2003) also on the United Kingdom, Javorcik (2004) on Lithuania, Keller and Yeaple (forthcoming) on the US, Liu (2008) on China and Javorcik and Spatareanu (2008) on Romania find that foreign firm penetration of the domestic market has positive indirect effects on domestic productivity.

Finally, there are two studies on Greece by Dimelis and Louri (2002, 2004), which find posi-tive direct and indirect effects on the productivity of domestic firms as a result of the existence of FDI. It is to these studies that we now turn.

3 FOREIGN DIRECT INVESTMENT IN GREECE

3.1 FINDINGS ON GREECE

The study by Dimelis and Louri (2002) utilises firm-level data for 1997. The data come from

4 See Keller (2004) for an overview of literature concerning technology diffusion.
5 See Blomström and Kokko (1998) for an overview.

the ICAP data base and include about 4,000 firms in the manufacturing industry. The results show that the positive direct and indirect effects on productivity differ depending on the level of productivity. Specifically, the direct effects are more obvious in the intermediate quantiles of productivity, i.e. foreign presence does not affect the productivity of firms which have either a very high or a very low productivity. Also, direct effects on productivity are only significant for firms where foreign shareholders possess the majority of the shares. Indirect effects due to technological spillovers are more positive for firms with high productivity, irrespective of whether foreign shareholders possess the majority or the minority of the shares. In contrast, firms with average or small productivity are positively affected solely by the presence of joint ventures i.e. with a co-ownership percentage of up to 50%.

The second study by Dimelis and Louri (2004) also employs firm-level ICAP data for 1997, for 3,742 firms operating in the manufacturing industry. The authors separate their sample into large and small firms (firms employing more than 50 persons and firms employing up to 50 persons). This separation is performed so that they can investigate the productivity differences between small and large firms.

The main findings of the study show that there are positive direct and indirect effects on the productivity of domestic firms as a consequence of FDI. Specifically, it is ascertained that the firms characterised as FDI ones and in which foreign investors possess a majority of shares are more productive than the domestic ones. Furthermore, the difference in productivity increases with the size of the firm, i.e. large firms (with more than 50 employees) are relatively more productive. By contrast, the positive indirect effects from technology diffusion are exerted by smaller joint ventures mainly in smaller domestic firms.

3.2 THE DATA

The data employed in the present study are firm-level data from the ICAP data base. The data is an unbalanced panel that covers the period 2002-2006 and a total of 16,780 firms, of which 1,113 firms have an FDI indication for at least one year. Also, the data concern all the industries of the economy, not only manufacturing.

The firms were selected on the basis of the following criteria: (a) firms with 10 or more employees, as defined in the ICAP data base; (b) firms with positive sales; (c) firms with positive own funds (the firms which had negative own funds were state firms with large accumulated losses). Finally, the financial sector was excluded because of the particularity of balance sheets in this sector.

Supplementary data on FDI, besides those of ICAP, were also taken from the Bank of Greece data base. These data concern foreign firms investing or disinvesting in the period 2002-2006. The ICAP data on foreign ownership were not intertemporal but concerned only the recent period. However, in order to have a more comprehensive picture of certain changes over time in the structure of foreign participation in our sample, the ICAP data were matched with data from the Bank of Greece.

3.3 AN OVERVIEW OF THE DATA

Probably the simplest way for someone to have a more general picture concerning firms characterised as FDI ones relative to domestic firms is through a visual analysis of the data.[6]

It should be pointed out that, on the basis of the numbers provided in each column, the majority of the firms in our sample operate in the manufacturing and the retail and wholesale trade industries (62% of all firms in 2005. The percentages concerning domestic firms as well as FDI firms are similar.) From Charts 2 and 3 it is obvious that in the two above-

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6 The data refer to 2005, as the majority of remarks regard that year. More charts as well as tables with descriptive statistics are included in the Annex.
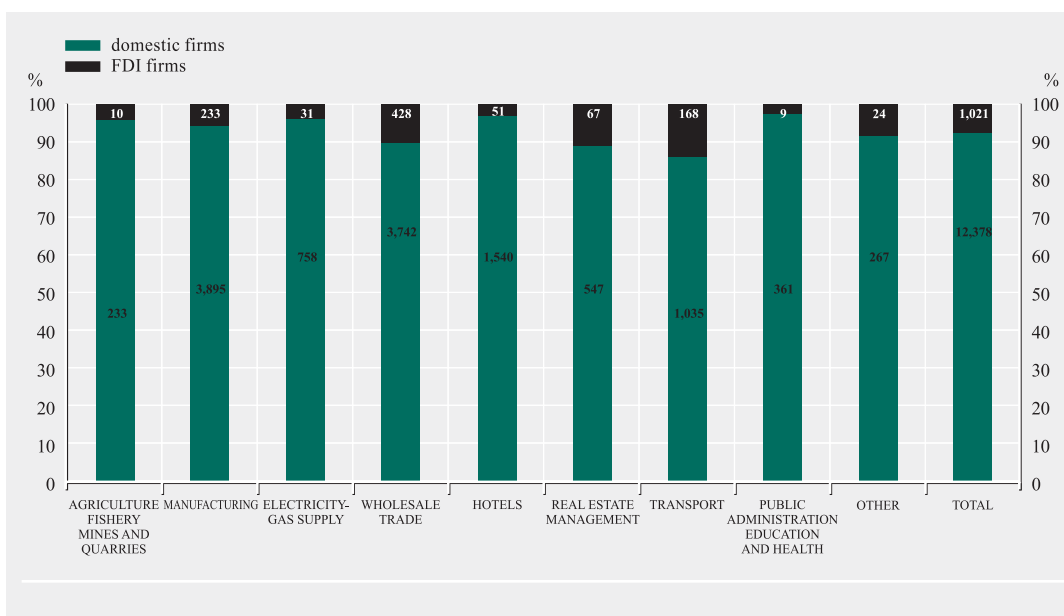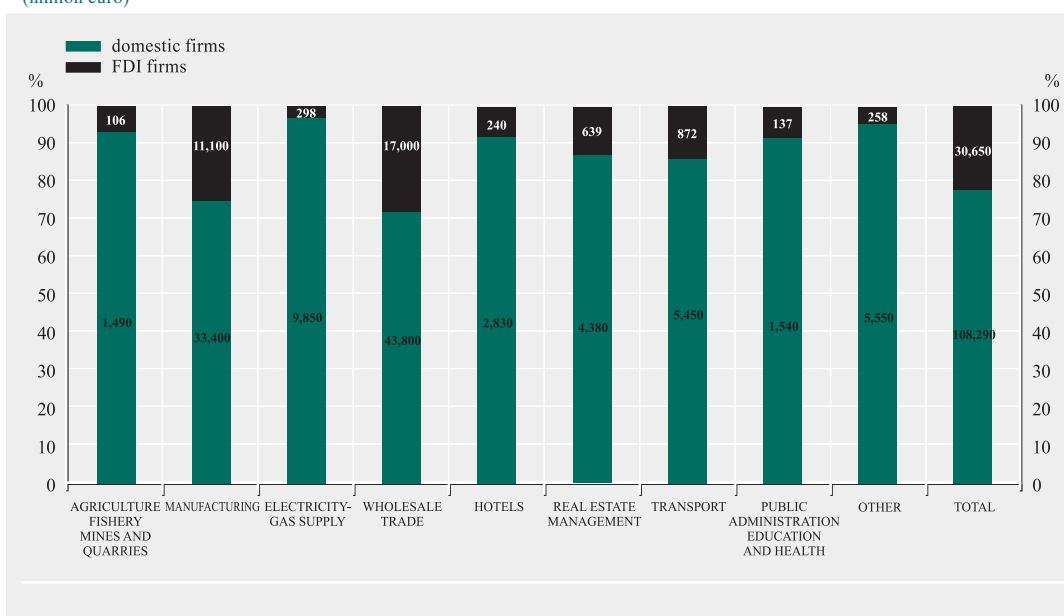
Chart 2 Number of firms per industry

Chart 3 Sales per industry (at firm level)

(million euro)

mentioned industries FDI firm sales relative
to the number of firms are quite large. Even
though there are certain differences among

industries concerning the presence of FDI
firms, on average 10% of all firms have an
FDI indication. However, their sales corre-

Chart 4 Average fixed capital per industry (at firm level)

(million euro)

- total firms
- domestic firms
- FDI firms
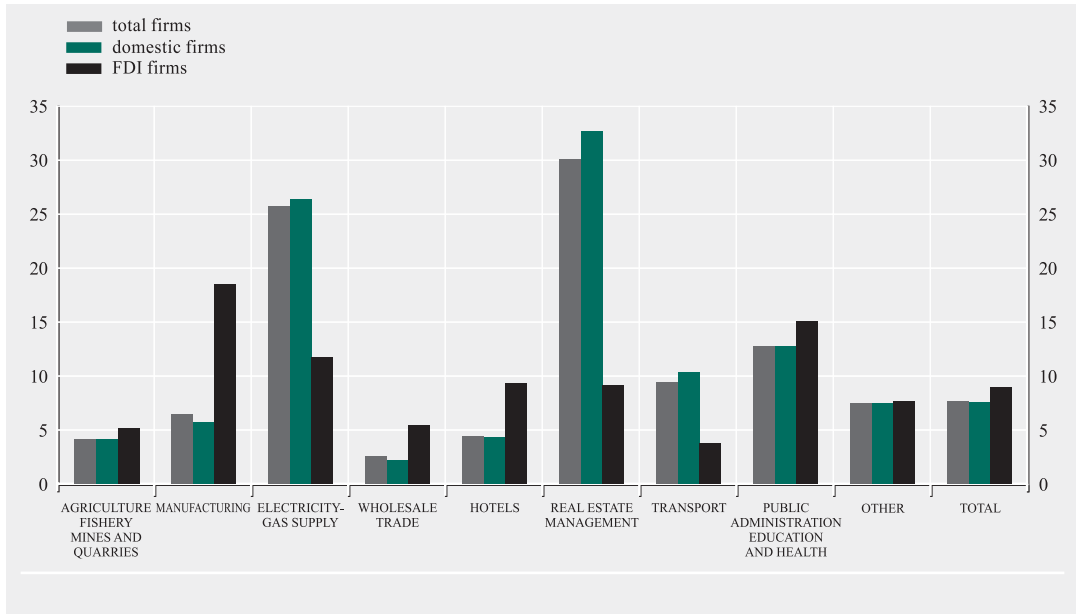
Chart 5 Average personnel per industry (at firm level)

(number of employees)

- total firms
- domestic firms
- FDI firms
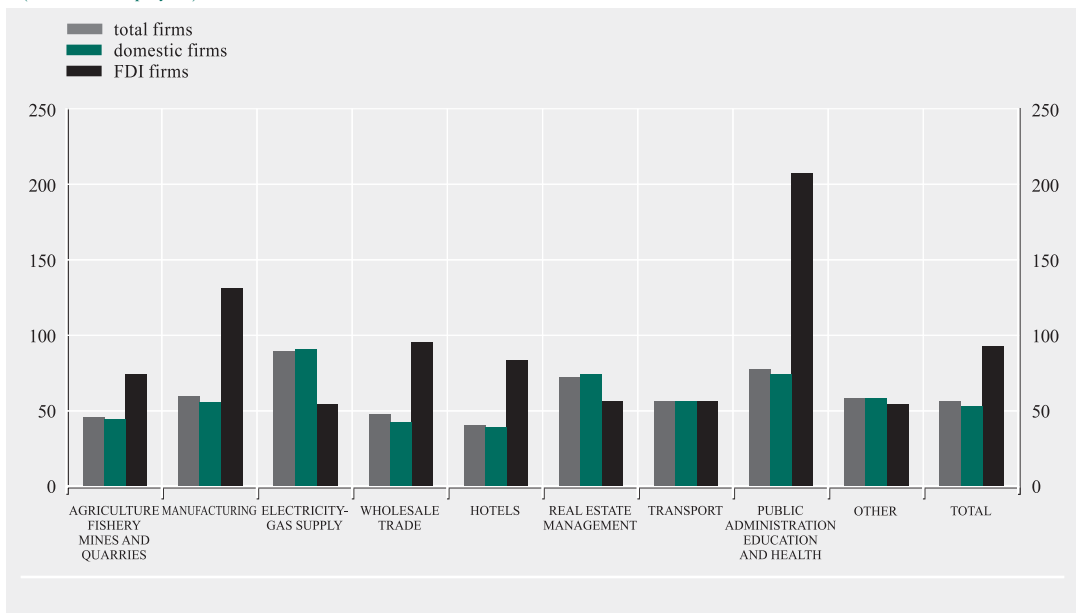
spond to 30% of total sales. This shows quite clearly that on average FDI firms are larger than domestic firms.

The differences between FDI and domestic firms become more evident if certain average (per firm) values are compared. Charts 4-6

Chart 6 Average value of sales per industry (at firm level)

(million euro)

■ total firms
■ domestic firms
■ FDI firms
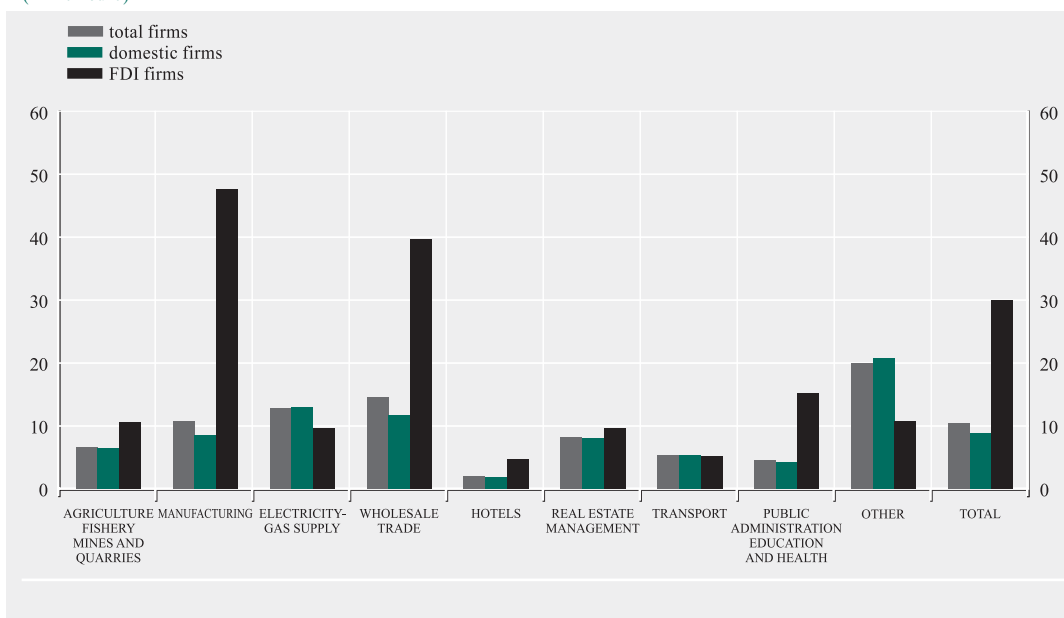
clearly show that, at least in the two largest industries, manufacturing and retail and wholesale trade, foreign firms have on average more personnel, more fixed capital and higher sales.

As shown in the charts, there are significant differences between industries in all economic aggregates. The fixed capital per firm seems to be concentrated in the industries "electricity-gas supply", "transport" and "manufacturing" ("manufacturing" covers only the FDI firms), which is reasonable, since they are also industries with high capital requirements. Regarding personnel, the highest bars always concern FDI firms. Specifically, the firms which, on average, have more personnel can be found in "public administration, education and health", "manufacturing" and "wholesale trade". Finally, in sales per firm, firms charachterised as FDI ones also come first. "Manufacturing" and "wholesale trade" display large differences in comparison with the other industries.

Probably the most interesting results appear if all three charts are examined together for the largest industries of the sample ("manufac-

turing" and "wholesale trade"). Manufacturing FDI firms, relative to domestic firms, employ about 3.2 times more fixed capital and 2.4 times more personnel, while they have 5.5 times larger sales. "Wholesale trade" employs respectively 2.5 times more fixed capital and 2.3 times more personnel, with 3.4 times larger sales. The economic aggregates for total firms give a similar picture.

The fact that FDI sales are disproportionately large means that FDI firms use in general less labour units and fewer capital units per each unit sold. This constitutes a first "visual" indication that FDI firms are more productive than domestic firms.

Although the charts provide a first visual indication of productivity differences, they cannot inform us precisely of its size or of whether it is systematic and statistically significant. Furthermore, they cannot answer the question whether FDI in Greece can help domestic productivity through technological diffusion or not. In order to answer these questions, certain econometric estimations must be employed.

4 MODELS

4.1 THE THEORETICAL MODEL

As a first step to employ econometric estimations we need to define a basic theoretical model. Here, we will use as a base the model presented in Dimelis and Louri (2002, 2004). The model is a general form of the production function, where the firm's output Y_i is formulated as:[7]

$$Y_i = F(K_i,L_i)e^{Z_i} = F(K_i,L_i)e^{\Sigma \gamma_j X_{ij} + e_i} \qquad (1)$$

where K_i and L_i are the production factors "capital" and "labour" respectively for the firm i. $Z_i = \Sigma \gamma_j X_{ij}$ imply other exogenous production factors, the effect of which is given by γ_j (Other exogenous factors imply certain economic factors that affect the dependent variable, but do not explicitly appear in the general form of the function. The exogenous variables are presented in detail below.) Finally, e_i denotes the random error.

4.2 THE EMPIRICAL MODEL

For the empirical specification we assume that equation (1) has a Cobb-Douglas form. Converting the equation into logarithms and rearranging gives us the following form:

$$ln(Y_i/L_i) = \gamma_0 + D_j + D_t + \alpha ln(K_i/L_i)$$

$$+ \Sigma \gamma_j X_{ijt} + e_i, \ i=1,...,N \qquad (2)$$

The model is now in labour intensive form. The dependent variable measures labour productivity and is defined as "total sales/number of employees". Productivity is a function of capital per employee, defined as "fixed capital/number of employees" and a series of other explanatory variables. γ_0 is an intercept, while D_j and D_t are dummy variable vectors based on the two-digit NACE classification and time respectively. Finally, the group of explanatory variables X_{ij} consists of:[8]

FDI dum.: it is a dummy variable with the value of 1 if the firm is an FDI firm for the year t (t=2002-2006) and 0 otherwise.

FDI maj.dum.: it is a dummy variable with the value of 1 if the firm is an FDI firm and the foreign shareholder possesses >50% of the shares for year t (t=2002-2006) and 0 otherwise.

FDI min.dum.: it is a dummy variable with the value of 1 if the firm is an FDI firm and the foreign shareholder possesses ≤50% for the year t (t=2002-2006) and 0 otherwise.

FDI. FC Spillover: this variable measures technological diffusion and has been created as follows: For each two-digit NACE industry classification, total fixed capital corresponding to foreign investors is divided by the total fixed capital of the industry. A positive effect on productivity will indicate technological spillovers to domestic firms i.e.more foreign capital in the industry has a positive impact on the productivity of the industry's firms.[9]

MNE domestic: it is a dummy variable with the value of 1 if the firm is a domestic multinational (without being an FDI firm) and 0 otherwise.

Exporter: it is a dummy variable with the value of 1 if the firm is an export firm (without being an FDI firm or a domestic multinational) and 0 other-wise.

l (Leverage): it is the logarithm of short-and long-term debt over net worth.[10]

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7 Without a loss of generality the (t) index for the time period is omitted.
8 A difference in relation to the explanatory variables employed by Dimelis and Louri (2002, 2004) is that here the size of the firm is not included. However, the variables MNE domestic and exporter are used. These variables display a high degree of correlation with the size of the firm, as multinationals and export firms tend to be bigger. Since the addition of variables MNE domestic and exporter allows us to draw certain interesting conclusions, we focus on them here.
9 For FDI firms, the foreign capital of the firm itself was deducted from total foreign capital, so that the capital of the firm can be added on to itself.
10 The logarithm of zero and negative numbers is not defined. However, given that a firm can have zero debt or zero (and negative) working capital, in these cases data for the variables in question were replaced with 0.000001. It should be noted that the general results do not depend on these changes.

l (Liquidity): it is the logarithm of working capital over total assets.

The two financial variables *l* (Leverage) and *l* (Liquidity) can depict either the consequences of the financial pressure on firms which makes them become more productive or the firm's capability to utilise investment opportunities (for which it holds liquidity) that are more productive. Both variables are expected to increase productivity (Nickel *et al.*, 1992, Caballero, 1997, Hubbard, 1998). However, caution is required concerning the 1(Leverage) variable, which, as noted above, refers to debt over the firm's net worth. A positive effect on productivity may be expected when the data concerning firms regard a period covering a whole economic cycle. The years covered in the study, 2002-2006, are characterised by a positive growth rate, without a decline period. In such a period there is the possibility that a relatively increased debt indicates firms with chronic problems and low productivity, so that the coefficient sign is negative.

5 EMPIRICAL RESULTS

5.1 THE ORDINARY LEAST SQUARES (OLS) METHOD

Equation (2) is estimated by ordinary least squares (OLS), where all estimations include the intercept, the two-digit NACE dummy variables and the time dummy variables. The results of the dummy variables are not presented due to space considerations.

Estimations have been performed on the whole sample, as well as on the sub-samples of small firms (with ≤50 employees) and large firms (with >50 employees). The reason for this division is that small firms may differ from large ones in their use of intermediate factors of production (without a division of the sample, the results could be biased), i.e. small and large firms may differ in terms of production factors(capital and labour) and productivity.

Table 1 presents some interesting results. From regression (1) a number of conclusions can be derived: First, capital per employee has a positive sign and is statistically significant. Since it is in logarithmic form, the coefficient represents the elasticity, i.e. a 10% increase in capital per employee increases productivity by about 1.8%. In addition, the financial variables 1(Leverage) and 1(Liquidity) are positive and statistically significant, although with a smaller coefficient.

The most interesting results are the following. As concerns dummy variables, we can recall that they denote whether the firm is an exporting firm, a Greek multinational or an FDI firm. The purely domestic firms are the excluded firms and thus constitute our control group. The results show that a Greek exporting firm is more productive by 9% $[(e^{0.0856}-1)\text{x}100\approx8.9]$ than a purely domestic one. A Greek multinational is 41% more productive, while an FDI firm is on average about 59% more productive than a purely domestic firm.

It should also be pointed out that the difference between the productivity of an FDI firm in relation to another Greek multinational is statistically significant (the difference in coefficients, 0.462 and 0.35, respectively, is statistically significant). What is interesting here is that it is obvious that foreign multinationals possess an advantage which makes them more productive than Greek firms.[11] Finally, it should be noted that the variable that measures technology diffusion (FDI. FC Spillover) is positive, but statistically significant only at the 10% level.

Regression (2) also shows that FDI firms in which the foreign shareholder possesses the majority of shares (usually 100%) are the firms which differ most in terms of productivity. According to the literature dealing with FDI, this difference can be explained as follows: if a

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[11] At this point, it should be noted that firm size is important for productivity and that export firms and multinationals are clearly bigger firms compared to the purely Greek firms, but the use of dummy variables allows more interesting results to be drawn.

	Whole sample (1)	Whole sample (2)	Small firms (3)	Small firms (4)	Large firms (5)	Large firms (6)
l(K/L)	0.181***	0.181***	0.159***	0.160***	0.275***	0.278***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.006]	[0.006]
l(Leverage)	0.012***	0.012***	0.015***	0.016***	-0.005***	-0.004**
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
l(Liquidity)	0.021***	0.022***	0.013***	0.013***	0.040***	0.042***
	[0.003]	[0.003]	[0.003]	[0.003]	[0.005]	[0.005]
FDI dum	0.462***		0.440***		0.491***	
	[0.014]		[0.018]		[0.023]	
FDI maj.dum.		0.538***		0.523***		0.572***
		[0.016]		[0.021]		[0.026]
FDI min.dum		0.276***		0.219***		0.324***
		[0.024]		[0.034]		[0.034]
FDI. FC Spillover	0.262*	0.258*	0.483***	0.488***	0.02	0.013
	[0.153]	[0.153]	[0.181]	[0.181]	[0.267]	[0.267]
MNE domestic	0.350***	0.348***	0.508***	0.507***	0.270***	0.266***
	[0.026]	[0.026]	[0.048]	[0.048]	[0.030]	[0.030]
Exporter	0.085***	0.086***	0.085***	0.085***	0.125***	0.125***
	[0.010]	[0.010]	[0.011]	[0.011]	[0.022]	[0.022]
Obs.	62,949	62,949	50,866	50,866	12,083	12,083
R2-adj.	0.36	0.36	0.34	0.34	0.52	0.52

Note: *, ** and *** imply statistical significance at a level of 10%, 5% and 1% respectively. Standard errors are given in square brackets.

foreign multinational has a more advanced technology and 'better' knowledge, it will be more willing to apply it in its subsidiary if it can have total control, without having to share this technological advantage with a domestic partner that may become its competitor in the future.

Finally, regressions (3)-(6) yield the following results: First, large firms, relative to small ones, differ clearly in terms of the contribution of capital per employee to productivity. From regressions (4) and (6), for instance, the difference in the coefficient, 0.278, for large firms from the coefficient, 0.160, for small firms is statistically significant.

Second, increased borrowing for small firms has positive effects on their productivity, while for large firms it has negative effects. Perhaps for the sample of large firms increased lever-

age indicates firms with chronic problems and relatively low productivity.

Third, FDI firms are more productive than Greek multinationals only when they are large firms. In the case of smaller firms, no differences are found in productivity between FDI firms and domestic multinationals (although both groups are more productive than the purely domestic firms as well as exporting firms). In regression (3), which concerns small firms, the coefficient for FDI firms is 0.44, while that for domestic multinationals is 0.508 (without, however, the difference being statistically significant). These results are also probably an indication that foreign firms are able to better manage economies of scale.

Moreover, it is obvious that technology diffusion is statistically significant only in smaller

firms. This result comes as a surprice and gives a first indication that technology diffusion is probably not the same for all levels of productivity.[12] This is because large firms are usually more productive due to economies of scale.

On the basis of these results, the effects of FDI are investigated below by applying quantile regressions.

5.2 QUANTILE REGRESSIONS

In this section, regressions (1) and (2) of Table 1 are estimated separately for each productivity quantile. This allows our explanatory variables to have a different impact on productivity for each quantile.

Specifically, the quantile estimation is based on the assumption that the dependent variable, productivity, is not identically distributed across the sample (in our sample, where the cross-sectional dimension, i.e. firms, dominates the time dimension, it means that productivity is not identically distributed across all firms). If this is true, the estimates carried out with the least squares method (OLS) may not be representative.

The empirical model defined in equation (2) can be rewritten to allow quantile regressions. In a compact form it becomes:

$$y_{it} = x_{it}'\beta(q) + e_{it} = Q_q(y_{it}) + e_{it}, \quad 0<q<1 \quad (3)$$

where $\beta(q)$ is a vector of coefficients that will be estimated for a given value of $q \in (0,1)$.

In order to make the results more comprehensible and due to space considerations, we do not present tables with estimation results. Instead, for the variables of interest, we plot the coefficients of each quantile regression. We include the point estimates of the coefficients that are statistically significant, which appear in numerical form in the charts. Estimates start from productivity quantile 0.05 (the 5% firms with the lowest productivity) and increase by steps of 0.05 up to quantile 0.95.

Chart 7 gives us an idea (by productivity quantile) of the productivity differences of FDI firms from Greek multinationals. Recalling that the productivity differences are relative to

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12 Dimelis and Louri (2002) show that this applies in their sample.

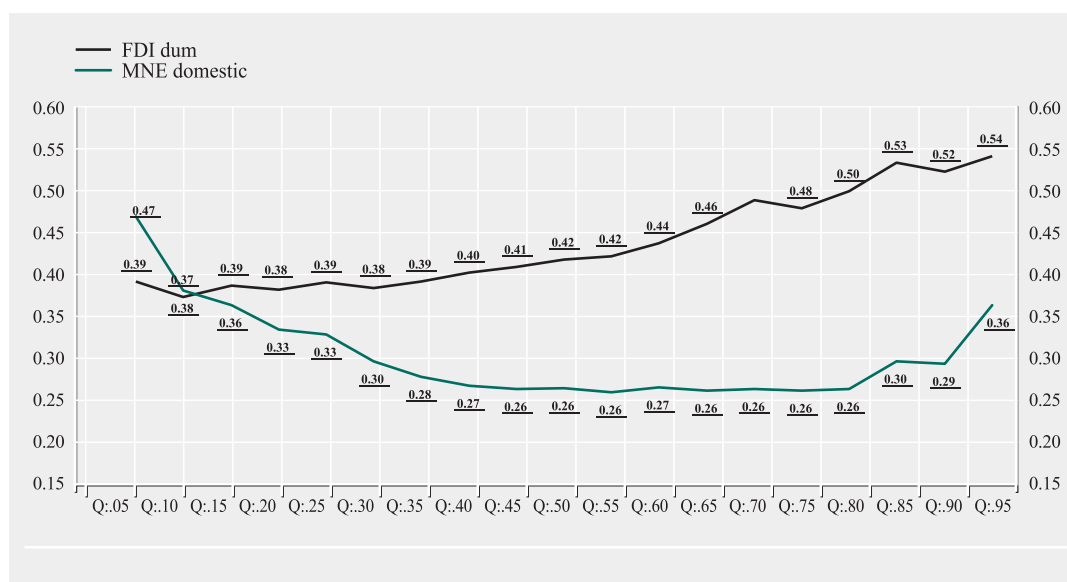## Chart 7 Quantile regression, FDI dummy variables and domestic variables

FDI dum
FDI FC Spillover

0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3

0.39 0.37 0.39 0.38 0.39 0.43 0.39 0.40 0.41 0.42 0.42 0.44 0.46 0.48 0.50 0.53 0.52 0.54

0.38 0.33 0.37 0.27 0.31 0.37 0.32 0.34 0.35

Q:.05 Q:.10 Q:.15 Q:.20 Q:.25 Q:.30 Q:.35 Q:.40 Q:.45 Q:.50 Q:.55 Q:.60 Q:.65 Q:.70 Q:.75 Q:.80 Q:.85 Q:.90 Q:.95
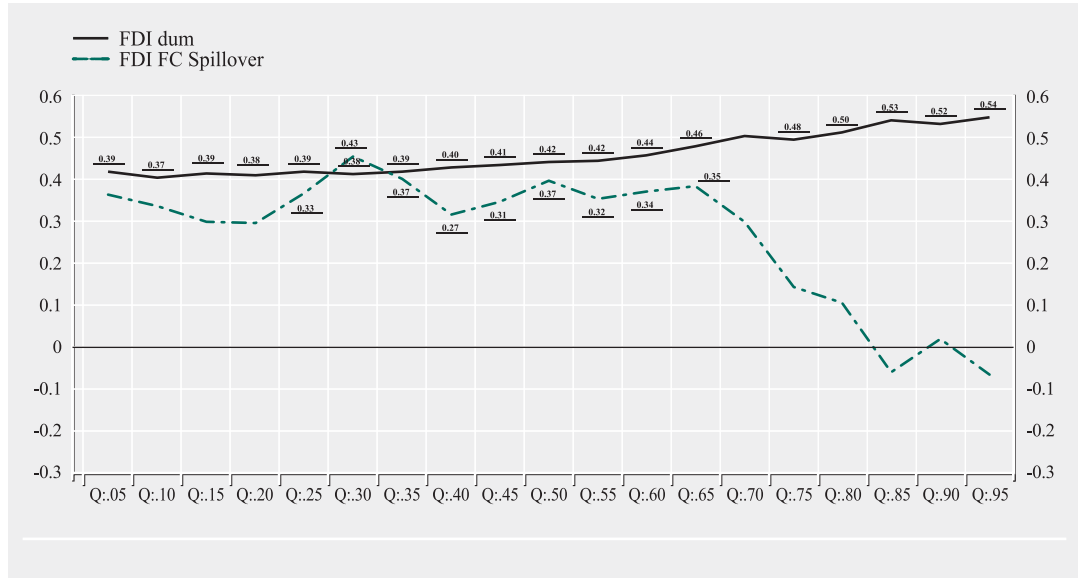
Chart 9 Quantile regression, majority FDI dummy variables, minority FDI and domestic multinationals

FDI maj.dum
MNE domestic
FDI min.dum

0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
0.20
0.15

0.47 0.45 0.43 0.45 0.45 0.46 0.47 0.48 0.49 0.51 0.51 0.52 0.54 0.55 0.56 0.56 0.57 0.58 0.57 0.60

0.38 0.36 0.33 0.33 0.29 0.28 0.27 0.27 0.26 0.25 0.26 0.26 0.26 0.26 0.30 0.30 0.30 0.36

0.21 0.27 0.30 0.29 0.27 0.24 0.23 0.22 0.21 0.20 0.22 0.21 0.21 0.22 0.24 0.27 0.30 0.37 0.30 0.44

Q:.05 Q:.10 Q:.15 Q:.20 Q:.25 Q:.30 Q:.35 Q:.40 Q:.45 Q:.50 Q:.55 Q:.60 Q:.65 Q:.70 Q:.75 Q:.80 Q:.85 Q:.90 Q:.95
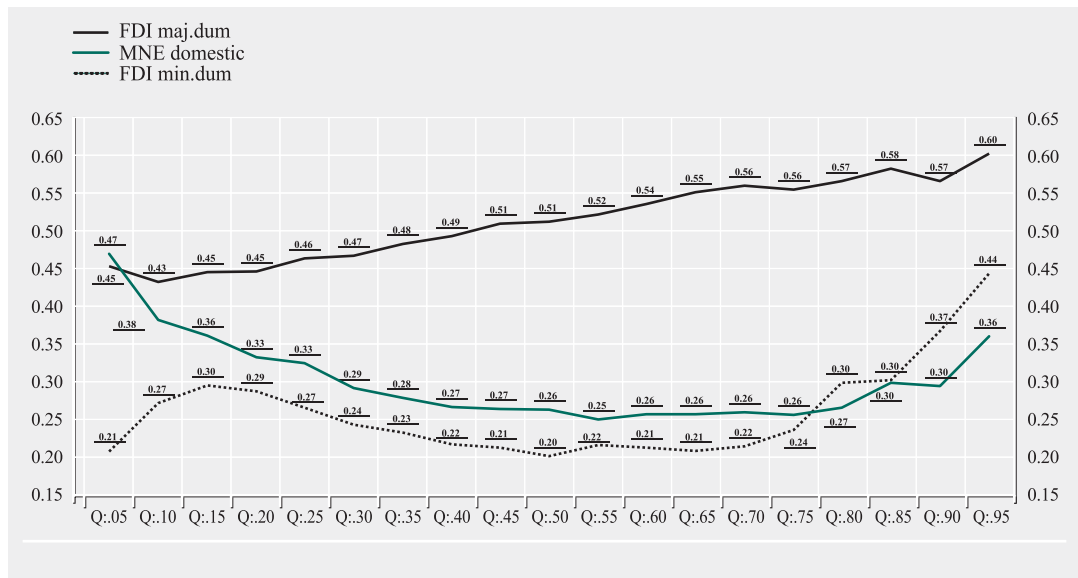
our control group, domestic firms, we can see that (excluding the lower productivity quantiles) foreign firms have a greater advantage relative to Greek firms, as they (both) are multinational.

Chart 8 shows that technology diffusion is statistically significant only for the intermediate quantiles. A reasonable explanation is that the less productive firms do not have the potential to assimilate and incorporate the technology

and know-how existing in foreign firms. The more productive firms by contrast may already have this technology and know-how; hence there is no effect on their productivity from foreign presence. By contrast, firms with moderate productivity, which are able to apply the more effective production methods that exist in foreign firms, experience a positive effect on their productivity from the presence of FDI firms.

If we compare Chart 7 with Chart 8 we can see that technological diffusion is statistically significant in the quantiles where the productivity of domestic multinationals is lower relative to that of foreign firms. This result may indicate increased competitive pressure for the quantiles where productivity differs more between foreign and domestic firms, i.e. there is higher pressure for an increase in productivity in these quantiles.

Finally, Chart 9 shows that if the firm is a foreign multinational or a Greek multinational, there is a statistically significant difference in productivity only if the foreign shareholder possesses a majority of shares. This large productivity difference applies in all quantiles and thus raises the following concerns. It appears that either (a) FDI firms in Greece in which the foreign shareholder has the minority of shares do not possess superior technology and/or know-how (however, it seems strange that foreign multinationals that invest in Greece and do not differ in productivity from Greek multinationals are minority FDI firms, while those that differ in productivity are majority FDI ones) or (b) the minority FDI firms are, for some reason, unwilling to adopt

superior technology and/or know-how that the foreign investor probably possesses (while it seems that superior technology and know-how is utilised in majority FDI firms).[13]

6 CONCLUSIONS

By utilising a large sample of Greek firms for the years 2002-2006, we investigated the direct and indirect productivity effects exerted by foreign direct investment in Greece. The results show that foreign firms, both on average and relative to domestic firms, are more productive. Differences in productivity are of the order of 59%. Furthermore, foreign firms are by about 18% more productive than Greek multinationals. The difference in productivity between foreign and Greek multinationals depends on the degree to which the foreign firm participates in the domestic firm. FDI firms in which foreign participation is 50% or less do not seem to be more productive than Greek multinationals. However, such firms *are* more productive than purely domestic firms. Finally, the presence of foreign direct investment seems to have a positive impact on technology diffusion in the Greek economy. Technology diffusion is significant for smaller firms which exhibit intermediate productivity levels. The overall picture is that foreign direct investment has a positive impact on the productivity of the Greek economy via both direct and indirect channels.

[13] There is also the possibility that minority investment has another, perhaps strategic, character, where productivity issues are of secondary importance.

ANNEX

Table A Descriptive sample statistics for the year 2005

(fixed capital and sales in million euro)

	Total fixed capital	Domestic fixed capital	FDI fixed capital	Total employment	Domestic employment	FDI employment	Total sales	Domestic sales	FDI sales	Number of firms	Number of domestic firms	Number of FDI firms	Number of majority FDI firms	Number of minority FDI firms
Agriculture, fishery, mines and quarries	1,010	955	51	11,085	10,346	739	1,600	1,490	106	243	233	10	4	6
Manufacturing	26,600	22,300	4,320	246,631	216,084	30,547	44,500	33,400	11,100	4,128	3,895	233	150	83
Electricity, gas, water supply and constructions	20,300	20,000	363	70,606	68,932	1,674	10,100	9,850	298	789	758	31	23	8
Wholesale trade	10,500	8,120	2,340	199,335	158,500	40,834	60,800	43,800	17,000	4,170	3,742	428	347	81
Hotels	7,060	6,590	476	64,289	60,022	4,266	3,070	2,830	240	1,591	1,540	51	35	16
Transport	18,500	17,900	614	44,250	40,491	3,758	5,020	4,380	639	614	547	67	43	24
Real estate management	11,300	10,700	636	67,550	58,051	9,499	6,330	5,450	872	1,203	1,035	168	112	56
Public administration, education and health	4,730	4,590	136	28,594	26,725	1,869	1,680	1,540	137	370	361	9	3	6
Other	2,180	2,000	184	16,929	15,627	1,302	5,810	5,550	258	291	267	24	12	12
Total	*102,180*	*93,155*	*9,120*	*749,267*	*654,778*	*94,489*	*138,910*	*108,290*	*30,650*	*13,399*	*12,378*	*1,021*	*729*	*292*

Source: ICAP.
Note: "Domestic" implies domestic firms, "FDI" implies firms with foreign participation above 10%.

Table B Descriptive sample statistics for the year 2005, averages per firm

	Total fixed capital	Domestic fixed capital	FDI fixed capital	Total employment	Domestic employment	FDI employment	Total sales	Domestic sales	FDI sales
Agriculture, fishery, mines and quarries	4.2	4.1	5.1	45.6	44.4	73.9	6.6	6.4	10.6
Manufacturing	6.4	5.7	18.5	59.7	55.5	131.1	10.8	8.6	47.6
Electricity, gas, water supply and constructions	25.7	26.4	11.7	89.5	90.9	54.0	12.8	13.0	9.6
Wholesale trade	2.5	2.2	5.5	47.8	42.4	95.4	14.6	11.7	39.7
Hotels	4.4	4.3	9.3	40.4	39.0	83.7	1.9	1.8	4.7
Transport	30.1	32.7	9.2	72.1	74.0	56.1	8.2	8.0	9.5
Real estate management	9.4	10.3	3.8	56.2	56.1	56.5	5.3	5.3	5.2
Public administration, education and health	12.8	12.7	15.1	77.3	74.0	207.7	4.5	4.3	15.2
Other	7.5	7.5	7.7	58.2	58.5	54.3	20.0	20.8	10.8
Total	*7.6*	*7.5*	*8.9*	*55.9*	*52.9*	*92.5*	*10.4*	*8.7*	*30.0*

Source: ICAP.
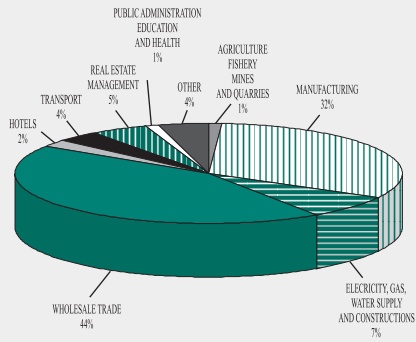Note: "Domestic" implies domestic firms, "FDI" implies firms with foreign participation above 10%.

PUBLIC ADMINISTRATION
EDUCATION
AND HEALTH
1%

AGRICULTURE
FISHERY
MINES
AND QUARRIES
1%

REAL ESTATE
MANAGEMENT
5%

OTHER
4%

MANUFACTURING
32%

TRANSPORT
4%

HOTELS
2%

WHOLESALE TRADE
44%

ELECRICITY, GAS,
WATER SUPPLY
AND CONSTRUCTIONS
7%

PUBLIC ADMINISTRATION
EDUCATION
AND HEALTH
2%

OTHER
1%

AGRICULTURE
FISHERY
MINES
AND QUARRIES
1%

MANUFACTURING
32%

REAL ESTATE
MANAGEMENT
10%

TRANSPORT
4%

HOTELS
5%

WHOLESALE TRADE
43%

ELECRICITY, GAS,
WATER SUPPLY
AND CONSTRUCTIONS
2%
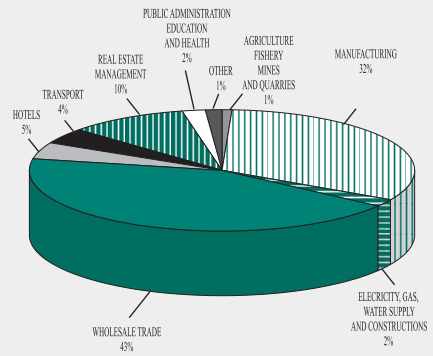
Chart C FDI sales per industry

PUBLIC ADMINISTRATION
EDUCATION
AND HEALTH
0%

REAL ESTATE
MANAGEMENT
3%

OTHER
1%

AGRICULTURE
FISHERY
MINES
AND QUARRIES
0%

MANUFACTURING
36%

TRANSPORT
2%

HOTELS
1%

WHOLESALE TRADE
56%

ELECRICITY, GAS,
WATER SUPPLY
AND CONSTRUCTIONS
1%

PUBLIC ADMINISTRATION
EDUCATION
AND HEALTH
1%

AGRICULTURE
FISHERY
MINES
AND QUARRIES
1%

REAL ESTATE
MANAGEMENT
7%

OTHER
2%

MANUFACTURING
47%

TRANSPORT

HOTELS
5%

WHOLESALE TRADE
26%

ELECRICITY, GAS,
WATER SUPPLY
AND CONSTRUCTIONS
4%

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

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1 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

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

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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).

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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

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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

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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).

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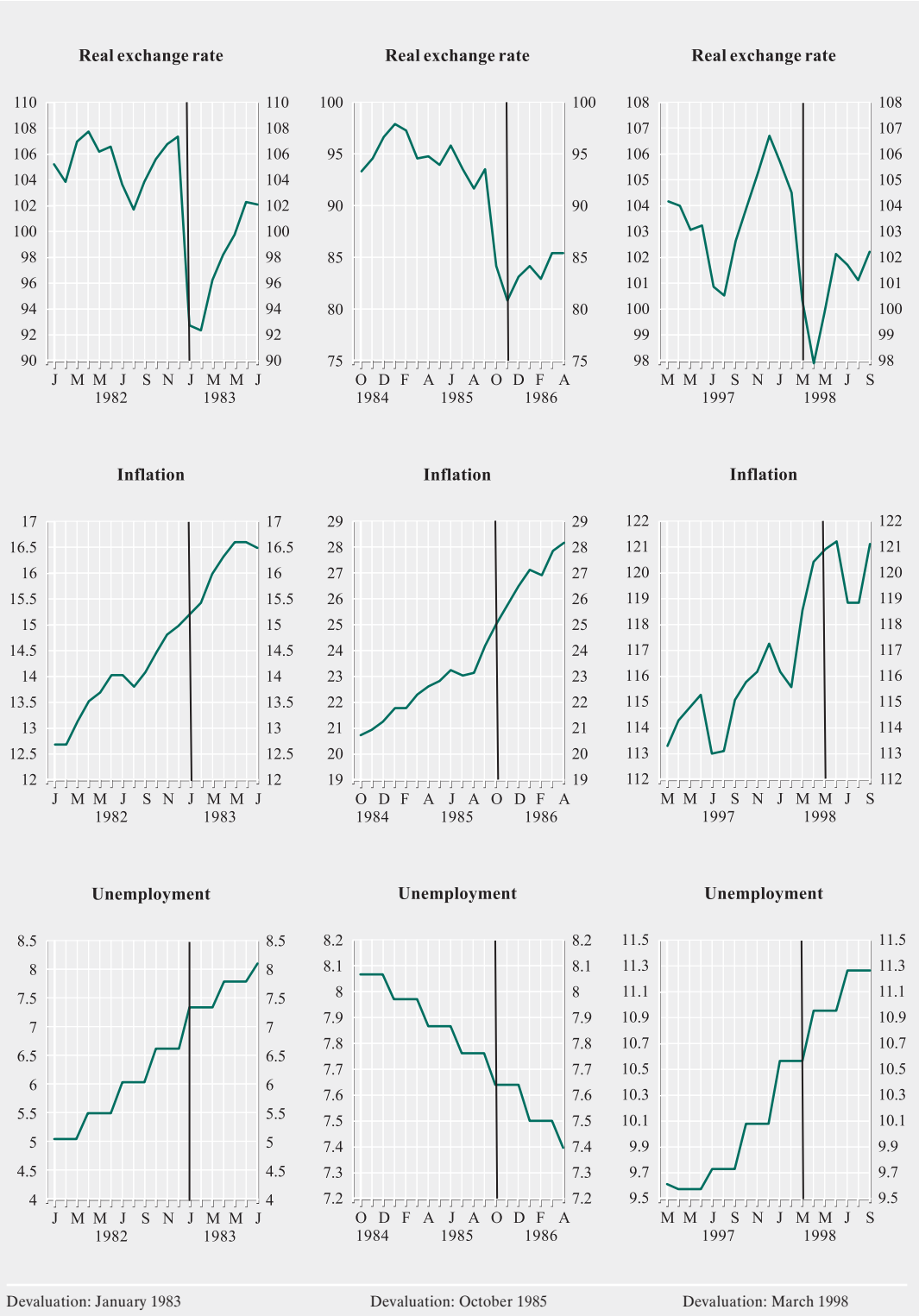
Chart 2 compares developments in the levels of unemployment and the cumulative real

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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

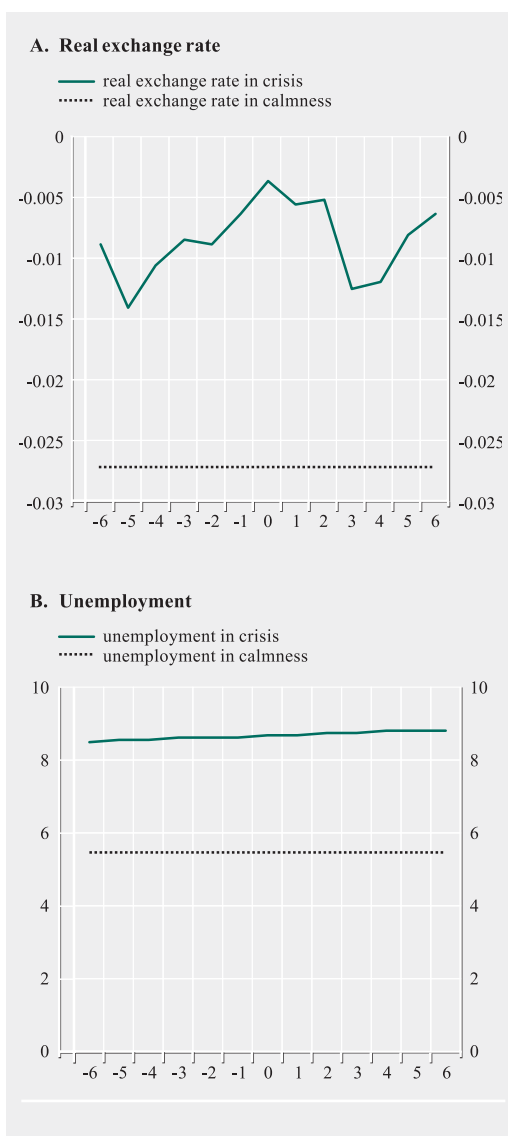(course of variables 12 months before and 6 months after each devaluation)

Real exchange rate

Real exchange rate

Real exchange rate

Inflation

Inflation

Inflation

Unemployment

Unemployment

Unemployment

Devaluation: January 1983   Devaluation: October 1985   Devaluation: March 1998

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

A. Real exchange rate

— real exchange rate in crisis
...... real exchange rate in calmness

B. Unemployment

— unemployment in crisis
...... unemployment in calmness

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

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[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.

	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: $\Delta s_{it} > 1,75\ \sigma_t^{\Delta s}$ 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), $\ln x_t$	-0.482	-1.373
	(0.6300)	(0.1699)
Inflation, $\ln x_t$-$\ln x_t$-12, *(cumulative)*	**2.597**	0.854
	(0.0094)	(0.3931)
Openness, $\ln x_t$	1.394	-0.459
	(0.1852)	(0.6459)
Real exchange rate, $\ln x_t$-$\ln x_t$-12 *(cumulative)*	1.350	**1.672**
	(0.1771)	(0.0935)
Unemployment, $\ln x_t$	**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

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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.*

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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" ($\beta\lambda$. 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), exces-

sive 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

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[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

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.

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WORKING PAPERS
(MARCH – SEPTEMBER 2008)

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CONTENTS

Modelling household expenditure on health care in Greece

Working Paper No. 68
Manos Matsaganis, Theodore Mitrakos and Panos Tsakloglou

Health expenditure data are known to be afflicted by restricted range, zero values, skewness and kurtosis. Several methods for modelling such data have been suggested in the literature to cope with these problems. This paper compares the performance of several alternative estimators, including two-part models and generalized linear models. The dependent variable is household expenditure on health care in Greece, a country where out-of-pocket health expenditure is higher than anywhere else in the European Union, whether as a proportion of GDP, as a share of all health spending, or in per capita terms. To facilitate comparison of model performance, household health expenditure is examined in two different specifications: expenditure on all health care (where zero values are rare) and expenditure on hospital services alone (where zero values are common). In the case of all health expenditures three of the estimators performed almost equally well in terms of three alternative model performance indicators: a modified two-part model with non-linear least squares in the second part, a constant-variance generalized linear model, and a variance-proportional-to-mean generalized linear model. In the case of hospital expenditures the constant-variance generalized linear model outperformed the rest. The findings suggest that no estimator is best under all circumstances, while most alternative estimators are likely to produce relatively similar results.

Price and non-price competitiveness of exports of manufactures

Working Paper No. 69
Panayiotis P. Athanasoglou and Ioanna C. Bardaka

This paper develops a demand function for Greece's exports of manufactures according to "New Trade Theory". The sample covers a rather long period of four decades at quarterly frequency. Trade data is aggregated based not on trade classification SITC (5-8), (which is usually adopted in most of the relevant empirical research) that categorizes about 80% of Greek manufactures, but on industrial classification (ISIC) which covers the total of manufacturing. The study contributes to a better understanding of the effects of export prices, domestic and competitors', as well as of price and non-price competitiveness, the latter approximated with capital stock, on export performance. The analysis assumes imperfect competition in international markets, where trade consists mainly of the exchange of differentiated products. The empirical estimation uses the Johansen maximum likelihood approach in the long run and a dynamic error-correction equation in the short run. The estimated long-run and short-run relationships follow the economic theory, are remarkably stable and exhibit satisfactory in sample predictive performance. It is shown that non-price competitiveness plays a vital role in explaining export performance in the long run as well as in the short run and that failure to include it in the export equation may lead to mis-specification error. As opposed to conventional models of export demand where income effects are very high, in the present study foreign income has a moderately high effect on exports in the long run and no effect in the short run. Long-run and short-run foreign income elasticities are higher when GDP is the foreign income variable. Further, export prices (domestic and competitors') have a strong effect on exports in the long run while their short-run impact is moderate. On the other hand, unit labour costs appear to be significant

only in the long run with elasticities higher when GDP is the foreign income variable. Also, long-run export price elasticities are higher compared with those of unit labour costs. Thus, we could argue that broader price or income definitions generate higher estimates of long-run elasticities. Price and cost competitiveness elasticities are close to one in the long run and even in the short run, indicating that Greek exporters have some ability to compete on the basis of prices. Finally, the speed of adjustment to the long-run equilibrium depends on the definition of foreign income adopted. The use of industrial production produces a higher speed of adjustment compared with GDP.

The benefits and costs of monetary union in Southern Africa: a critical survey of the literature

Working Paper No. 70
George S. Tavlas

With the 14 members of the Southern African Development Community (SADC) having set the objective of adopting a common currency for the year 2018, an expanding empirical literature has emerged evaluating the benefits and costs of a common-currency area in Southern Africa. This paper reviews that literature, focusing on two categories of studies: (1) those that assume that a country's characteristics are invariant to the adoption of a common currency; and, (2) those that assume that a monetary union alters an economy's structure, resulting in trade creation and credibility gains.

The literature review suggests that a relative-small group of countries, typically including South Africa, satisfies the criteria necessary for monetary unification – they are subject to few asymmetric shocks between themselves and have a high shares of intra-SADC trade. However, the fact that the major exports among all countries of the SADC differ significantly leads to the conclusion that a single monetary policy may not be appropriate for all SADC countries. The literature also suggests that, in a monetary union comprised of all SADC countries and a regional central bank that sets monetary policy to reflect the average economic conditions (e.g., fiscal balances) in the region, the potential losses (i.e., higher inflation) from giving up an existing credible national central bank, a relevant consideration for South Africa, could outweigh any potential benefits of trade creation resulting from a common currency.

The above factors point to the desirability of a selective and gradual approach to monetary unification in Southern Africa, centred on the Common Monetary Area (CMA) as a core monetary union. As neighbouring countries demonstrate an ability to deliver disciplined and stable macroeconomic policy —particularly with respect to fiscal balances— they could become members of the monetary union. Such a selective and gradual approach could build on the credibility of the existing monetary arrangement (the CMA) in Southern Africa.

Monetary and fiscal policy interaction: what is the role of the transaction cost of the tax system in stabilisation policies?

Working Paper No. 71
Panagiotis Chronis and Aspassia Strantzalou

A general equilibrium model is built, in order to investigate monetary and fiscal policy interactions within a monetary union, with two heterogeneous countries and a common central

banker, who is conservative vis-à-vis inflation. The aim is to look for economic policy implications regarding the way the efficiency of fiscal policy affects the price stability pursued by the central bank of the monetary union.

The main contribution of this paper is the introduction of the operational or transaction cost of the tax system into economic (monetary and fiscal) policy analysis. In this way, fiscal policy is allowed to endogenously affect (via the transaction cost) the price stabilisation policies of the central bank of the monetary union, thus resulting in the non-neutrality of fiscal policy. This fiscal policy non-neutrality is consistent with the departure from the Ricardian equivalence proposition, which explicitly assumes that the tax instrument does not have any effect on economic activity, pointing to the view that inflation is only a monetary phenomenon.

The analysis does not explicitly assume any specific type of tax instrument (e.g. lump sum or proportional). Instead, a more general consideration of the tax system is adopted, by introducing the transaction or operational cost. This stems from the fact that the imposition of taxes generates frictions which relate the behaviour of tax payers, stipulated by socioeconomic and psychological characteristics, with tax administration aspects, like tax collection and tax compliance, resulting in a loss of tax revenue or a deadweight loss, with budgetary consequences. The functional form of the transaction cost is endogenously derived, within optimality.

Thus, a microfountation of macroeconomic theory, regarding monetary and fiscal policy interactions, is formed, where, starting from the operational properties of the tax system, the way the efficiency of fiscal policy is related to the political cycle, the path of debt and inflation level is examined. The assumption that countries are heterogeneous allows for the identification of possible spillovers in a monetary and fiscal policy interaction framework.

It is shown that in the presence of a considerable degree of heterogeneity, the transaction cost of the tax system is the factor determining the countries' policy choices and hence the resulting level of debt as well as the inflation path. On the other hand, when a considerable degree of homogeneity is the case, it is the countries' strategic behaviour that determines the outcome.

The paper formally develops a channel, through which the operational cost of the tax system, related to fiscal policy objectives, is not independent of price stability (the primary objective of the central bank). In this framework, it is also shown that numerical fiscal rules (such as those of the stability and growth pact) are not efficient at altering the behaviour of the agents as they do not change the economy's path.

An affine factor model of the Greek term structure

Working Paper No. 72
Hiona Balfoussia

The objective of this paper is to contribute to our understanding of the dynamics driving the Greek term structure of nominal interest rates and to explore their possible macroeconomic determinants. The framework employed is founded on the theoretical concept of a unique stochastic discount factor pricing all financial assets in the economy, as used in the context of the affine class of term structure models. These allow us to model the entire term structure, including the risk-free rate, and to extract and examine the underlying factors which drive its evolution over time. A canonical, Vasicek-type latent (unobservable)

affine factor model of the Greek nominal term structure is estimated, using a Kalman filter, on data spanning the period March 1999 to February 2007. This specification is parsimonious and theoretically consistent with the absence of arbitrage opportunities, while maintaining sufficient flexibility to provide a close fit to yield dynamics. Moreover, it allows a direct examination of the impact of the extracted factors on the shape of the yield curve over time and on the associated price and amount of risk in the term structure. Three latent factors appear to capture most of the time variation in the Greek nominal term structure of interest rates and to drive its intertemporal and cross-sectional dynamics over the sample period. Their respective "level", "slope" and "curvature" effects on the yield curve fall in line with related findings in the literature. While the model does not use macroeconomic information, conclusions can nonetheless be drawn on the interdependence between the bond market and macroeconomic fundamentals. Macroeconomic intuition in the latent factor context stems from an examination of the time-series properties of the extracted factors, as well as from their comparison to observed data on macroeconomic fundamentals they may possibly represent. When examined on the basis of business cycle theory and related to developments in macroeconomic fundamentals of the Greek economy, the evolution of the extracted factors over time seems largely intuitive.

Exploring the nexus between banking sector reform and performance: evidence from newly acceded EU countries

Working Paper No. 73
Sophocles N. Brissimis, Manthos D. Delis and Nikolaos I. Papanikolaou

Three interrelated determinants of bank performance stand out prominently in the related literature, namely the financial reform process, the degree of competition and the risk-taking behaviour of banks. At least two groups of studies involve these determinants: one mainly theoretical that examines the relationship between deregulation, bank risk taking and competition, and an empirical one that investigates the evolution of bank performance during periods of financial deregulation.

In the present paper we combine these two approaches by focusing on how bank performance is affected by reforms in the banking sector, and the associated changes in the industry structure and the risk-taking behaviour of banks. To carry out such an analysis, we develop a two-stage empirical model that draws on the recent econometric contributions of Simar and Wilson (2007) and Khan and Lewbel (2007). Bank performance, measured in terms of productive efficiency and total factor productivity (TFP) growth, is derived via nonparametric techniques in the first stage and then the scores obtained are linked to reform, competition and bank risk taking, using bootstrapping techniques that account for the possible endogeneity of risk. We opt for an application of this model to ten newly acceded EU countries, since the transition from centrally planned to market economies involved quite uniform institutional, structural and managerial changes in the banking sectors.

The results indicate that, on average, efficiency and TFP have been improving, while competitive conditions in the banking systems examined have changed only slightly. Also, banking sector reform has a positive effect on bank efficiency, which is partly channelled through the effects of competition and risk-taking of banks. Moreover, TFP gained ground toward the end of the reform process, capturing the longer-term effects of technological improvements. Finally, the effect of capital risk and credit risk on bank performance is usually negative, while increased liquid assets seem to reduce bank performance.

Government bankruptcy of Balkan nations and their consequences for money and inflation before 1914: a comparative analysis

Working Paper No. 74
Peter Bernholz

Government bankruptcies in the countries of the so-called periphery during the period of the gold standard were no rare event. They were also not limited to the Ottoman Empire and the Balkan countries. Prominent examples outside this region were Peru, Brazil, Argentina and Portugal.

In this paper a distinction is drawn between open and hidden, or veiled, government bankruptcies. The latter occur if budget deficits are covered by substantial money creation leading to inflation. In this case non-indexed government debt loses its value and is inflated away. This path is not open, if the debt is not denominated in the national but in a stable foreign currency or in units of gold or silver. This is usually the case for debt owed to foreigners. But sometimes both kinds of government bankruptcies occur together.

In the present paper several general qualitative hypotheses are tested for the Balkan countries and the Ottoman Empire: First, that the abolishment of fixed exchange rates is usually the consequence of budgetary deficits leading to inflation. Second, that in this case the national currency becomes undervalued. Third, that, by contrast, an overvaluation arises if only a mild inflation is caused in this way, so that the fixed exchange rate can be maintained. And fourth, that with an open bankruptcy relative to foreign owed debt a kind of crisis develops which finally leads to an international agreement reducing the amount of the debt, or of the interest rate paid on it. Another feature of this agreement may be the institution of more or less far-reaching foreign control of the fiscal and monetary policies of the debtor country.

Multiple potential payers and sovereign bond prices

Working Paper No. 75
Kim Oosterlinck and Loredana Ureche-Rangau

Sovereign bonds are usually priced under the assumption that only the sovereign issuer is responsible for their repayment. In some cases, however, bondholders may legitimately expect to be repaid by more than one agent. For example, when a country breaks up, successor states may agree to recognize their responsibility for part of the debt. Other extreme events, such as repudiations, may lead (and have led) bondholders to consider several bailout candidates at the same point in time. This paper first discusses the theoretical financial implications stemming from an infrequent and challenging situation, namely the existence of multiple potential payers. Then, through a historical precedent, the 1918 Russian repudiation, the

paper confirms that the existence of multiple potential payers has a diversification effect which lowers the volatility of the bond price and increases its value. These results are strengthened by a comparison with a closely related standard case of default.

Our results also show that the debate on the role of institutional interventions, especially operated by the IMF, during financial crisis caused by sovereigns stopping their debt service, is far from being closed. These interventions indeed may induce some moral hazard both in debtor and creditor attitude towards risk but they also may allow a certain diversification of risk sources that maintains bond prices

at a higher level than sovereign bonds with a single potential payer.

This comparison of repudiated and defaulted bonds opens a more general question regarding the way financial markets perceive different events. Looking at our results, one could then even wonder if, in the end, a political revolution is not considered by financial markets as being more likely to be reversed than an economic crisis. One can indeed imagine that revolutions, state disintegration or political regime changes can be very sudden, whereas rebuilding a country's economy generally requires a longer time.

The banking sector and the Great Depression in Bulgaria, 1924-1938: interlocking and financial sector profitability

Working Paper No. 76
Kiril Danailov Kossev

The economic narratives of Southeast Europe during the first part of the 20th century are currently being re-written. A story of failed industrialisation and delayed modernisation during the Interwar period has dominated since the pioneering work of Gerschenkron, but not enough aggregate data are available to see this as the only interpretation. In particular, virtually nothing is known about the financial system. This paper has two aims. First, it looks at the banking sector in Bulgaria between 1924 and 1938. We provide new data for the 1920s rise and the 1930s decline of the Bulgarian banking sector and we evaluate its potential contribution to Bulgarian economic growth. In the second part, we discuss different explanations for the widespread collapse of commercial banks after the onset of the Great Depression. Relying on a new data set for over 100 Bulgarian commercial banks, we show that traditional explanations for the collapse of European commercial banks in the 1930s (based on the default of risky loans and falling asset prices due to deflation) need to be complemented by the pernicious effects of widespread insider lending in the Bulgarian case. We conclude that insider lending was the single most important factor behind the demise of the private banking system after the onset of the Depression.

The regulation and supervision of the Belgian financial system (1830-2005)

Working Paper No. 77
Erik Buyst and Ivo Maes

This paper provides an overview of the regulation and supervision of the Belgian financial system from the creation of Belgium in 1830 to the early 21st century. After severe crises in 1838 and 1848, the National Bank of Belgium was established in 1850. The Great Depression and the bankruptcies of the 1930s led to major reforms, increasing the role of the government in the financial sector. A Decree of August 1934 required the so-called mixed banks to be split up into two separate institutions: a pure deposit bank and a holding company. Separating deposit-taking from the acquisition of shares restricted the leverage of the banking sector. A Decree of July 1935 established the Banking Commission. This institution had the power to require banks to maintain a liquidity ratio and a solvency ratio. In the post-war period, reforms in the institutional framework of banking supervision were not driven by crises, like in the interwar period, but by changes in the financial landscape, especially an increasing role for market forces. In line with the despecialisation process, the responsibilities of the Banking Commission were gradually extended. In 1990, it was transformed into the Banking and Finance Commis-

sion and in 2004 it was merged with the Insurance Supervision Office, creating the Banking, Finance and Insurance Commission. Moreover, at the turn of the millennium, the role of the National Bank of Belgium in financial stability matters was enhanced.

Banking transformation (1989-2006) in Central and Eastern Europe – with special reference to Balkans

Working Paper No. 78
Stephan Barisitz

The paper provides an overview of the history of banking transition (1989-2006) in 13 Central and Eastern European countries (Belarus, Bulgaria, Croatia, the Czech Republic, Hungary, Kazakhstan, Poland, Romania, the Russian Federation, Serbia and Montenegro, Slovakia, Ukraine and Uzbekistan) - with particular emphasis on the four Balkan countries included in this list.

In most countries, the 1990s were a decade of major banking upheavals, turmoil and reform. The turn of the millennium either featured sector consolidation or represented the culminating point of restructuring efforts. The first years of the new millennium have generally featured calmer, stronger and more open banking sectors than the 1990s. Two "banking reform waves" are distinguished, salient features of which all countries (need to) run through in order to mature. The first reform wave immediately follows the collapse of communism, and includes liberalization measures, up-front rehabilitation and initial efforts at privatization

(often "surface privatization"). The macroeconomic situation temporarily stabilizes. But underlying distorted incentives favour the renewed accumulation of bad loans and set the stage for new banking crises. Only the second reform wave ushers in hard budget constraints, in-depth privatization and "real" owners (which are mostly —but not exclusively— foreign direct investors). Banking regulation and supervision are tightened substantially.

Western European FDI has come to dominate banking in all former socialist countries that have either already become members of the EU or are candidates or are involved in association agreements or the association process with the prospect of eventual Union membership – this latter category includes the entire Balkan region. Recently, dynamic catching-up processes have gathered momentum in many countries. Against the background of sustained economic recovery and expansion, credit booms have unfolded, which are not without risks.

Banking performance in Southeastern Europe during the interwar period

Working Paper No. 79
Žarko Lazarević

In the framework of the broader political and economic development of the individual states on the Balkan Peninsula, this paper makes a comparison between the performance of the banking sector in the newly established Yugoslavia, Romania, Greece and Bulgaria. The analysis is carried out on the sample of bal-

ance sheets for the most important joint stock banking companies in the respective countries. The analysis of the business performance was carried out from 1928 and 1929. Those were important years, since they represent the peak of the activity and performance of banks in region. In the following years, the whole region

sank into the abyss of the Great Depression of the thirties when the issue of banking performance was considered differently, mostly in terms of the extent to which private banking systems could survive and the degree to which state intervention was necessary. The banks analysed primarily had one thing in common and that is the fact that they both shared the same geographical area, that is Southeastern Europe. Common patterns do exist in some segments of a certain shared feature. One of those features is certainly the prevailing role of short-term resources and a huge imbalance in interest incomes and incomes from other bank transactions. This fact testifies not only to high margins and effective interest rates, but also to a limited portfolio in bank services and other transactions, which was the consequence of the social and economic environment in which banks had to operate.

How similar to South-Eastern Europe were the islands of Cyprus and Malta in terms of agricultural output and credit? Evidence during the interwar period

Working Paper No. 80
Alexander Apostolides

Cyprus and Malta have always been considered in economic history as similar to other South-Eastern European states in performance and structure, despite the lack of substantial evidence to prove it. This paper uses new evidence on the gross domestic product of the islands during the interwar period in order to evaluate the extent to which the economic structure of the islands differed from each other, as well as from other South-Eastern European states.

For the sectors calculated (rental income from housing, construction, mining, agriculture, forestry and fishing), the interwar period (1921-1938) was one of positive growth for both islands, contrary to the existing literature; too much emphasis is placed on the depressed state of the islands' economies in the 1930s and the real growth improvements during the 1920s are ignored. However, since income prior to 1921 is unknown, the improvement in growth witnessed in the 1920s might simply be due to a recovery from the recession of 1920-1921.

Recovery after the Great Depression was slow and uneven, possibly due to the lack of independent economic policies; it is in the late 1930s that the performance of the islands truly diverge from that of the Southern European states. This could be due to a limited ability to exercise independent economic policies, since both Cyprus and Malta were British colonies at the time; thus their ability to influence their economic fortunes during the period was constrained.

It is interesting to also note how the islands exhibit slightly different periods of growth and decline from South-Eastern European countries such as Greece and Bulgaria. Malta has a shallow recession but is again in recession in 1936. Cyprus is affected by a severe drought in 1930 -1932 that leads to output falling below the 1921 level; however, recovery was particularly strong at the end of the 1930s. Although both islands show signs of slow structural change, their economies are not transformed until after the Second World War.

In terms of economic structure, the islands also seem to differ from the stylised Southern European typology. Malta is an exception due to the very high urbanisation of its economy. Its economic fortunes were explicitly linked to the British navy's presence on the island and thus its income was also influenced by global political events. It is no surprise that Cyprus, being geographically closer to continental Southern European States, shows an eco-

nomic structure which is similar to that of Greece and Turkey. However, despite some similarities, there are again significant differences: the Cypriot economy was not as reliant on one staple product for its foreign exchange and remained more open to world trade throughout the interwar period—as colonies with limited ability to exercise independent economic policy, the islands did not initiate extensive protectionist measures. Overall, despite their differences, some tentative suggestions on the advantages and disadvantages of being independent during the 1930s can be evaluated.

Stabilisation policies in Bulgaria and Yugoslavia during communism's terminal years: 1980s economic visions in retrospect

Working Paper No. 81
Roumen Avramov and Dragana Gnjatović

In the course of the 1980s, Bulgaria and Yugoslavia faced severe economic crises generated in different political contexts but sharing common features and outcomes. For both countries, those disorders were not simply events related to habitual macroeconomic imbalances. They bore the seals of a fin de regime and of the ultimate exhaustion of long-standing societal and economic models. Indeed, Bulgaria and Yugoslavia represented archetypes of the post-war communist extremes. The former was the most orthodox Soviet ally, copying in detail the features of its planning infrastructure. The latter, in turn, symbolized for decades the "revisionist" approach to economic policy and successfully played in the no man's land between the Communist block and Western democracies. In this paper, we adopt a comparative view of the stabilization policies designed and implemented in Bulgaria and Yugoslavia during the fatal economic crises of their regimes in the late 1980s. The role of the IMF can be better highlighted by comparing "with (Yugoslavia) – without (Bulgaria)" scenarios in a communist context. The authorities' views are discussed and newly accessible archival evidence is presented in the case of Bulgaria. The ruling elites' vision is confronted by that of critical professionals, thus permitting a retrospective assessment of the conceptual readiness of the society for the forthcoming transition to a market economy in the early 1990s.

The evolution of Bulgarian banks' efficiency during the twenties: A DEA approach

Working Paper No. 82
Nikolay Nenovsky, Martin Ivanov and Gergana Mihaylova

This paper studies the dynamics of bank efficiency in Bulgaria in 1924 and 1929. In so doing, several similarities in response are detected, related mainly to the reaction of different type of banks to the financial crisis and financial stabilization. Official bank balance sheets and the profit and loss statements of nearly 70 Bulgarian credit institutions are used. After their classification into subgroups, different variations of dynamic envel- opment analysis (DEA), and more particularly the intermediation approach, are applied to the banks' financial positions. The DEA allows us to overcome several deficiencies associated with traditional accounting measures of bank efficiency – an advantage that has made DEA very popular in the recent literature. To our knowledge, this method has not been applied so far to historical data.

Banking in Turkey: history and evolution

Working Paper No. 83
Yüksel Görmez

When the Republic of Turkey declared independence in 1923, there were no foreign exchange reserves, no central bank and little human capital to allow economic recovery and the creation of a strong financial system. The adoption of a rational approach to finance by the young Republic prevented a banking or financial crisis as the lack of capital was managed successfully. With increased emphasis on liberalisation policies during the 1950s, public banks extended their leading role in the financial system.

In the 1960s, a semi-socialist system of planning was successfully applied to the Turkish economy and banking was shaped by "five-year plans". Unfortunately, the oil crises of the 1970s took away all hope for the emergence of strong private banks. After the balance of payment crises at the end of the 1970s, liberalisation allowed the free setting of deposit and credit rates in support of market discipline. The second half of the 1980s was marked by private banks beginning to acquire a market share.

The 1990s may be described as the "lost years" of banking, not only because of the 1994 banking crisis, but also because of a lack of commitment to social welfare and economic re-structuring, as the losses of public banks rose to unbearable amounts and fiscal deficits led to significant crowding out so that the banking system fell again into another crisis in 2001. Since then, the Turkish banking system has been recovering from the crises and performing re-structuring. The adoption of European standards is almost complete with the exception of the privatisation of public banks.

Banking and finance in South-Eastern Europe: the Albanian case

Working Paper No. 84
Kliti Ceca, Kelmend Rexha and Elsida Orhan

This paper aims to present the main developments of banking and finance in Albania in a historical perspective. After the fall of the communist regime in 1989, the Albanian banking sector was still underdeveloped and centrally planned. The reform process consisted in the establishment of a two-tier banking system, the privatization of the state-owned banks, the introduction of a new regulatory regime and the entry of foreign banks. The pyramid schemes phenomenon in 1997 and the deposit crises in 2002 were the main difficulties the country had to face. During recent years, the level of financial intermediation has increased significantly due to a rise in customers' confidence in banks, adequate legal protection of lenders and the introduction of modern credit risk management techniques. This historical overview might help to better understand not only the great difficulties and obstacles the country faced in the past, but also the successes it achieved. It is widely known that the financial system, especially the banking sector, is considered as very important as it serves as a catalyst for the economic development of the country. And this is because financial depth determines economic growth. The paper also highlights the future challenges that the Albanian financial system will face within the context of the country's European integration and the EU harmonization of the financial policies.

Growing up to financial stability

Working Paper No. 85
Michael D. Bordo

Financial crises are an old problem going back to the origins of capitalism. However, the topic is an important one today for emerging market economies in the current era of globalization. It was similarly important in the earlier era of globalization from 1870 to 1914. However, the incidence and virulence of crises was much less in the earlier era for the emerging countries than is the case today. Advanced countries in recent years have experienced few crises, but they experienced many more in the course of their economic development, when they were emerging market economies. During the interwar period and again in the 1970s, 1980s and the early 1990s, advanced countries experienced both currency and banking crises. This paper briefly revisits

the evidence on the incidence and severity of different varieties of crises within the context of globalization pre-1914 and from 1980 to the present, drawing on my earlier work with Barry Eichengreen and Chris Meissner. I discuss the determinants of emerging market crises from the perspective of the recent balance sheet approach to financial crises which builds on the earlier literatures of banking crises, debt crises, and first and second generation currency crises. This approach puts the importance of financial development on centre stage. I then consider the 'deep' institutional determinants of financial development and their relationship with financial stability. In conclusion, some lessons from history are presented.

Banking and central banking in pre-WWII Greece: money and currency developments

Working Paper No. 86
Sophia Lazaretou

In the gold standard era, central banks acted as the guardians of the gold standard, currency managers and providers of war finance. Laissez-faire rules secured monetary and financial stability. In the interwar years, however, the new orthodoxy of monetary policy implementation turned its attention to the founding of 'real' central banks in each country, in order to use monetary policy tools effectively to protect economies from the serious monetary and financial disorders that followed the aftermath of the war. This paper aims to trace the history of banking and central banking in pre-WWII Greece.

First, we study the country's financial structure and the process of financial development. Several indices of financial development are assessed and their evolution studied. Financial depth increased at the turn of the 19th century

and expanded further till the early 1920s. However, on the basis of the behavioural indices examined, banks are shown to have been poorly managed on both the asset and the liability sides of the balance sheet. They also suffered from capital inadequacy and were highly leveraged. Second, an analysis of the composition of the money supply and its long-run behaviour suggests that monetary base variations were the proximate determinants of money supply movements, whereas the money multiplier had only a limited impact. Third, central banking in pre-WWII Greece is viewed with regard to the monetary policy strategy, the monetary policy implementation framework and state interventions. The balance sheet of the Bank of Greece reveals an excessive focus on the chosen monetary policy strategy of a currency peg. Domestic credit was controlled via liquidity-providing standing facilities,

either discounts or advances. Moreover, the Bank's considerable involvement in government re-financing is likely indicative of considerable state intervention.

Monetary policy objectives and instruments used by the privileged National Bank of the Kingdom of Serbia (1884-1914)

Working Paper No. 87
Milan Sojic and Ljiljana Djurdjević

In the first thirty years of its operations, the three key functions of the Privileged National Bank of the Kingdom of Serbia (1884-1914) were those of a creditor of the economy, issuer of currency and banker to the central government. At the time of its founding, the National Bank of Serbia was one of 16 central banks operating and its activities were more or less the same as the activities of other central banks.

Pursuant to the 1883 Law on the National Bank, its objective was "to promote trade and economic activity by providing access to cheap capital and viable credit arrangements". This was stipulated in all pieces of legislation on the National Bank until the enactment of the 1920 Law. Until the end of World War I, the National Bank's primary activity was the extension of credit. The discount rate of the National Bank was always lower than market interest rates, indicating that the Bank did not use rates to ease the pressure on gold reserves, but rather to encourage commercial banking and create conditions for the economic development of the country.

In its function as an issuing institution, the National Bank was responsible for stability of the national currency – the issuing of banknotes and maintenance of convertibility of the dinar into gold and silver at fixed parity. The first gold-backed 100-dinar banknotes were issued immediately after the establishment of the National Bank in 1884. However, as they could not be retained in circulation, silver-backed 10-dinar banknotes were issued in 1885, marking the introduction of bimetallism. This remained the basis of Serbia's monetary system all the way through to the end of World War I.

The National Bank's efforts to sustain the value of domestic currency often clashed with its function as banker to central government. Due to the need to finance budget deficits, the government resorted to substantial borrowing from the National Bank. In 1898 government debt with the National Bank was nearly three times higher than the debt of all credit bureaus taken together. In 1903, the relationship between the National Bank and the government was set on new foundations. Strict supervision of budget revenue and expenditures was implemented by the government and its borrowing from the National Bank, from 1903 until the outbreak of World War I, was temporary and short-term in character. As a result, the National Bank of Serbia was able to implement both credit policy measures and those aimed at stabilizing the dinar with more success.

The National Bank of Romania and its issue of banknotes: between necessity and possibility, 1880-1914

Working Paper No. 88
George Virgil Stoenescu, Elisabeta Blejan, Brînduşa Costache and Adriana Iarovici Aloman

From a historical perspective, the issue of banknotes is the overriding task of a central bank. Starting from this prerequisite, we look at the National Bank of Romania's activity from 1880

through 1914 and consider the role of note issue in modernising Romanian society and making it a part of the economic system prevailing in Europe.

The paper analyses the level of cover respecting the National Bank of Romania's notes and the avenues used by the central bank to put its banknotes into circulation. Developments in discounting commercial paper, loans backed by government paper and the trade in drafts and remittances provide the most relevant evidence on the National Bank of Romania's support for the promotion of commercial, industrial and agricultural activities via the establishment of a nationwide credit system and to the Romanian government's endeavour to put in place a modern institutional infrastructure. The National Bank of Romania's responses to the episodes of crisis in 1884, 1899-1900 and 1907 were of paramount importance.

The National Bank of Romania was successful in managing the seigniorage right and thus provided the Romanian economy and the society as a whole with some of the financial means for modernisation. At the same time, maintaining a stable, trustworthy domestic currency ensured that Romania's economy developed in line with those of the other European economies.

Institutions matter: financial supervision architecture, central bank and path dependence. General trends and the South-Eastern European countries

Working Paper No. 89
Donato Masciandaro and Marc Quintyn

The current worldwide wave of reforms in supervisory architectures leaves the interested bystander with a great number of questions regarding the true determinants of, and motivations behind, these changes. These questions are all the more justified because the emerging institutional structures are certainly not homogeneous across countries.

An answer to these questions requires a political economy approach. Indeed, financial supervisory reform is a political process which involves many stakeholders: the political class, the central bank, the supervised entities, as well as the customers of the financial services. So the all-encompassing question is: which considerations and views prevail in the end in the decision-making process, and to what extent are the decision-makers taking into account the views of these different classes of stakeholders when deciding on a reform of the supervisory structures.

We propose a path dependent approach to analyze the evolution of the financial supervisory architecture, focusing on the institutional role of the central bank, and then apply our framework to describe the institutional settings in a selected sample of countries. The policymaker who decides to maintain or reform the supervisory architecture is influenced by the existing institutional setting in a systematic way: the more the central bank is actually involved in supervision, the less likely it is that a more concentrated supervisory regime will emerge, and vice versa (path dependence effect).

We test the path dependence effect describing and evaluating the evolution and the present state of the architecture of six national supervisory regimes in South-Eastern Europe (SEE): Albania, Bulgaria, Greece, Romania, Serbia, and Turkey. The study of the SEE countries confirms the postulated role of the central bank in the institutional setting. In five cases the high involvement of the central bank in supervision is correlated with a multi-authorities regime, while in one case a high degree of financial supervision unification is related to low central bank involvement.

MONETARY POLICY AND FINANCIAL SUPERVISION MEASURES (JANUARY – NOVEMBER 2008)

MONETARY POLICY MEASURES OF THE EUROSYSTEM[1]

10 JANUARY, 7 FEBRUARY, 6 MARCH, 10 APRIL, 8 MAY AND 5 JUNE 2008

The Governing Council of the ECB decides that the minimum bid rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility will remain unchanged at 4.00%, 5.00% and 3.00% respectively.

3 JULY 2008

The Governing Council of the ECB decides to increase the minimum bid rate on the main refinancing operations by 25 basis points to 4.25%, starting from the operation to be settled on 9 July 2008. In addition, it decides to increase by 25 basis points the interest rates on both the marginal lending facility and the deposit facility, to 5.25% and 3.25% respectively, with effect from 9 July 2008.

7 AUGUST, 4 SEPTEMBER AND 2 OCTOBER 2008

The Governing Council of the ECB decides that the minimum bid rate on the main refinancing operations and the interest rates on the marginal lending facility and the deposit facility will remain unchanged at 4.25%, 5.25% and 3.25% respectively.

8 OCTOBER 2008

The Governing Council of the ECB decides to decrease the minimum bid rate on the main refinancing operations by 50 basis points to 3.75%, starting from the operations to be settled on 15 October 2008. In addition, it decides to decrease by 50 basis points the interest rates on both the marginal lending facility and the deposit facility, to 4.75% and 2.75% respectively, with immediate effect.

Moreover, the Governing Council decides that, as from the operation settled on 15 October, the weekly main refinancing operations will be carried out through a fixed-rate tender procedure with full allotment at the interest rate on the main refinancing operation (i.e. currently to 3.75%). Furthermore, as of 9 October, the ECB will reduce the corridor of standing facilities from 200 basis points to 100 basis points around the interest rate on the main refinancing operation. Therefore, as of 9 October, the rate of the marginal lending facility will be reduced from 100 to 50 basis points above the interest rate on the main refinancing operation, i.e. currently to 4.25%, and the rate of the deposit facility will be increased from 100 to 50 basis points below the interest rate on the main refinancing operation, i.e. currently to 3.25%. The two measures will remain in place for as long as needed, and at least until the end of the first maintenance period of 2009, on 20 January.

6 NOVEMBER 2008

The Governing Council of the ECB decides to decrease the interest rate on the main refinancing operations of the Eurosystem by 50 basis points to 3.25%, starting from the operations to be settled on 12 November 2008. In addition, it decides to decrease by 50 basis points the interest rates on both the marginal lending facility and the deposit facility, to 3.75% and 2.75% respectively, with effect from 12 November 2008.

JANUARY-NOVEMBER 2008

With a view to supporting the normalisation of the euro money market, the Governing Council of the ECB decides to conduct supplementary open market operations, further to the regular main and longer-term refinancing operations.

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1 For more details, see www.ecb.europa.eu/press/govcdec/mopo/html/index.en.html

REGULATORY AND SUPERVISORY DECISIONS OF THE BANK OF GREECE

2 JANUARY 2008
The Greek branch of the Germany-based "Deutsche Bank AG" commences operations.

22 JANUARY 2008
– Authorisation is given for the merger by absorption of Proton Financial Consultants, Technology and IT SA by Proton Bank SA.

– The Cyprus-based Costanus Limited is authorised to acquire a qualifying holding in Aegean Baltic Bank SA.

4 FEBRUARY 2008
– Increase in the upper limits of the financial penalties that may be imposed by the Bank of Greece on supervised entities and setting deadlines for the payment of fines imposed by the Bank of Greece.

– Codification and amendment of the provisions of existing Bank of Greece decisions on the criteria and the procedure for the assessment of credit institutions' applications for authorisation to establish new branches in Greece or abroad.

21 FEBRUARY 2008
Codification of the provisions on credit institutions' reporting obligations (supervisory data and other information) to the Bank of Greece and definition of the persons that are considered as related parties and are thereby subject to a specific supervisory regime.

22 FEBRUARY 2008
Amendment of Annex 4 "Prevention of money laundering and terrorist financing" to Bank of Greece Governor's Act 2577/9 March 2006, re: framework of operational principles and criteria for the evaluation of the organisation and Internal Control Systems of credit and financial institutions, and relevant powers of their management bodies.

22 APRIL 2008
Setting of the framework governing the transactions of credit institutions with the persons that are considered related parties within the meaning of Bank of Greece Governor's Act 2606/21.2.2008.

2 MAY 2008
– Clarification of the provisions of Bank of Greece Governor's Act 2501/31.10.2002 on credit institutions' requirement to provide information to customers with respect to the terms and conditions that govern their transactions.

– Extension of the deadline for the implementation of International Accounting Standards by credit cooperatives.

– Alpha Bank SA is authorised to establish 25 new branches in Albania.

12 MAY 2008
– The period granted to T.C. Ziraat Bankası A.Ş. to commence operations is extended until 31.12.2008.

– The authorisation for the conversion of Geniki Cards and Financial Services SA to a credit company under the name SFS Hellasfinance SA is revoked.

15 MAY 2008
A new Act of the Monetary Policy Council is adopted, amending an earlier Act on the instruments and procedures for the implementation of monetary policy by the Bank of Greece.

19 MAY 2008
– Agricultural Bank of Greece SA is authorised to participate in the increase of the share capital of FBB – First Business Bank SA.

– National Bank of Greece SA is authorised to acquire a qualifying holding in Hellenic Postbank SA.

– EFG Eurobank Ergasias SA is authorised to acquire a qualifying holding in Hellenic Postbank SA.

26 JUNE 2008

– ICAP Group is recognised as an eligible External Credit Assessment Institution (ECAI) whose credit assessments of Greek non-financial corporations can be used by credit institutions for the purpose of calculating the capital requirements under the standardised approach.

– Emporiki Bank of Greece SA is authorised to increase its qualifying holding in the Romania-based Emporiki Bank Romania SA.

– EFG Eurobank Ergasias SA is authorised to increase its qualifying holding in its Amsterdam-based subsidiary EFG New Europe Holding SA.

– Approval is given to the renaming of the representative office of Banca del Gottardo SA to BSI SA.

– The authorisation to the Manila-based Equitable PCI Bank to operate a representative office in Greece is revoked.

21 JULY 2008

– Further clarifications are given on the application of the provisions regarding the requirement on credit institutions to provide information to customers under the terms and conditions that apply to their transactions.

– The Greek branch of Cetelem bank is renamed to BNP Paribas Personal Finance.

26 AUGUST 2008

National Bank of Greece SA is authorised to establish five new branches in Albania.

15 SEPTEMBER 2008

– Approval is given to the renaming of the American Bank of Albania – Greek Branch to Intesa Sanpaolo Bank of Albania – Greek Branch.

– Approval is given to the renaming of the representative office of IBI Bank to J&T Bank Switzerland Ltd.

DECISIONS OF THE BANK OF GREECE

BANK OF GREECE GOVERNOR'S ACT 2602/4 FEBRUARY 2008

Raising the upper limits of the financial penalties that may be imposed by the Bank of Greece on supervised entities and setting deadlines for the payment of fines imposed by the Bank of Greece

Bank of Greece Governor's Act 2602/4 February 2008 raises the upper limits of the administrative sanctions that it can impose on banks and other supervised entities, under its Statute which has the force of law.

In more detail, the new Act increases the upper limits as follows:
- from €8,804,108 to €20,000,000 for the penalty in the form of a non-interest bearing deposit with the Bank of Greece imposed in cases where the amount of the violation cannot be determined (a penalty which essentially translates into lost interest income, depending mainly on the opportunity cost of alternative holdings);
- from €880,441 to €2,000,000, the lump sum fine in favour of the Greek State; and
- from €1,467,351 to €3,000,000, for the penalty that can be imposed in the event of repeated violation.

These penalties may be combined with other administrative sanctions and corrective measures, as laid down by law.

The adjustment of the above mentioned limits is aimed to ensure harmonisation with those applying to the other penalties that the Bank of Greece can impose according to the legislation in force, for violations connected to the provision of investment services (Law 3606/2007), and to update the amounts taking into consideration the growth of banking aggregates and transactions in the period since the limits were first specified.

BANK OF GREECE GOVERNOR'S ACT 2603/4 FEBRUARY 2008

Criteria and procedure for the assessment by the Bank of Greece of credit institutions' applica-

tions for authorisation to establish new branches in Greece or abroad

BANK OF GREECE GOVERNOR'S ACT 2604/4 FEBRUARY 2008

Acquisition by credit institutions of a qualifying holding in financial corporations

These two Acts (2603 and 2604) codify and amend the provisions of existing relevant decisions of the Bank of Greece (Decision of the Monetary and Credit Matters Committee No. 505/8/23 July 1992 and Decision of the Banking and Credit Committee No. 80/15/29 August 2000, as currently in force) requiring credit institutions to seek prior authorisation from the Bank of Greece for: (i) any extension of a bank's branch network and (ii) any acquisition of a "qualifying holding" (10% and more of the capital) in a financial corporation.

These new Acts simplify the application of assessment procedures by introducing an automated authorisation process based on minimum criteria, with the aim of ensuring the required supervisory monitoring while reducing administrative costs. These criteria mainly relate to:
- the level of the capital adequacy ratio (CAR), assessed on the basis of quantitative and qualitative criteria referring to all the risk exposures of the credit institution (Bank of Greece Governor's Act 2595/20.8.2007, Pillar II); and
- in the case of an intended expansion of network, the level of non-performing loans (NPL) assessed against the targeted NPL ratio set by the Bank of Greece for each bank.

BANK OF GREECE GOVERNOR'S ACT 2606/21 FEBRUARY 2008

Codification of the provisions on credit institutions' supervisory reporting obligations to the Bank of Greece – Definition of the persons that are considered as related parties

Bank of Greece Governor's Act 2606/21 February 2008 determines and consolidates into a

single legal act credit institutions' supervisory reporting obligations to the Bank of Greece. This facilitates credit institutions in fulfilling their obligations under the current regulatory supervision framework and at the same time enhances the efficiency of supervision by the Bank of Greece.

In more detail, by this Act, which replaces Bank of Greece Governor's Act 2563/19 July 2005:

a. credit institutions' reporting for the purpose of computation of capital requirements, own funds and capital adequacy is adjusted to the requirements of the new banking law (Law 3601/1 August 2007) and the relevant decisions of the Bank of Greece. Supervisory reporting shall be submitted using the Common Reporting (COREP) templates prepared by the Committee of European Banking Supervisors (CEBS);

b. the obligation for financial reporting in line with the said COREP templates is established;

c. additional specific reporting is required in respect of:

(i) certain investment products and new banking instruments;

(ii) persons considered, for supervisory purposes, as related parties, as defined by the Bank of Greece under authorisation of Law 3601/1 August 2007.

This Act is the final step, also at the technical level, towards the implementation of Basel II framework and at the same time brings the supervisory reporting regime up to date.

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