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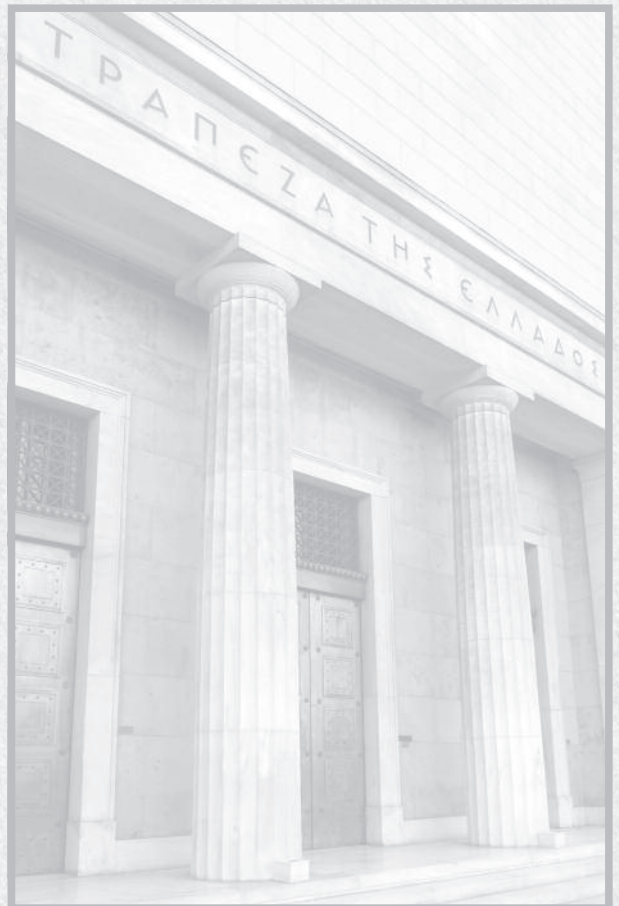2010

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CONTENTS

INDEPENDENT FISCAL COUNCILS AND THEIR POSSIBLE ROLE IN GREECE[1]

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1 INTRODUCTION

The emergence and persistence of fiscal deficits over long periods of time, leading to increased public debt, seems to be a common feature in most OECD countries, at least in the last 30 years. In these countries, public debt as a percentage of GDP rose from an average of around 40% in 1975 to almost 70% in 2006 (see OECD, 2007). Fiscal deficits, once typically small and controlled in most OECD countries, have risen dramatically in the last two years, due to the global financial crisis. Had the emerging deficits and increased debts been the results of some counter-cyclical policy pursued in order to deal with adverse developments in the domestic and/or the world economy, the problem might not have been that great. But the systematic emergence of deficits and the ensuing higher debt in many developed countries, and indeed over long periods of time, suggest the existence of other endogenous factors that play a significant role in this development.

According to both theoretical and empirical studies, lack of fiscal discipline and weak fiscal management are such systemic factors. For instance, it has been established that in periods of fast growth, governments, rather than taking advantage of the economic upturn to improve their country's fiscal position by creating surpluses and reducing its debt, tend to adopt an expansionary fiscal policy, by increasing public expenditure, or cutting taxes, or both. Thus, when the economic climate reverses, the counter-cyclical policy pursued entails the creation of high deficits and a considerable increase of public debt. Typical examples can be found in many countries of the euro area, particularly from 2004 onwards. A period of economic euphoria was not accompanied by adequate fiscal adjustment, so the outbreak of the global economic crisis has led many of these countries into a fiscal crisis (see Van Riet, 2010). In the worst case, the ability to conduct a counter-cyclical policy becomes considerably limited, as the recent experience of Greece clearly shows. A key question that arises is why governments exhibit such a tendency to create fiscal deficits (deficit bias), and what mechanisms could deter this behaviour.

The main mechanism for ensuring fiscal discipline, implemented at times in most OECD countries, is the imposition of various forms of *fiscal rules*, such as numerical limits to the level of public expenditure, or to the level of deficit as a percentage of GDP. For instance, the Stability and Growth Pact, which constitutes the regulatory framework for fiscal policy in the countries of the EU and, more specifically, of the euro area, sets as a medium-term objective the achievement of a balanced budget, and, at the same time, sets a limit of 3% of GDP on the annual general government deficit.[2] Lately, however, attention has also been paid to the importance of another institution, namely that of *independent fiscal authorities or councils*.

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1 The views expressed in this study do not necessarily reflect those of the Bank of Greece. The authors would like to thank Heather Gibson and Vassilis Manessiotis for their constructive comments.

2 The strictness and inflexibility of the Pact's rules led to a revision of certain provisions in 2005, so that now each member country has a different medium-term objective; however, the Pact's overall rationale regarding the imposition of quantitative rules on key fiscal aggregates remains unchanged.

The theoretical investigation of such institutions was originally sparked by the successful assignment of the right to conduct monetary policy to independent central banks (see Eichengreen et al., 1999, Calmfors, 2003, Wyplosz, 2005). In practice, independent fiscal councils have gradually been established in a growing number of countries where, although not involved in the conduct of fiscal policy (according to the standards applicable to central banks), they play an important role in enhancing the reliability and transparency of the respective countries' fiscal policy.

The specific activities and responsibilities of each of these councils differ considerably across countries (see European Commission, 2009); yet, as a general rule, the operation of almost all of them involves monitoring and assessing the fiscal policy followed, publicly making recommendations regarding the country's economic policy, assessing macroeconomic projections and examining the reliability of the forecasts for expenditure and revenue contained in the budget, and therefore the deficit. Another element systematically assessed by such councils is the long-term sustainability of fiscal aggregates, and especially of public debt.

This study attempts to analyse the reasons why the establishment of such an independent authority may prove extremely useful, particularly in countries with considerable fiscal problems and a history of inadequate institutions promoting fiscal discipline. Specifically, the next section examines in brief why governments on their own may not adopt a prudent fiscal policy, and why certain mechanisms already in place for the promotion of fiscal discipline may not be adequate. The third section attempts to concisely present the various forms of independent fiscal authorities suggested in the theoretical literature, and also examines the main features of fiscal councils already active in various OECD countries. Section 4 refers in particular to the role that such a council could play in Greece, as well as to the prerequisites for its successful operation. Finally,

the last section attempts to draw some basic conclusions.

2 WHY DO PARLIAMENTARY SYSTEMS LEAD TO EXCESSIVE DEFICITS?

In public economics, a major issue that has attracted a lot of attention, particularly in recent years, has been to explain why there is a deficit bias in parliamentary democracies. The cumulative result of successive deficits is the gradual accumulation of a high public debt, with major negative implications for a country's growth and social policies. Numerous reasons have been suggested in the theoretical literature to account for this phenomenon, and their detailed presentation would perhaps necessitate dozens of pages.[3] Hence, any reference made to these reasons in the present study is more indicative rather than exhaustive.[4]

The first and most convincing explanation offered is the "common pool" problem, a notion originally introduced by Hardin (1968) with respect to the overexploitation of freely accessible natural resources, and later extended in the field of fiscal policy by numerous other authors, including Shepsle and Weingast (1981), von Hagen and Harden (1995), and Krogstrup and Wyplosz (2006). Put simply, the core idea of this approach is that when many individuals potentially have access to a scarce resource, while at the same time bearing only a small part of the respective costs incurred, there is an observed tendency towards overconsumption of this resource. A similar phenomenon can often be observed with respect to a country's public budget as well. Under the pressure exerted by usually small but powerful interest groups, public expenditure is increased to the benefit of these

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[3] The issue has attracted a lot of attention within the strand of Economics called Public Choice. For a brief yet thorough presentation of the main postulates of Public Choice, see Mueller (2003).

[4] For a more detailed analysis of the reasons creating this deficit bias, see, among others, Krogstrup and Wyplosz (2010), Wren-Lewis (2010), Reinhart and Rogoff (2010) and Rogoff and Bertelsmann (2010).

groups, which however contribute only a small share to the tax revenue required for financing such expenditure. The government and the parliament should normally understand that such a policy generates problems, but in practice, and to the extent they are influenced by these groups, they give in and raise expenditure and/or reduce taxes, leading to the creation of excessive fiscal deficits.

Another distortion that may lead to a lack of fiscal discipline stems from the fact that the time horizon within which a government operates is much shorter than that of the electorate. Elected representatives are mainly interested in their re-election and thus in the consequences the policies they adopt may have only during their term in power. Based on such an approach, their consideration for the impact of their policies in the more distant future is lessened, because what matters for them most is their re-election at the next elections. If they feel that they can secure political gains by cutting taxes or increasing public expenditure in the present, and, at the same time, that they will not have to bear the costs eventually incurred in the future due to the ensuing expansion of the deficit, the result will always be the creation of deficits, probably higher than what the citizens would have approved (see Tabellini and Alesina, 1990, Rogoff, 1990). Using a much more complex model that involves two political parties with dissimilar preferences as regards public goods and the total size of the public sector, Persson and Svensson (1989) arrive at the conclusion that both parties adopt a myopic behaviour, resulting in higher deficits, exactly because they assume that they are not going to stay in power forever.

According to other theoretical approaches, elected representatives seek to maximise the state budget, while voters lack the necessary knowledge and information that would enable them to effectively assess public policies. Lack of transparency in the pursuit of fiscal policy hinders the exercise of democratic control, and this leaves room for excessive increases in deficits and debt. Lack of transparency has several dimensions: insufficient information regarding the various state budget aggregates, an absence of clear rules and accountability with respect to the preparation of the state budget and its implementation and ambiguity of the macroeconomic projections, on which fiscal policy decision-making relies. These different dimensions of a lack of transparency are interrelated. For instance, according to von Hagen (2009), the biased fiscal and macroeconomic forecasts in EU countries seem to be directly associated with the process of preparing and implementing the state budget. Single-party governments that enjoy a strong majority and full power in preparing and implementing the budget tend to be optimistically biased when making such forecasts.

Particularly in the case of monetary unions, assigning the right of monetary policy conduct to a supranational body reduces governments' incentive to exercise fiscal discipline. When a country is responsible for its own monetary policy, the unpleasant likelihood of increased public debt ultimately leading to higher interest rates and inflation in the future can prompt governments to exercise a certain level of self-discipline. But within a monetary union, this discipline is indirect, while at the same time expectations are fostered that, in case serious fiscal problems appear for a country, support from other countries of the union would be very likely (see Beetsma and Bovenberg, 1999).

In the case of Greece, its high fiscal deficits can be explained in several ways. The most important among them is the governments' inability to control public expenditure and collect tax revenue. But the fundamental cause has to be sought in the weak institutional framework that governs the operation of the public sector. The mechanisms available for budget preparation and implementation and for the operation of tax administration are outdated and inadequate (see Rapanos, 2007). Moreover, budgets rely on typically optimistic forecasts regarding key macroeconomic aggregates (GDP, inflation, etc.), and thus forecasts

regarding tax revenue often end up being over-optimistic. If one adds to the above the absence of any mechanisms for systematically monitoring and assessing budget implementation, it becomes clear that deficit creation is hard to avoid.[5] Another element aggravating the situation is that the release of fiscal data is usually fragmented, as well as greatly delayed, so that ultimately the citizens, the media and even members of parliament themselves are not in a position to assess how budget implementation is progressing, or to identify any possible deviations from the targets set. It is obvious that this situation runs contrary not only to the basic principles of modern fiscal management, but also to the democratic principles of transparency and accountability.

A factor that could theoretically reduce this deficit bias is the reaction of financial markets. A downgrading of the credit rating of a country that exhibits high fiscal deficits over a number of years and a growing public debt leads to a deterioration in its borrowing terms. Financing the deficits and refinancing the public debt is then only achievable through the payment of higher interest rates, a fact entailing a cost for the government: increased expenditure for public debt servicing and reduced funds available for other public expenditure. In the worst case, borrowing costs rise to a point where they necessitate a fast and abrupt fiscal adjustment, with a negative impact on growth and employment.

But, in practice, financial markets do not appear particularly consistent or effective in playing their disciplining role. Markets punish fiscal indiscipline in an inconsistent manner, and often only when it has already grown to particularly large proportions. Empirical studies that attempt to identify the determinants of real interest rates in developed countries conclude that the effect of fiscal variables is in most cases rather small and uncertain. Therefore, the political cost that markets indirectly create for a country as a response to its fiscal indiscipline is not high enough to deter the latter in a consistent and systematic man-

ner (see Gale and Orszag, 2003, Balassone et al., 2004).[6]

To deal with deficit creation and increased debt, a growing number of countries have gradually adopted *fiscal rules* aimed at limiting or eliminating their deficits. This implies the imposition of a numerical limit on some key fiscal variable, such as the fiscal deficit, public debt, public expenditure, etc. (see Kopits and Symansky, 1998). Within EMU for instance, the Stability and Growth Pact sets 3% of GDP as a maximum limit for the general government deficit, and the achievement of a balanced budget as a medium-term objective. Fiscal rules can indeed be very effective, particularly when they provide for specific sanctions in case of non-compliance (see de Haan et al., 2004, Wierts, 2008). The Maastricht Treaty and the Stability and Growth Pact did play a catalytic role in reducing the deficits of countries that wanted to ensure their participation in the euro area.

However, fiscal rules also exhibit some major weaknesses. The first is that they encourage the adoption of pro-cyclical (rather than counter-cyclical) policies. Particularly in the case of rules that set numerical limits to the deficit (or the debt), such limits usually risk being breached in an economic downturn. Therefore, the rule generates incentives for adopting a restrictive fiscal policy when the economic juncture would demand the exact opposite. Correspondingly, against a backdrop of robust growth, the fiscal rule is relatively easily respected, and thus there is no motive for fiscal adjustment.

Fiscal rules have also been criticised for the additional reason that they do not contribute to an improved quality of fiscal policy. Since

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5 Macroeconomic projections are prepared by the Ministry of Finance and in recent years have systematically proved to be excessively optimistic.
6 Recent developments in Greece, with the highly increased borrowing costs, seem to cast doubt on the above views. However, one should bear in mind that this development came immediately after a major world economic crisis and while the fiscal deficits of major economies have soared to unprecedented levels.

their sole objective is to reduce e.g. the deficit, the means by which fiscal adjustment might be achieved may include the reduction of productive public expenditure (e.g. cuts in the public investment budget). Finally, if fiscal rules do not reflect a broader political will for fiscal discipline, they may encourage the use of creative accounting in the production of fiscal data, reduce the transparency with which the state budget is implemented, and ultimately weaken democratic control of the budget (see von Hagen and Wolff, 2006).

This problem is intensified by the fact that compliance with a fiscal rule usually entails the adoption of policies that will put the targeted fiscal variable on a future trajectory (e.g. achievement of a balanced budget within a specified time horizon). But the forecasts regarding the achievement of this target are usually produced under conditions of uncertainty. Hence, to achieve the target with the least effort required, governments adopt optimistic projections as regards the evolution of key macroeconomic aggregates and budget revenue. The recent experience of countries subject to fiscal rules has shown that governments indeed tend to be biased with respect to such projections, as they consistently adopt over-optimistic scenarios about the economy's development (see Jonung and Larch, 2004 and 2006).

Overall therefore, fiscal rules, although extensively applied, entail considerable problems. According to Wyplosz (2005), rules "tend to be rigid and artificial (arbitrary limits set to the debt or the deficit; 'golden' rules that rely on aggregates that can be misrepresented), so that in the end their application is impossible to justify in the eyes of public opinion". Within the euro area, Wyplosz's view has some merit. There is no doubt that the fiscal rules imposed by the Stability and Growth Pact contributed to the containment of deficits among euro area countries. However, strict adherence to these rules proved impossible when EU economies entered periods of recession or prolonged weak growth (well before the emergence of the

recent financial crisis). Yet the dilemma exists, however, in that any degree of flexibility is only achievable through increased complexity, something that reduces the rule's functionality (see Anderson and Minarik, 2006).

3 THE ROLE OF INDEPENDENT FISCAL AUTHORITIES

In the wake of the problems analysed above, in recent years all the more emphasis has been placed at the global level on the complementary role that independent fiscal authorities (or councils) can play in a country's fiscal consolidation. This role could theoretically involve the analysis and assessment of fiscal policy and/or a partial assignment of its conduct. The theoretical literature has examined two types of fiscal authorities, distinguished based on whether the conduct of fiscal policy is partially assigned by the elected representatives to the independent authority or not. Discussions over the establishment of independent fiscal authorities empowered to make decisions that would be binding for the government are of great theoretical interest, as they focus on whether such an authority could operate according to the standards of independent monetary authorities, such as the central banks, that exist in practically all developed countries.[7]

The present study focuses on the possible role of fiscal councils generally entrusted with the analysis and assessment of fiscal policy, while the fiscal policy decision-making and implementation competences remain with the parliament and/or the government. After all, this is the type of fiscal councils that operate in many countries today. Relying as much on the relevant theoretical literature as on the experience of countries that have made best use of the institution at issue, we will next examine the main activities of these councils, as well as the requirements of their successful operation.

[7] For a more detailed presentation of relevant theorisations, see Debrun et al. (2009) and Wyplosz (2008).

Although in practice the type and scope of the competences entrusted to these fiscal councils differ considerably across countries, one can discern three basic areas for which such councils are responsible (see von Hagen, 2010, Anderson, 2009, European Commission, 2006):

1. *They assess the reliability of the macroeconomic projections on which forecasts about budget aggregates are based.* Fiscal policy planning relies on a series of assumptions regarding the future course of the economy. Therefore, successful budget implementation presupposes the adoption of realistic and prudent macroeconomic forecasts. In fact, in some countries fiscal councils are mandated to produce independent macroeconomic forecasts, which are binding for the government in the budget preparation process. Such are, e.g., the cases of the WIFO in Austria, the Federal Planning Bureau (FPB) in Belgium, and the Central Planning Bureau (CPB) in the Netherlands.

2. *They analyse and assess the forecasts on public revenue and expenditure, and highlight possible risks of deviation from the targets set in the budget.* In several countries — see e.g. Calmfors (2010) for Sweden and Chote et al. (2010) for the UK — fiscal councils check whether the policy and the measures announced by the government are compatible with the fiscal targets the government itself has set (e.g. the deficit that appears in the Stability and Growth Programme).

3. *They supervise the budget implementation process throughout the year and provide relevant information and statistical data at regular intervals.*

Through its above activities and functions, a fiscal council enhances the degree of transparency and accountability in the conduct of fiscal policy and contributes to its improved reliability. It thus ensures better information for parliament members and citizens alike, assesses the pragmatism of suggested policies,

and systematically monitors the progress of their implementation. Any deviations from the targets set are promptly identified, which entails a higher political cost for the government in case of any inconsistency in its policies. In addition to these basic functions, fiscal councils — depending on their available resources and personnel — engage in other activities as well, such as assessing the proposed policies over a short- and medium-term horizon, examining the long-term sustainability of public finances, analysing the consequences of the state-imposed institutional and regulatory frameworks on the operation of markets, analysing the impact of proposed tax reforms, etc.

The scope and type of their activities vary across countries, and are defined depending on each country's institutional framework, traditions, historical evolution, particularities, and challenges to be met. It would be interesting to cite a few examples. The oldest fiscal council is the Central Planning Bureau (CPB) in the Netherlands, which was established in 1947 and numbers approximately 150 staff members. The CPB's activities cover almost all the fields mentioned above, such as producing short- and medium-term forecasts for key macroeconomic aggregates, analysing the institutions in certain sectors of the economy, conducting cost/benefit analyses regarding proposed public investment projects, assessing the fiscal policies pursued by the government, etc. (see Bos and Teulings, 2010). Its reports and studies are widely accepted and constitute points of reference in public debates. One particularity of the CPB is that it also carries out estimates of the fiscal cost entailed by the pre-election promises of political parties. These estimates meet with such broad acceptance that citizens literally demand that politicians accompany any pre-election promise with the respective CPB estimate as regards its fiscal cost.

The fiscal council with the highest number of staff members (235 people) is the Congressional Budget Office (CBO) in the US, an independent authority that reports to the US Congress.

The Congress is called upon to decide on the adoption or not of proposals submitted by the US President. The main role of the CBO is to provide analysis and information on all, proposed or alternative, policies describing the advantages and disadvantages of each, while it also carries out studies on various issues of fiscal interest. Its primary objective, therefore, is to improve the quantity and quality of the information on which Congress members will rely to make decisions, without however making suggestions as to what they would ultimately need to vote for.

In the case of Belgium, the country's conversion into a federal state in 1989 was accompanied by a transfer of the powers related to expenditure programmes to local governments, while the responsibility for revenue collection remained with the central administration. This fact gave rise to reasonable concerns about the fiscal problems that may emerge as a result of any lack of coordination among the various levels of government. Since then, the Belgian fiscal council (the High Council of Finance) has been playing an important coordinating role, setting medium-term targets for the budgets of both central government and the regions. These targets form the basis of negotiations between central and local government, in order to arrive at an agreement concerning the annual target for the fiscal deficit/surplus of each level of government.

In Chile, the role of the independent advisory committee (ACRCP) is to provide the Ministry of Finance with, among other things, forecasts on the potential level of world copper prices, on which a significant part of the country's public revenue depends. Similar councils have lately been established in other countries as well, e.g. Sweden and Hungary, while one should not overlook the existence of such a council operating under the Canadian Federal Parliament, modelled along the standards of the Congressional Budget Office in the US.

The above brief and quite selective review points to the conclusion that the independent fiscal councils currently active in various countries are, according to Wyplosz's (2008) terminology, "soft" fiscal policy councils, in the sense that their role is mainly advisory. But how can one ensure the effectiveness of this type of institution in influencing the fiscal policy pursued, if it lacks the power to make government-binding decisions? As international experience shows, even a soft council can play an important role, provided that political parties and society in general accept its studies and view them as a product of scientific analysis and not according to whether they agree with their own ideological or political standpoints.

4 IS GREECE IN NEED OF A FISCAL POLICY COUNCIL?

This question is vital for Greece, considering the size of fiscal imbalances the country currently faces. Indeed, the government recently announced its intention to establish an independent fiscal council that will report to Parliament. As mentioned above, the experience of other countries has shown that such a council may prove to be useful, given that its existence enhances transparency in the conduct of fiscal policy and therefore increases the political cost of 'bad' or inconsistent policies. In a country such as Greece, where a critical element with respect to fiscal policy is the reliability of data included in the budget, the existence of a body such as — let's name it— the Parliamentary Budget Office, may contribute substantially to the improved quality and prompt release of fiscal aggregates. Moreover, by carrying out analyses of the reliability of the government's macroeconomic forecasts, evaluating the forecasts related to budget revenue and expenditure and monitoring budget implementation, such a council will provide extremely useful information to the political parties and Members of Parliament, enabling them to better carry out their work.

It is known that the reliability of Greece's fiscal statistics is quite low, a fact attributable as

much to the poor quality of the data as to their tardy release. The existence of such a council that will report to Parliament can exert considerable pressure on the executive branch, both to promptly provide data on the process of implementing the budget and to improve their quality. But to be able to play this role, the Parliamentary Budget Office, first of all, has to gradually and methodically build its reputation – a task not easy to accomplish.

The credibility of a fiscal council stems from its independence from government, political parties and other interest groups. Therefore, it must be above all political affiliations. As Anderson (2009) states, such a council has to be "non-partisan", which does not mean that it should be "bi-partisan". The former means not affiliated to any party (apolitical), whereas the latter means affiliated to and/or influenced by the two major (or all) parties. It is imperative for its members to be selected based on merit and professional skills, and not with a view to striking a political balance by letting all parties have a representative in the council. In the case of Greece, it would perhaps be advisable to keep the number of council members relatively low (e.g. three) so as to dissuade negotiations between the political parties for appointing persons somehow affiliated to each of them. If the composition of the council is the result of political arrangements, its effectiveness and credibility will be undermined *ab initio* (see Rapanos, 2010). The absence of any political identity is a key characteristic of all fiscal councils that successfully play their role (see Steuerle and Rennane, 2010, Bos and Teulings, 2010).

Another parameter that contributes to the actual independence of a fiscal council relates to the duration of its members' mandate. It is advisable for this duration to exceed the government's term of office. In several countries it has been set at 5 years, and council members can only be replaced in case of a serious breach of their duties. Their dates of appointment could also be different, so as to ensure that memberships do not expire simultaneously.

Another question that arises with respect to the design of such a council relates to its reporting line and its financing. The practice followed in other countries is not universal. In some countries (e.g. the US and Canada) the council reports to parliament (Congress); in others it operates under the Ministry of Finance (e.g. the Netherlands, Chile) or reports to the government (Sweden) or is a totally independent authority. In the case of countries with powerful single-party governments that enjoy absolute control over budget preparation and implementation, the subordination of an independent fiscal council to parliament is a rather appropriate choice (see Anderson, 2009, Schmidt-Hebbel, 2010).

In the case of Greece, according to the Constitution (Article 79), the Parliament votes to approve the budget of central government revenue and expenditure for the following year, and, in fact, broken down by ministry. Thereafter, however, the Parliament has no mechanism available for monitoring the implementation of the budget it has approved. Therefore, although it has an important institutional role, in practice the Parliament is unable to effectively play it. A fiscal council reporting to Parliament would therefore enhance the Parliament's role in the budget implementation process, and, by way of releasing reports and conducting open public debates, it would put pressure on the government so as to deter deviations from the budget targets. Hence, the intention of the Greek government to establish a fiscal council under Parliament appears to be the right choice, as this would strike a better balance between the legislative and the executive branches.

As regards the financing of the council, in other countries this is usually covered by government or parliamentary funds, while a small fraction is offered by the private sector. However, financing an authority with funds from the government, the policies of which this authority is called to transparently and objectively assess, could potentially be a problem. An indicative recent example is that of the Par-

liamentary Budget Office (PBO) in Canada, established as recently as in 2008. The release of a council report that assessed the cost of the Canadian engagement in the Afghanistan war resulted in a considerable reduction of the funds granted to the council for the following year. But even so, such actions obviously entail a huge political cost for the government, exactly because they are widely publicised, and are thus rarely attempted. Nevertheless, in the case of Greece, financing the council with funds from the Parliament's own budget (approved only by the Parliament itself and not by the Ministry of Finance), is perhaps the most appropriate choice.

A connected issue relates to the recruitment of specialised and properly trained personnel for the council. The number of people supporting the work of fiscal councils varies significantly across countries, from 4 people in Sweden to roughly 250 people in the US (CBO), and the scope of activities these councils can undertake is of course proportional to that number. Initially, such a council could hire a small number of experts with a background in fiscal and macroeconomic analysis, and use, even under part-time employment contracts, members of the academia. In Greece, recruiting the appropriate scientific personnel is usually a time-consuming and costly process. For this reason, until it finally hires its own personnel, the council could make best use of the human resources available in certain other general government institutions —such as the Centre of Planning and Economic Research (KEPE)— to provide technical support on some fiscal issues at least (e.g. conduct macroeconomic analyses and assess the consistency of official forecasts, etc.). With respect to its inspectional role, the council should not only employ a small number of specialised experts, but should also enjoy legally secured access to data from the State General Accounting Office and other services of various Ministries and authorities of the broader public sector.

In light of the above, it becomes evident that the creation of a Fiscal Policy Council report-

ing to Parliament could contribute considerably to Greece's efforts to consolidate its public finances. To deal with the current fiscal crisis, which has recently turned into a generalised economic crisis, Greece needs not only a strict fiscal policy, but also major changes in its institutional framework for conducting fiscal policy. One such institutional change is the creation of such a council.

In conclusion, the experience of countries with active independent fiscal councils shows the immense importance of allowing such a council to build up the reputation that its assessments are reliable, and to convince the markets and the public that it is unbiased and truly independent of any government, political party or other interest group. In the case of Greece, an independent fiscal council could become a point of reference, not only for Members of Parliament but also for economic analysts or even international credit rating agencies, and —together with the Bank of Greece— could constitute a valid source of information on the country's fiscal developments. One of the major problems of Greece today is the lack of credibility of its fiscal policy and the poor quality of the statistical data related to its public finances. Restoring such credibility is a long process, in which an independent fiscal council could play a catalytic role.

However, regardless of how good it is considered to be or how successfully it has functioned in other countries, no institution can serve as a magic bullet (see Debrun et al., 2009, von Hagen, 2010). The ability of an independent fiscal council to effectively fulfil its task depends on the prevailing political will and the support it receives from all political parties, as well as on the eagerness of the government and its authorities to cooperate, by providing statistical data and other information to the council even if the supply of such data does not constitute a formal legal obligation. An independent fiscal council can contribute to the improvement of a country's fiscal performance only in the case the government itself shares the opinion that there is indeed a fiscal disci-

pline problem that has to be dealt with. It is not coincidental that many countries have established independent fiscal councils precisely during or right after a serious fiscal crisis. As regards Greece, the current fiscal crisis is not the first in its recent history. Based on the above rationale, the opportunities for strengthening the fiscal policy framework through institutions such as that of an independent fiscal policy council could have already been seized in the past.

Thus, a question arises whether the existence of such a council would have helped the country avoid, or limit to some extent, the current fiscal crisis. Answering this question is not straightforward. It is well-known that an institution can only operate successfully if its creators respect its terms of operation and all others that enjoy its services consider it to be impartial, reliable and effective. Political, economic and other institutions do not operate in a vacuum, but within a certain political, economic and social arena, which both affects and is affected by their operation. In our opinion therefore, even if a council existed and was reliable, and the political system had invested in its impartiality and reliability, the council by itself would not have averted the crisis. But the members of our political system and the public would have been provided with much more accurate and promptly released information regarding the dramatic deterioration of the country's fiscal aggregates, and this would have led them to realise and respond to the problem much earlier.

5 CONCLUSIONS

The sustainability of a country's fiscal position is a prerequisite for sound growth. According to a widely accepted definition, a country's fiscal position is sustainable when the existing institutions (tax system, social security and public healthcare system, etc.) can be sustained over a long-term horizon without generating an uncontrolled increase in public debt. In the international literature, the problems created by a high level of debt mainly refer to the future. As Musgrave (1988) wrote, "debt creation allows the generations that live now to take resources from the generations that will live in the future". But as experience has recently proved once again, a high public debt can also create considerable problems at the present time (see Reinhart and Rogoff, 2010).

Indeed in the case of Greece, what lately became painfully evident is that a high public debt is not only a problem for future generations, but may even cause a chain of problems in the economy and put at risk the country's growth trajectory in the present as well. In that sense, the systematic lack of fiscal discipline that leads to such situations constitutes a failure of the political system (political failure), hence, one way to support its redress could be through reforms of the institutional framework that governs the preparation and implementation of the general government budget.

In the course of the past few months, Greece has entered a profound fiscal crisis. In order to deal with this crisis, and following the dictates of the international organisations monitoring the Greek economy, the government has adopted an ambitious programme of strict fiscal adjustment. The Greek government's commitment to reduce the general government deficit from 13.6% of GDP to below 3% within a period of 3 to 4 years represents the greatest adjustment ever attempted by a euro area country. The target is ambitious, but feasible. If Greece wants to avoid reliving the history of the 1990s, when the period of fiscal adjustment was followed by a relaxation of fiscal policy and an ensuing expansion of deficits with devastating results, it needs to resolvedly move ahead with the reform of the institutional framework governing its fiscal policy as well. In this direction, the establishment of an independent fiscal council could offer a key element of credibility. But one should not remain under the false impression that such an establishment is going to solve the fiscal problem. This council could play an important but only complementary role in the overall effort to rad-

ically reshape the broader institutional framework for fiscal policy.

Decisions regarding the conduct of fiscal policy in a country inescapably involve value judgments related to a series of questions, such as the importance of individual liberty and freedom of choice, solidarity with other members of society, compassion for the disadvantaged in need of assistance, people's right to be compensated in the future in exchange for efforts made in the present, responsibility towards and care for future generations (see Kornai, 2010), etc. In this sense, such decisions are political in nature, and it is not the role of an independent fiscal council to act as a substitute to the executive. The potential value added of such a council resides in its ability to analyse the short- and long-term implications of adopted or alternative policy choices, to verify their consistency, and ultimately to enhance transparency in the conduct of fiscal policy, disseminating information that is accessible to all, rather than to a closed circle of technocrats. It can thus strengthen the exercise of democratic control over the executive and the latter's obligation for accountability, which is a fundamental principle of democracy.

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DETERMINANTS OF YOUTH UNEMPLOYMENT IN GREECE WITH AN EMPHASIS ON TERTIARY EDUCATION GRADUATES*

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SUMMARY

The problem of unemployment, especially youth unemployment, is a central issue of public discourse in Greece. Youth unemployment rates in Greece are among the highest across the EU and, in contrast with other countries, a significant proportion of young unemployed persons are tertiary education graduates. This study aims to provide a detailed analysis of the determinants of unemployment in Greece, with an emphasis on the variables related to the educational qualifications of the labour force, using microdata from the Labour Force Surveys conducted by the National Statistical Service of Greece (NSSG) between 2004 and 2007.

The results of this study imply that the discussion about youth unemployment is slightly misplaced. The problem is not quite one of youth unemployment as such, but a problem of transition from education to the labour market, irrespective of age. It also involves graduates of all education levels, not only tertiary education. The difference between tertiary education graduates and graduates of lower education levels is that the unemployment rates of the first tend to decline at an acceptable level a few years after graduation, while for the latter the pace of this decline is substantially slower and unemployment rates usually converge to higher levels. Furthermore, across the entire spectrum of tertiary education (Technological Educational Institutes – TEI, Universities – AEI, postgraduate studies), the higher the level of education the lower the long-term unemployment rate, although significant variations can be observed in each education level. In fact, certain groups of tertiary edu-

cation graduates (Law school or IT graduates), at least men, face no real unemployment problems after their graduation. Some other groups, however, run a high risk of unemployment but only for a few years after graduation (graduates from Schools of Physical Sciences, Mathematics & Statistics) and yet others face serious unemployment problems for several years after graduation (Physical Education & Sports, Social Sciences and several TEI graduates). Finally, *ceteris paribus*, women in general, and female tertiary education graduates in particular, face a significantly higher probability of unemployment compared to men with similar educational qualifications. In some groups of female tertiary education graduates, the estimated unemployment rates are exceptionally high, even several years after graduation (university graduates from Horticulture & Forestry, TEI graduates from the schools of Agriculture & Food Technology and Economics & Management).

The results of this study reflect the conditions in the labour market between 2004 and 2007; thus it would not be advisable to extrapolate them to the future. This is due to the fact that in the past fifteen years tertiary education in Greece, like in most OECD countries, has expanded very rapidly and the share of tertiary education graduates in recent cohorts is substantially higher than in previous ones. More-

over, the recent financial crisis has brought about significant changes to employment and unemployment, as well as to the real economy both at the national and the international level. Whether the increase in graduate labour supply in Greece will lead to a more lasting rise in graduate employment rates, even after some difficulties in the first years of labour market participation, depends on several factors, such as whether enterprises will increase their demand for high-skilled human capital or whether they will be willing to recruit graduate labour to fill positions where higher education qualifications are not required. Nevertheless, the results of the paper suggest that the high demand of young individuals for tertiary education is rational, as tertiary education seems to be quite effective in shielding against unemployment, even if only in the long run. It should also be noted that schools associated with lower unemployment rates are among the most popular ones.

1 INTRODUCTION

In the last two decades, the problem of unemployment, especially youth unemployment, is a central issue for public discourse in Greece. The rate of unemployment, which stood at 7.4% in 1986, peaked to 11.9% in 1999, fell to 8.8% in 2006 and further to 7.6% in 2008. Female unemployment rates are twice as high as male unemployment rates in every year for which data are available, while a constantly rising proportion of the unemployed are long-term unemployed, i.e. unemployed for more than 12 months. This percentage started off from 42.5% in 1986 and stabilised to over 50% after 1993. In 2006, it reached 56.1%, but dropped to 49.6% in 2008. Finally, both for males and females, there is a negative relationship between age and unemployment rate, with unemployment percentages for the age groups 15-19 and 20-24 being disproportionally higher than those for older groups. In most of the years in the period under review the unemployment rate of the (numerically small) group of women aged 15-19 who participate in the labour market was above 50%, whereas that of women aged 20-24 was con-

stantly higher than 30%. High unemployment rates are also recorded among females aged 25-34 (14%-22%). Rates for the corresponding male groups are also high, but not as high as for the female ones, which range from 14% to 28% for the 15-19 age group, and from 15% to 22% for the 20-24 age group.

It should be clarified that the problem of youth unemployment is shared by all European countries. However, as shown by recent Eurostat data for the first quarter of 2009, based on the harmonised definition of unemployment, the unemployment rate of persons aged up to 24 in Greece was 24.2%, against 18.3% of the EU-27 average. This stems from the very high unemployment rate of young women (31.8% against 19.1% of the EU average); by contrast, the unemployment rate of young men was not much higher than the EU average (18.3% against 17.4%).[1]

Therefore, it is of particular interest — in terms of both scientific analysis and policymaking — to explore the determinants of unemployment for the entire labour force and more specifically of youth unemployment. This can be achieved in two ways: either at the macroeconomic level, with a view to identifying the factors that influence the aggregate unemployment rate (and possibly its composition) or at the microeconomic level, with the purpose of assessing the determinants of the probability of unemployment, given the total unemployment rate. This study adopts the second approach and aims at investigating the determinants of unemployment, focusing on tertiary education graduates and using the micro data from Labour Force Surveys (LFS) conducted between 2004 and 2007.

In the following section, we present a brief overview of the findings of available empirical studies on youth unemployment in Greece. The third section presents the LFSs used in the analysis, the fourth section sets out the most

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[1] In the first quarter of 2009, compared with Greece, the only countries which recorded higher unemployment rates for young people aged up to 24, were Spain (33.6%) and Italy (24.9%).

important empirical results of this study and the last one summarises its findings.

2 LITERATURE REVIEW[2]

Certain features of the Greek labour market often account —more or less— for the high unemployment rates, observed mainly in young people and women. For instance, the Greek labour market features dualism, i.e. there is an official labour market (subject to regulations/controls and offering job security) and an unofficial labour market (without job security, often with black labour, bad employment conditions and low compensation).[3]

In the past 25 years, the unemployment of tertiary education graduates has risen (4.3% in 1981, 6.6% in 1990, 7.6% in 1997), but this does not seem to affect all graduates in the same way. Thus, according to Karamessini (2003), unemployment among graduates from physical education & sports, philosophy, theology, horticulture & forestry is higher than average. Graduates from economics, social and political sciences, pedagogics, physical sciences and mathematics follow next.

In particular as regards high-skilled individuals, there is some imbalance between supply and demand (Liagouras et al., 2003, Katsanevas and Livanos, 2005), either because of the education system failure to adjust to the needs of the labour market, or because of the Greeks' insistence to acquire tertiary education (Papailias, 2006). Conversely, ISTAME (2006) considers that the main factor behind the high unemployment rates is the inadequate development of the economy's private sector and the subsequent low demand for highly skilled human capital (e.g. tertiary education graduates). According to this study, most new jobs require low specialisation and offer low compensation in return. The strong demand for tertiary education is often attributable to the comparatively low unemployment rates of tertiary education graduates (Kassimis, 2002, Karamessini, 2003). Keeping its focus on grad-

uates, IOBE (2007) attributes high unemployment on the one hand to the inability of the education system to adjust to rapid technological progress[4] and on the other hand to the slow adjustment process of a significant portion of the economy's productive (private) sector. Even graduates themselves consider the lack of adequate information and —at the personal level— the lack of appropriate recommendations as the main reasons behind unemployment (IOBE, 2007).

There are relatively few available empirical studies on the issue of youth unemployment in Greece; these can be grouped in three categories according to the data they use. The first consists of the studies based on the single specialised survey on the transition from education to the labour market that was carried out by the National Statistical Service of Greece (NSSG), under the auspices of Eurostat, in the second half of 2000. The second contains research based on field studies on the graduates of specific university schools or faculties. The main advantage of such studies is that they are targeted and thus, the interviewees supply all necessary information for the investigation of the issue at hand. On the other side, though, such studies typically involve small subgroups of youth population (or young graduates), thus providing an incomplete picture. Finally, the third category is based on Labour Force Surveys compiled by the NSSG, which offer the advantage of country-wide coverage and a multitude of useful information for the analysis of the unemployment issues. Most of the available empirical studies are primarily descriptive and their conclusions are not always consistent.

The results of studies in the first category show that men's transition from education to their

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[2] For a detailed review of the literature on the employability of tertiary education graduates in Greece, see Cholezas and Tsakloglou (2008). This section provides a brief overview of the main findings of empirical studies regarding the issue of youth employment and especially youth unemployment of tertiary education graduates in Greece.

[3] See ISTAME (2006).

[4] According to a study conducted by the Hellenic Federation of Enterprises – SEV (2004), half of the enterprises reported lack of tertiary education graduates with specific qualifications.

first important job —defined as a job of at least 20 hours per week, held for at least six months— lasts longer compared with women (36 months on average against 29), although this can be attributed to military service (Karamessini and Kornelakis, 2005). Moreover, according to the same authors, graduates specialised in the provision of services need less time than other graduates to find an important job. When the sample is limited to those who graduated (any education level) between 1996 and 1999, then about one third of AEI graduates and one fourth of TEI graduates had not managed to find an important job until the second quarter of 2000. Among AEI graduates, this percentage is comparatively higher for the graduates of physics, mathematics, IT, social sciences, mass communication, humanities and pedagogics (over 40%). All in all, tertiary education graduates need on average more than 16 months to find an important job but, still, they are in a better position than those without a degree. Based on this criterion, graduates of physics, mathematics, IT, physical education & sports and polytechnic schools hold the worst position between all tertiary education graduates (over 18 months). In relation to gender, male tertiary education graduates seem to find an important job with more delay than female ones (around 20 months compared to 14).

Using the same data, Nicolitsas (2007) attempts to investigate the determinants of the duration of the transition period, applying hazard models. The results of her study show that the transition period is longer for married men, foreigners, residents in rural areas and older graduates, while the period is shorter for persons whose father is engaged in some business activity. The duration of the transition period is negatively correlated with local unemployment rate, graduation year and education level. Finally, female graduates of technical schools, TEI, IEK, polytechnic and medical schools find a job faster.

In the second type of research which is based on field studies, Bitros (2002) analyses the condi-

tions for Economics graduates. According to his conclusions, slightly more than half of the graduates find a job within less than a year after graduation. The main justification for this low percentage, according to the graduates themselves, is the mismatch between education and labour market demands, as well as the lack of additional skills. The transition of engineering schools' graduates, especially graduates from the National Technical University of Athens (NTUA), to the labour market is the object of a number of studies; the results of these studies show, on the one hand, low unemployment rates (2.2% according to NTUA, 2002) and, on the other hand, short periods of transition to the first job (only 5 months after graduation, according to NTUA, 2002, and 5.7 months according to the Technical Chamber of Greece – TEE, 2006).

Another field study forms the basis for Karamessini's (2006b) analysis, which focuses on graduates from the University of Thessaly. Roughly 5 years after graduation, the unemployment rate of that University's graduates is 7%. *Ceteris paribus*, women, kindergarten teachers, horticulturalists and land planning & regional development engineers face the biggest problems in entering the labour market. However, according to the author, the temporary nature of many graduates' employment remains a big problem, as 5-8 years after graduation 45% of the graduates still have no permanent job.

The field study conducted by IOBE (2007) addresses both firms (about 200) and employees (about 500), which makes it particularly interesting. Results show that over 90% of the graduates found a job within 20 months after graduation – most of them in fields related to their studies. Conditions seem to be more difficult for graduates of social sciences, biology, horticulture and genetics, as well as for those who come from families with poor education background, are younger graduates or postgraduates. Turning to their field of work, it takes graduates from schools of fine arts and mathematics & statistics longer to find a job relevant to their degrees.

The most detailed field study is the one used by Karamessini (2007), which covers a large number of Greek AEI. According to its findings, 5-7 years after graduation 84% of AEI graduates found a job, with minor differences between men and women. Lower employment rates are observed among graduates from schools of biology, theology, history, archaeology and political science. Regarding unemployment, rates are higher for women (7% against 5% for men and 6.4% on average) and for graduates of history, archaeology and theology. Although 5-7 years after graduation from AEI almost all graduates (97%) have some working experience, 18% have no important working experience and just 71% have non-temporary employment (69% of women and 74% of men). As regards the timing of the first important job, large variations are observed. Thus, 15% found a job before graduation, 19% within one month from graduation, 33% needed one year and the remaining 33% more than one year. These results paint a different picture than IOBE (2007), where the percentage of graduates who found a job within a year was much higher (91% against 67%); this is possibly due to both the stricter definitions used in Karamessini (2007) and the fact that IOBE (2007) excluded unemployed graduates from its sample. However, a really alarming finding of Karamessini (2007) is that 41% of the graduates reported that they remained unemployed for more than 12 months after graduation. The picture only gets gloomier for women.

Finally, the studies of Karamessini (2006a) and Karamessini and Prokou (2006) fall under the third category, i.e. those using LFS data. In both studies, emphasis is placed on AEI and TEI graduates. According to their results, TEI graduates have higher rates of participation in the labour market in the first years after graduation —probably because proportionally more AEI graduates undertake further (postgraduate) studies— which are equalised thereafter (about 6 years after graduation). With respect to gender, men have higher rates of participation if they are TEI graduates, but differences are negligible among AEI graduates. Conversely, unemployment rates are clearly higher for TEI graduates and women, while the gap widens as we move further away from graduation. These higher unemployment rates are attributed by the authors to the higher participation rate of TEI graduates in the labour market and to discrimination against women. The results show that new graduates face high rates of unemployment after graduation (34.4% for AEI and 36.5% for TEI graduates), which decline with time, especially for AEI graduates. Also, they have difficulties in solidifying themselves to employment, as 32% (29%) of AEI (TEI) graduates still have no permanent job 6 years after graduation.

3 LABOUR FORCE SURVEY: SHORT DESCRIPTION AND FIRST DESCRIPTIVE RESULTS

For the purposes of this study, we used the micro-data of quarterly LFSs that the NSSG conducted during 2004(Q1)-2007(Q3). We chose this period because the methodology of collecting data for the LFS was radically revised in 2004 and, moreover, for this period micro-data are available by the NSSG in the form of rotating panels, as each member of the sample participates in the LFS for six consecutive quarters ("waves").

The LFS has been conducted on a quarterly basis by the NSSG since 1998 (earlier it was conducted only in the second quarter of every year) with the aim of collecting detailed data on the employment and unemployment status of household members aged 15 or over.

More specifically, the LFS aims at:

(a) recording the employment status of household members aged 15 or over, together with gender, age and education background, at national and regional level;

(b) studying the breakdown of employment by sector of economic activity, profession, working hours etc.;

(c) monitoring the duration of unemployment, in relation to gender, age, education back-

ground, region and some features of the latest job, such as the sector of economic activity and the profession;

(d) studying the employment condition of household members a year before, whether employed persons have a second job, etc.

In the LFS, the unemployed are defined according to the original definition of the International Labor Organization (ILO); we used the same definition in our study too. In particular, a person is considered unemployed if:

(i) s/he hasn't worked for even one hour in the reference week;

(ii) s/he's looking for a job;

(iii) s/he reports the actions s/he did to this end in the last four weeks before the study;

(iv) s/he is ready to start working the following week, if s/he finds a job.

The LFS quarterly sample includes approximately 30,000 households (a sampling fraction of 0.85% of the total population of the country), with one sixth of the sample rotating (being replaced) every quarter.

The main features of the LFS used in this study are depicted in Tables 1 and 2. Table 1 shows participation rates of persons aged 15-64, by gender, level of education and breakdown by age group, for the period 2004-2007. The total participation rate follows a slightly upward path in the period under review. Male participation is significantly higher than female participation (79.0% against 54.5%, on average) and, furthermore, there are significant differences in terns of education level and age. Female participation is higher at tertiary educational levels, whereas male participation shows a small decline between primary and secondary education and a sharp increase in tertiary education graduates. Differences between male and female labour force participation rates of ter-

tiary education graduates are relatively small (below 10%), especially in the age group 15-34. By contrast, for the two other education levels, large differences are noticeable in male and female participation rates: over 35% for primary or lower education graduates and over 25% for secondary education graduates.

Table 2 shows unemployment rates by gender, education level and age group between 2004 and 2007. During this period, total unemployment declined (from 11.3% to 9.1%). For both men and women, the decline was substantial but it was more pronounced in the case of women, even though the female unemployment rate was constantly more than double that of men. Both for men and women, unemployment rates decline with age (with a small exception for the male group aged 55-64). In the age group 15-24, unemployment rates are particularly high. In women, unemployment rates are markedly higher among secondary education graduates, whereas in men, differences in unemployment rates do not vary substantially with the education level.

As it was already mentioned above, one of the most attractive features of the LFS for the purposes of this study, besides its large sample, is the form of rotating panel which (theoretically) allows for the isolation of the impact of non-observable individual characteristics, with the use of appropriate econometric techniques, and the calculation of a "net" impact that particular components of the educational system have on a person's probability of unemployment. This isolation was not possible, however, as the intertemporal variation of the dependent variable and (to an even greater extent) of many independent variables per individual was extremely limited. In other words, most of the participants were either always employed or always unemployed over the quarters they participated in the LFS, while all other features remained usually unchanged throughout their participation in the survey. Therefore, for the purpose of analysis, we used the first observation of each individual in the LFS of the period under examination.

Table I Rate of participation of persons aged 15-64 in the labour force: LFS (2004 Q1 – 2007 Q3)

	2004			2005			2006			2007*		
	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women	All
Primary or lower education												
15-24	67.6	37.8	55.9	65.6	26.4	49.3	67.4	29.0	51.8	57.7	35.9	48.0
25-34	92.9	50.3	74.3	92.5	52.1	75.0	92.3	54.3	75.7	93.0	45.5	73.8
35-44	93.3	57.5	74.6	93.1	59.2	75.7	92.5	57.1	74.6	91.1	56.1	73.5
45-54	90.2	47.1	65.6	89.1	49.1	66.6	89.7	46.3	65.5	89.6	48.4	65.5
55-64	56.8	24.9	38.4	57.7	25.0	38.6	58.1	24.2	38.2	59.8	24.9	39.6
Total	77.4	39.4	56.8	77.3	39.8	57.0	77.7	38.3	56.3	77.4	39.0	56.5
Secondary education												
15-24	33.9	24.2	29.0	34.0	21.0	27.9	32.2	20.9	26.7	33.1	21.1	27.3
25-34	95.4	67.3	82.8	95.4	64.8	81.7	94.6	67.0	82.4	94.9	63.5	80.9
35-44	97.1	65.7	81.6	97.4	65.6	82.1	97.9	65.7	81.9	98.2	66.8	83.3
45-54	91.0	50.4	70.6	92.6	51.0	73.1	91.9	53.1	72.3	91.2	57.2	74.0
55-64	53.7	17.8	35.9	53.4	22.0	38.6	58.7	22.2	40.5	56.5	26.1	42.2
Total	73.3	46.6	60.4	73.5	46.0	60.6	73.3	46.2	60.2	74.6	47.8	61.9
Tertiary education												
15-24	86.2	87.1	86.8	79.1	88.3	85.0	75.4	86.4	82.4	84.6	87.8	86.4
25-34	94.2	87.8	90.6	94.3	89.7	91.8	95.0	89.5	92.1	95.0	87.4	90.7
35-44	98.1	86.9	92.5	99.0	87.5	93.0	97.1	87.7	92.4	98.7	88.1	93.3
45-54	94.5	76.9	87.0	94.4	80.1	87.8	94.2	81.0	88.3	92.7	79.2	86.7
55-64	65.0	37.8	55.4	67.7	42.3	58.7	65.9	40.7	56.3	67.1	38.9	56.9
Total	91.1	82.2	86.6	91.2	84.0	87.5	90.6	83.4	87.0	90.8	82.2	86.5
All												
15-24	41.4	34.2	37.8	40.1	31.2	35.8	38.3	30.8	34.6	40.0	31.1	35.7
25-34	94.7	74.5	84.8	94.7	74.8	84.9	94.5	76.3	85.8	94.7	73.3	84.2
35-44	96.7	70.7	83.7	97.2	72.0	84.5	96.7	71.8	84.3	97.2	72.1	84.9
45-54	91.8	54.6	72.9	92.0	57.0	74.5	91.9	56.9	74.1	91.2	58.9	74.6
55-64	57.7	24.6	40.3	58.6	26.1	41.7	60.0	25.6	41.9	60.5	27.1	43.5
Total	78.9	53.6	66.1	78.9	54.5	66.7	78.9	54.3	66.6	79.6	55.0	67.3

* Q1, Q2 and Q3.

Table 2 Rate of unemployment of persons aged 15-64: LFS (2004 Q1 – 2007 Q3)

	2004			2005			2006			2007*		
	Men	Women	All	Men	Women	All	Men	Women	All	Men	Women	All
Primary or lower education												
15-24	18.5	38.9	23.9	14.5	25.4	16.9	25.9	46.1	30.5	13.5	27.0	18.0
25-34	9.2	27.4	14.5	5.6	16.8	9.0	7.1	21.1	11.5	9.4	17.5	11.4
35-44	7.2	19.4	12.2	4.9	17.0	9.8	6.4	15.6	9.9	7.2	16.3	10.7
45-54	4.7	13.1	8.1	5.2	11.8	7.9	4.4	11.8	7.3	4.8	11.9	7.8
55-64	5.7	4.9	5.4	3.9	5.0	4.3	4.5	3.7	4.2	5.6	4.5	5.2
Total	*7.0*	*14.8*	*9.9*	*5.4*	*12.0*	*7.9*	*6.4*	*12.3*	*8.6*	*6.6*	*11.9*	*8.6*
Secondary education												
15-24	20.6	38.5	28.0	21.6	37.0	27.0	20.3	37.0	26.6	12.6	31.6	19.7
25-34	8.6	21.8	13.4	8.0	19.0	11.9	8.2	20.3	12.5	7.1	16.7	10.4
35-44	4.3	16.5	9.1	5.6	14.7	9.1	4.0	12.9	7.5	4.4	12.4	7.5
45-54	4.6	9.5	6.4	3.2	12.2	6.2	3.4	9.4	5.6	2.7	8.8	5.1
55-64	4.1	7.9	5.0	2.6	5.4	3.3	3.3	8.0	4.6	2.9	5.6	3.7
Total	*8.1*	*20.4*	*12.7*	*7.8*	*18.2*	*11.5*	*7.3*	*17.5*	*11.0*	*5.8*	*14.8*	*9.1*
Tertiary education												
15-24	22.4	36.3	31.4	22.9	37.7	32.7	24.6	31.0	28.9	20.8	38.1	30.9
25-34	10.3	17.4	14.2	12.7	16.6	14.8	9.7	16.3	13.1	13.7	15.3	14.6
35-44	3.0	9.2	5.9	4.5	9.1	6.8	3.3	7.6	5.3	2.9	7.1	4.9
45-54	2.9	6.3	4.1	1.5	4.6	2.8	1.3	2.9	1.9	0.5	4.2	2.0
55-64	3.0	2.2	2.8	2.4	1.9	2.3	1.5	4.5	2.3	1.6	0.6	1.4
Total	*6.3*	*14.9*	*10.4*	*7.2*	*13.9*	*10.5*	*5.8*	*12.4*	*9.0*	*6.6*	*12.4*	*9.3*
All												
15-24	20.6	37.7	28.4	20.8	36.7	27.5	21.7	35.0	27.6	14.4	33.8	22.7
25-34	9.2	19.9	13.8	9.3	17.6	12.9	8.7	18.2	12.7	9.7	15.9	12.3
35-44	4.4	14.1	8.5	5.1	12.7	8.4	4.1	11.0	7.1	4.4	10.7	7.0
45-54	4.1	9.8	6.3	3.3	9.6	5.7	3.1	8.0	5.0	2.6	8.3	4.9
55-64	4.7	5.0	4.8	3.2	4.6	3.6	3.4	4.9	3.9	3.8	4.1	3.9
Total	*7.3*	*17.1*	*11.3*	*7.1*	*15.2*	*10.4*	*6.6*	*14.5*	*9.8*	*6.2*	*13.3*	*9.1*

* Q1, Q2 and Q3.

The next problem we encountered relates to the definition of education groups. The LFS divides the population into a large number of education groups – sometimes quite arbitrarily. As this study focuses on tertiary education graduates, we chose to group AEI and TEI graduates with as much detail as possible. However, in many cases this was not feasible, as the number of observations was too small. In the end, the criterion for keeping or merging tertiary education groups, apart from the homogeneity of the disciplines, was the existence of a minimum number of observations (around 100 men or women, whichever lower) covering a large number of years since graduation. For lower education levels, fewer groups were formed. Moreover, it was decided to exclude from the sample a small number of groups that presented specific problems (e.g. graduates of special needs schools; open university and inter-disciplinary selection programmes, graduates of military and law enforcement schools and the School of Pedagogical and Technological Education– SELETE/ASPETE, graduates from pedagogic academies with a two-year duration of studies).

Even after these exclusions, the sample of the analysis remains very large, as it covers a total of 108,847 employed or unemployed individuals (58% men and 42% women). Labour force participation rates and unemployment rates of the sample are shown in Table 3. The variations in both percentages on account of the education level are obvious. The rate of participation in the labour force is positively related to the education level and variations within a level do exist but are not large – with one exception: the participation of general lyceum graduates in the labour force is about 27 percentage points smaller than that of higher technical education graduates (technical lyceum, post-gymnasium technical school).

Table 3 also shows that the unemployment rate is lower in the small group of individuals with postgraduate studies (7.5%) and higher in the group of post-lyceum and non-tertiary education graduates (14.3%). Significant variations are also observed between the two larger groups of tertiary education graduates (AEI: 7.9% and TEI: 12.3%). Even within the narrow definition of education levels, there are variations. For instance, the unemployment rate of technical lyceum graduates is 18.4%, whereas that of general lyceum graduates, albeit higher than the national average, is significantly lower (10.9%). Accordingly, within AEI, the unemployment rate of Law school graduates is just 2.8%, while the corresponding rate for graduates of Social Sciences is 12.9%. Within TEI, the unemployment rate of polytechnic schools graduates (Structural Engineering, Mechanical Engineering and IT) is less than 8% and the rate of the graduates from the school of Agriculture & Food Technology is more than 17%. Therefore, it is of particular interest to analyse the probability of unemployment for specific graduate groups. Moreover, these variations may be the result of factors which are not associated with the education system. For example, according to many studies, the probability of unemployment is negatively correlated with the time that has lapsed since graduation. Given the very rapid growth of tertiary education in Greece in recent decades, it is quite probable that tertiary education graduates will be much younger on average than the graduates of lower education levels. It is, thus, particularly interesting to isolate the effect of the two factors (education and years after graduation).

Especially in relation to this last point, we have to underline that public discourse typically makes mention of "youth unemployment". But is it really a youth unemployment problem or a problem of transition from education to the labour market? Undoubtedly, 5 or even 10 years after graduation, a compulsory education (gymnasium) graduate is still very young; this, however, is not necessarily true for a tertiary education graduate or, even less, for a postgraduate degree holder. An initial approximation to this problem is made in Charts 1 and 2 where the members of the sample are divided into two large groups according to the number of years that have lapsed since their graduation: those with 5 or less years and those with 6 or more years since graduation.

Education level	Rate of unemployment	Rate of participation in labour force	N (labour force)
Pre-lyceum education	*9.8*	*56.8*	*40,955*
Primary	9.1	59.6	27,891
Lower secondary	11.1	52.3	13,064
Lyceum	*11.7*	*65.1*	*35,773*
General lyceum	10.9	60.5	27,514
Technical lyceum	18.4	86.3	4,529
Post-gymnasium technical school	9.4	88.2	3,730
Post-lyceum non-tertiary education	*14.3*	*85.5*	*9,844*
IEK	14.6	86.0	8,573
Other post-lyceum education	12.4	82.4	1,271
TEI	*12.3*	*90.2*	*5,490*
Structural Engineering	7.5	90.3	326
Mechanical & Computer Engineering	7.9	92.3	1,319
Agricultural & Food Technology	17.2	89.5	463
Economics & Management	15.9	90.1	1,720
Medical Sciences	11.3	90.0	1,418
Other TEI	12.8	82.7	244
AEI	*7.9*	*88.0*	*15,093*
Structural Engineering	5.0	91.9	1,252
Mechanical Engineering	6.5	92.3	888
IT	5.1	88.5	203
Physical Sciences	7.3	87.2	860
Mathematics & Statistics	5.7	90.0	680
Medical School etc.	5.5	89.8	1,804
Horticulture & Forestry	8.9	88.7	513
Law School	2.8	87.4	1,120
Economics & Management	7.8	85.5	2,824
Social Sciences	12.9	81.8	405
Humanities	11.8	86.2	2,131
Languages	9.5	86.2	600
Physical Education & Sports	11.8	92.1	665
Pedagogics	11.0	91.2	918
Other AEI	11.4	79.9	230
Postgraduate studies	*7.5*	*94.3*	*1,292*
Postgraduate degree	8.6	93.2	875
Doctorate	4.9	97.1	417
TOTAL	**10.7**	**67.5**	**108,447**

Chart 1a illustrates the rates of unemployment by education level for recent (up to 5 years) and older (6 or more years) graduates. Panels 1b and 1c repeat the same, splitting the sample for men and women. For reasons of comparability, in all three panels we applied the same scale to the x-axis. In the first panel, it is clear that for all education levels, the rate of unemployment is substantially higher for recent than for older graduates (27.0% against 8.6% for the total). In general, the unemployment rates of tertiary education graduates are lower than those of primary or secondary education graduates, both for recent and for older graduates. However,

what is impressive with tertiary education graduates is the discrepancy in the unemployment rates of recent and older graduates (ratios of 3.7:1 for TEI graduates, 5.1:1 for AEI graduates and 4.0:1 for postgraduates). Especially in the case of older AEI graduates and postgraduates, at first sight unemployment rates do not appear to be particularly alarming (4.7% and 3.8% respectively).

Charts 1b and 1c paint a similar picture for both men and women: unemployment rates are significantly higher for recent graduates compared with older ones. However, some differ-

Chart 1 Rates of unemployment by education level

■ up to 5 years since graduation
■ 6 or more years since graduation

a. Total
(%)

b. Men
(%)
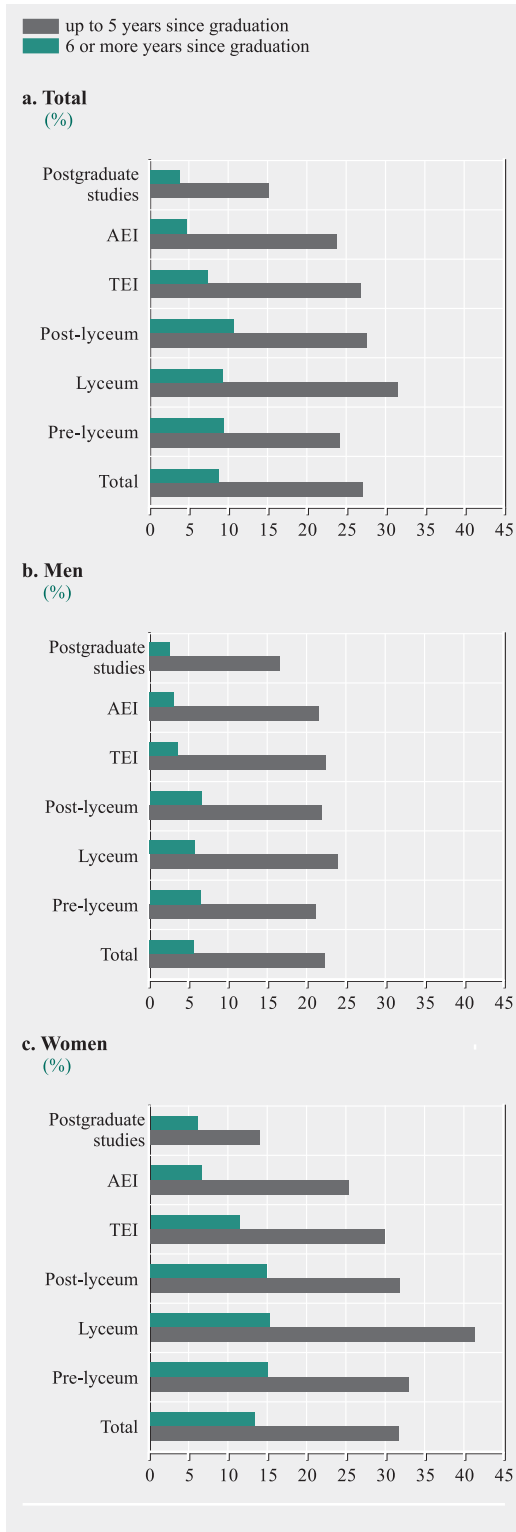
c. Women
(%)

Chart 2 Rates of unemployment for tertiary education gratuates

■ up to 5 years since graduation
■ 6 or more years since graduation

a. TEI
(%)

b. AEI
(%)

c. Post gratuate
(%)
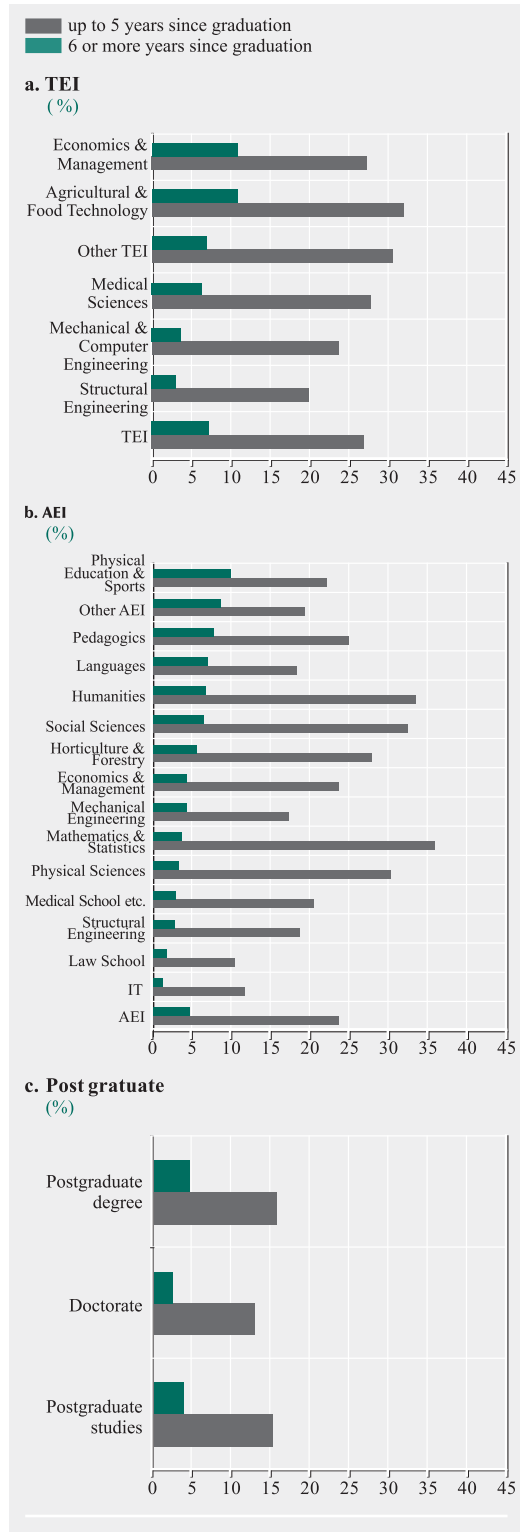
ences between the two genders are also impressive. In all individual groups, without exception, female unemployment rates are higher than male ones. Especially for women who have recently graduated from lyceum, the unemployment rate is excessively high (41.2%). Male unemployment rates for older tertiary education (AEI, TEI, postgraduate studies) graduates are in the area of 2.6% to 3.7%, whereas in the corresponding female group these rates are considerably higher (6.0% to 11.3%). Moreover, although male unemployment rates of recent tertiary education graduates are not very different from those of lower education graduates, there are significant differences in women.

Charts 2a, 2b and 2c focus on tertiary education graduates and provide a more detailed picture for TEI and AEI graduates, as well as for the small but rapidly growing group of postgraduates (Kikilias, 2008). The conclusion that is clearly drawn from these charts is that, even though some generalisation is possible, there are major intra-group differences. Chart 2a shows that, among TEI graduates with high unemployment rates, there are similarities between the groups of recent and older graduates (with the exception of graduates from the school of Economics & Management). However, unemployment rates of recent graduates and, to a greater extent, of older graduates show considerable differences between groups of schools. For example, the unemployment rate for older graduates from Polytechnic Schools (Structural Engineering, Mechanical Engineering and IT) is below 4%, whereas for older graduates from the school of Economics & Management and Agricultural & Food Technology it is above 10%.

There are even larger differences within the group of AEI graduates, which is evident in Chart 2b, possibly as a result of the larger number of sub-groups in the sample. In all these groups, without exception, unemployment rates of recent graduates are much higher than those of older ones. However, in some groups, unemployment rates are alarmingly high for older

graduates (e.g. graduates from the schools of Physical Education & Sports: 9.8%), whilst in other groups the corresponding rates are lower than those typically classified as frictional unemployment (e.g. graduates from IT: 1.3% or Law: 1.7%). Furthermore, in the classification of schools by unemployment rates of older and recent graduates, the groups are not really correlated. For example, while the unemployment rates of older graduates from the schools of Physical Sciences and Mathematics & Statistics are very low, those of the recent graduates from the same schools are among the highest for recent graduates. Finally, Chart 2c shows that acquiring a postgraduate or a doctorate degree is associated with very low unemployment rates 6 or more years after graduation; however, such degrees should not be considered as effective shields against unemployment in the first five years after graduation (unemployment rates of recent graduates are 15.8% and 12.9% respectively).

4 ECONOMETRIC RESULTS

Naturally, an individual's probability of unemployment is influenced by various factors and not solely by educational qualifications. Some of these factors are directly observable while others are not. Furthermore, random factors may influence this probability. The LFS includes a number of variables which may influence the probability of unemployment. Therefore, in order to better understand the phenomenon, it is necessary to apply a multivariate econometric probability analysis, which is the primary objective of this part of the study.

The descriptive results of the previous section provide some indications. First, the labour force participation rate seems to be associated with both the individual's age —and, most likely, with the number of years that have lapsed since graduation— and the education level, as well as with gender (and, possibly, other factors such as family status). Hence, without controlling for the probability of

labour force participation, it is very likely that the estimated results for the probability of unemployment are biased (from a statistical point of view). In other words, it is highly likely that a two-stage estimation method is required: (i) a first estimation of the probability of labour force participation, and (ii) a subsequent estimation of the probability of unemployment following the inclusion of the relevant correction term in the explanatory variables (Inverse Mills Ratio).

The descriptive results show that, in all likelihood, the variable related to the probability of unemployment is the time interval from graduation and not the individual's age *per se*. The same results imply that the time interval from graduation has a non-linear effect on the probability of unemployment, something that should be taken into account in the econometric estimation.

Moreover, the descriptive results indicate that both the unemployment rate and its change after graduation vary significantly between men and women. Therefore, it is essential to estimate different equations for men and women rather than introducing a dummy variable for women in the unemployment probability equation for the entire sample.

Lastly, since the evolution of the unemployment rate in relation to the years that have lapsed since graduation shows substantial differences between groups of graduates of the same education level, graduates of different schools should not only be distinguished by applying dummy variables, but flexible, non-linear formulas should also be used, which allow for different unemployment probabilities as a function of the time after graduation for different types of education groups.

All of the above were taken into account in the specification and estimation of the econometric model. The methodology used is a variation of Heckman's (1979) two-stage method, with which we attempted to correct the sample's selection bias. At a first stage, the probability

of labour force participation was estimated using the sample of all individuals aged 15-64 who participated in the labour market. The variation lies in the fact that at the second stage of the estimation of the unemployment probability, a binominal variable (instead of a continuous one, as in Heckman's classical method) was used as a dependent variable. This has brought about changes in the estimated maximum likelihood function (Pindyck and Pubinfeld, 1998, Greene, 2003). The detailed results of these estimations and the definitions of the variables used are presented in the Annex.

The presentation of the results begins with the estimation of the labour force participation probability, in which the sample comprises all individuals aged 15-64 (79,288 men and 83,736 women). The male labour force participation rate in our sample is 79.9% and the female rate is 53.8%. In both equations (men and women) the control group consists of members of childless couples, who are Greek nationals, general lyceum graduates, residents of Athens and took part in the LFS in 2007(Q3), whereas, on account of heteroskedasticity, the estimated standard errors of coefficients were corrected using White's (1980) method.

Both for men and —markedly— women, the probability of labour force participation is closely linked with their family status. In comparison with the control group, the probability of female labour force participation is significantly lower when women are married with children (the opposite is usually observed for female heads of single-parent households), while, in connection to men, the result varies depending on the number and age of the children. In terms of education level, for both men and women, *ceteris paribus*, the labour force participation probability for graduates of all education groups (except gymnasium graduates) is higher compared with general lyceum graduates. For both genders, the labour force participation probability of postgraduates is particularly high (a finding which is in line with the predictions of human capital theory). Fur-

thermore, for both men and women, the probability of labour force participation appears to have a close but non-linear association with the number of years since graduation.

Regional differences in terms of labour force participation are not particularly large in men, whereas, in women, differences are more important and probabilities of participation are higher in most regions (compared with Attica). As regards the degree of urbanisation, *ceteris paribus*, higher participation rates are observed in semi-urban and, particularly, rural areas. Finally, there are no significant differences with respect to the year of the LFS or seasonality (the survey's quarter). In both equations, the coefficient showing whether there is bias ("arthrho") is statistically significant and implies the existence of systematic bias, which is corrected using the Inverse Mills Ratio in the equations for the probability of unemployment (in other words, the results of the estimation for the probability of unemployment presented below would not be reliable without this correction).

After the presentation of the results on the probability of labour force participation, we move on to the presentation of the results from the estimation of the probability of unemployment. This time, the samples consist of 63,378 men and 45,060 women. Similarly to previous equations, on account of heteroskedasticity, the estimated standard errors of coefficients were corrected using White's (1980) method. Most of the results are presented in charts. Once more, the control group comprises members of childless couples, who are Greek nationals, general lyceum graduates, residents of Athens and took part in the LFS in 2007(Q4). The dependent variable is the probability of unemployment and independent variables include the individual's education background, the number of years after graduation (and its square), dummy variables related to household composition, the individual's nationality, the region and the degree of urbanisation of the place of residence, the local unemployment rate, as well as the dummy vari-

ables for the year and the quarter of the LFS in which they participated. Education groups are much more detailed, compared with the previous equations (like the groups of Table 3), while demographic groups (household composition) are much less detailed. In order to capture the different unemployment probabilities for each education group in relation to the time interval from the year of graduation, we introduced multiplicative terms between the dummy variable of each education group and (a) the time from the individual's graduation and (b) its square.

The dummy variables of the quarters aim to capture the potential seasonality of unemployment, while the dummy variables of the years seek to capture possible effects of the economic cycle on employment.[5] The two groups of variables are not statistically significant, both in the female and the male function. The variable that relates to the local unemployment rate refers to the unemployment rate of the region of the individual's place of residence in the period of their participation in the LFS. As expected, this variable has a positive effect on the unemployment probability and is statistically significant. As regards the demographic features of the individual's household, the results indicate that both for men and women, single parenthood as well as the presence of household members other than spouse and children increase the probability of unemployment compared with the control groups (members of childless couples).

Before moving on to the presentation of results in detailed charts, it would be interesting to examine the corresponding results for six broad groups according to the education level (pre-lyceum, lyceum, post-secondary non-tertiary, TEI, AEI, postgraduate studies). These results stem from estimations that use the variables mentioned above, but this time for broader groups of graduates, and are presented in Charts 3a and 3b for men and

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[5] However, it should be noted that the LFS used in this paper cover a period of 4 years, during which the Greek economy was growing at a quite high rate.

Chart 3 Estimated rates of unemployment of broad education groups

pre-lyceum
lyceum
post-lyceum
TEI
AEI
postgraduate studies

a. Men
(%)

Years since graduation
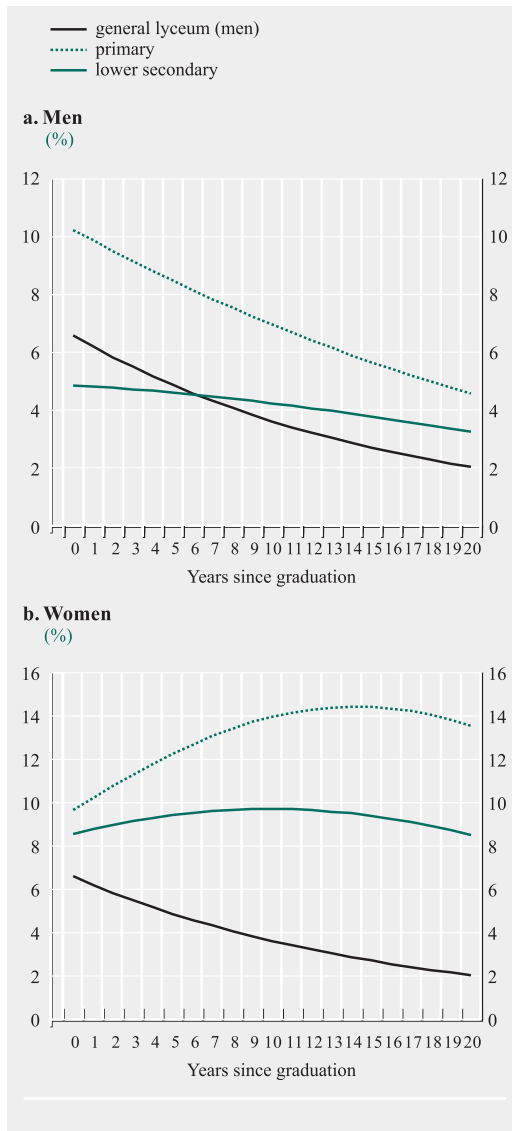
b. Women
(%)

Years since graduation

women, respectively. These charts show the estimated rate of unemployment (vertical axis)[6] as a function of the first 20 years since graduation from the highest education level completed (horizontal axis), after controlling for the effect of all other variables (family status, region, urbanisation, nationality, local rate of unemployment, etc.).[7] Similar charts are used in the remainder of this study.

Many interesting conclusions can be drawn from Charts 3a and 3b. Both men and women with low education level (pre-lyceum) begin with lower rates of unemployment compared to the other members of the sample right after their graduation, but their estimated rate of unemployment changes very slowly throughout their working life. Differences between lyceum and post-secondary non-tertiary graduates are negligible for women, while for men estimated rates of unemployment of post-secondary non-tertiary graduates are considerably higher than those of lyceum graduates in the first 5-6 years after graduation; differences get small thereafter. As regards tertiary education graduates, estimated rates of both male and female unemployment for a given number of years since graduation are lower for holders of postgraduate degrees, followed by AEI graduates and, finally, TEI graduates. However, while estimated rates of female unemployment of AEI graduates and holders of postgraduate degrees converge about 20 years after graduation, they never converge with the estimated rate of unemployment of TEI graduates. On the contrary, the difference in the estimated rates of male unemployment of AEI and TEI graduates is very small about 6 years after graduation and converges with the estimated rate of unemployment of postgraduate degree holders 12-13 years after graduation, at levels much lower than in other education levels.

The next seven charts, 4.1a to 4.7b, present the estimated rates of unemployment (one for men and one for women) as a function of the years since graduation, for homogeneous groups within education levels. Because the scale of the vertical axis (estimated rates of unemployment) does not always have the same length, all charts referring to education groups also include, for reasons of comparability, the estimated rate of unemployment of male lyceum graduates.

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6 It should be noted that the scale which measures the rate of unemployment is much "lengthier" in the case of women, since their estimated rates of unemployment were much higher than those of men.

7 In all likelihood, 20 years after graduation is the maximum period that young people consider when deciding on the level and specialty of their studies.

general lyceum (men)
primary
lower secondary

a. Men
(%)

Years since graduation

b. Women
(%)

Years since graduation

Charts 4.1a and 4.1b refer to groups with low educational qualifications: primary education and lower secondary education. It should be noted that most members of these groups are of relatively old age. The "primary education" category comprises both persons who have not finished primary school and primary school graduates who have additionally attended a few years of gymnasium. Male members of lower secondary education groups start off with a low rate of unemployment and their esti-

mated rate of unemployment changes little with time, while the rate of unemployment of primary education graduates remains at relatively high levels even many years after graduation. For female graduates of these two categories, the results are rather surprising, as the estimated rate of unemployment seems to increase in the first few years since graduation (especially for "primary education" graduates), before starting to decline.
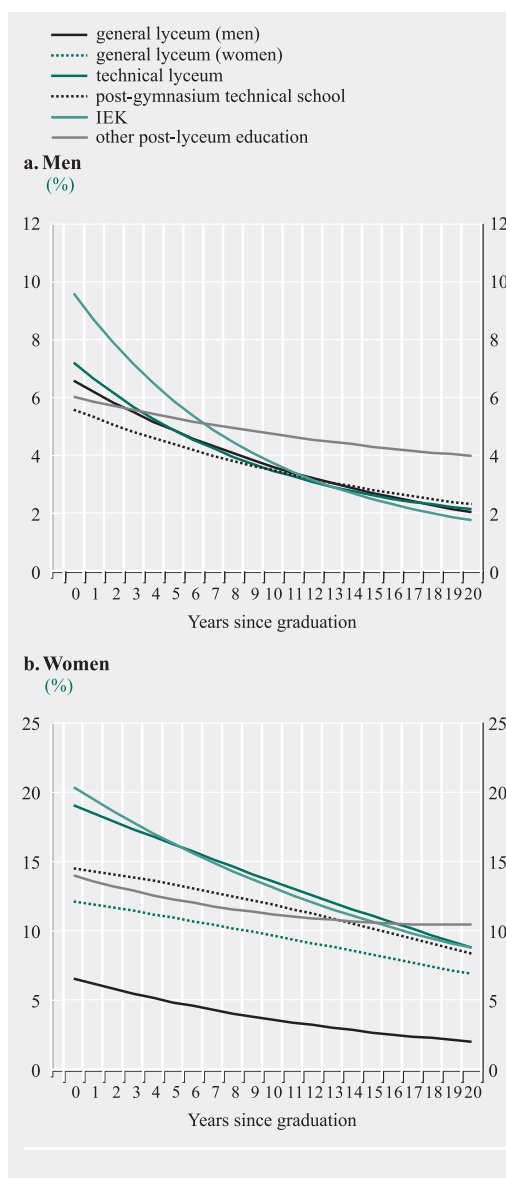
Charts 4.2a and 4.2b show the estimated rates of unemployment of higher secondary and post-secondary non-tertiary education graduates. Graduates of higher secondary education are grouped into three categories: general lyceum, technical lyceum and post-gymnasium technical schools. The first category also comprises persons who have not completed tertiary education studies; the second category consists of graduates from Technical Vocational Lyceums (TEL), Unified Multidisciplinary Lyceums (EPL) and Technical Vocational Institutes (TEE); and the third category comprises graduates from Technical Vocational Schools (TES), post-gymnasium foreman schools and post-gymnasium mercantile marine schools. Post-secondary non-tertiary education graduates are grouped into two categories: graduates from (public or private) Institutes of Vocational Training (IEK) and graduates from other post-secondary education. The latter category comprises graduates of colleges, dance schools, tourism, (non-university) foreign languages, mercantile marine officers, etc.

Differences between men and women in Charts 4.2a and 4.2b are noteworthy. For men, differences between general and technical lyceum graduates are negligible. Graduates of post-gymnasium technical schools are at a slightly better position in the first few years after graduation, but differences from the other levels of higher secondary education are eliminated about 6 years after graduation. Conversely, graduation from IEK or other post-secondary non-tertiary education establishment is associated with higher rates of unemployment than graduation from a higher

secondary education establishment. In the case of IEK, the estimated rates of unemployment converge with those of higher secondary education about 10 years after graduation, while in the case of graduates of other post-secondary establishments, the estimated rate of unemployment constantly diverges from that of higher secondary education graduates. As in almost all charts, the estimated rates of female unemployment in Chart 4.2b are higher than those of male unemployment for each education group of Chart 4.1a. In women, however, the lowest estimated rates of unemployment are recorded among general lyceum graduates. In the first 15 years after graduation, the rates of unemployment of female technical lyceum graduates are higher than those of post-gymnasium technical schools graduates and, as mentioned above, both are much higher than those of general lyceum graduates. Estimated rates of unemployment of IEK graduates and, to a lesser extent, other post-secondary establishments are very high and, in the case of other post- secondary establishments, diverge from the rates of unemployment of general lyceum graduates. The above results do not corroborate the view often expressed in public discourse on the need to boost technical education in order to combat youth unemployment in Greece.
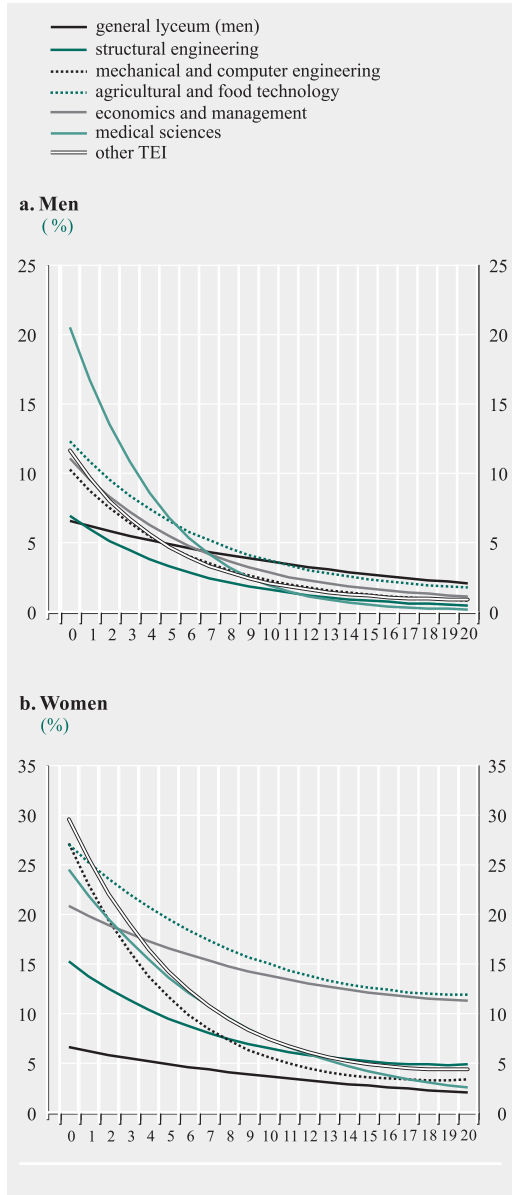
Charts 4.3a and 4.3b show the estimated rates of unemployment of TEI graduates (or, previously, KATEE, i.e. Centers of Higher Technical and Vocational Training). These graduates have been grouped into six categories. The first two categories have a technical orientation (Structural Engineering and Mechanical & Computer Engineering), the third one resulted from the merging of the graduates of Agricultural and Food Technology schools, the next two relate to graduates of Economics & Management and Medical (or Paramedical) Sciences, while the last one (other TEI) comprises Librarians, Social Workers and Applied Arts graduates. Due to the heterogeneity of the latter and the small number of observations, results concerning the category "other TEI" must be interpreted with caution.

Chart 4.2 Estimated rates of unemployment of graduates of higher secondary and post-lyceum non-tertiary education

— general lyceum (men)
········ general lyceum (women)
— technical lyceum
········ post-gymnasium technical school
— IEK
— other post-lyceum education

a. Men
(%)

Years since graduation

b. Women
(%)

Years since graduation

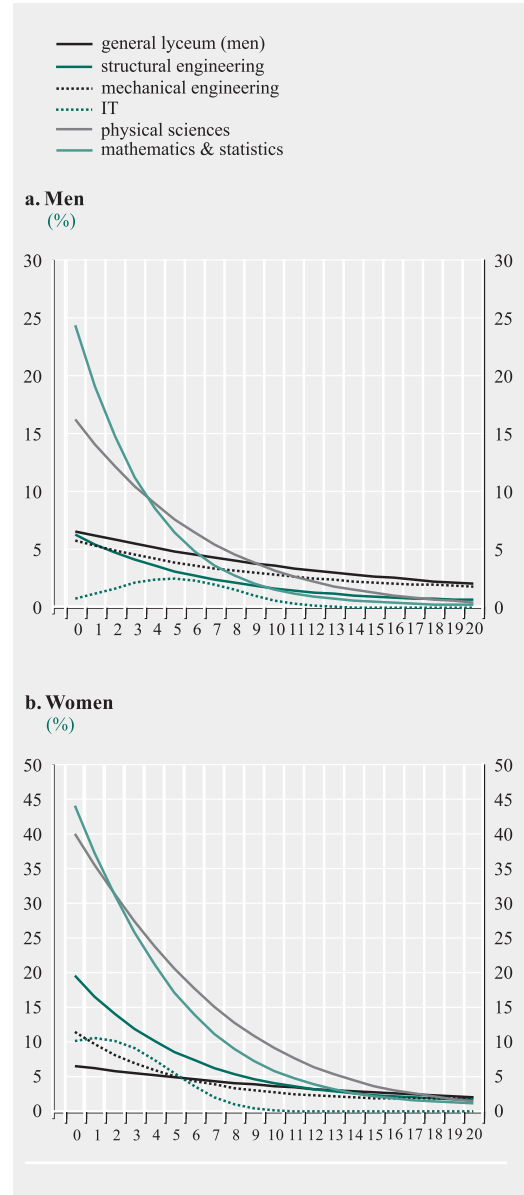For both male and female TEI graduates, the lowest estimated rates of unemployment are observed among technical school graduates. A relatively better position between the two groups is held by Structural Engineering graduates compared with Mechanical & Computer Engineering graduates (for women, this is true only for the first 7 years after graduation). Among men, Medical Sciences graduates begin with extremely high

Chart 4.3 Estimated rates of unemployment of TEI graduates

Chart 4.4 Estimated rates of unemployment of AEI graduates

general lyceum (men)
structural engineering
mechanical and computer engineering
agricultural and food technology
economics and management
medical sciences
other TEI

a. Men
(%)

b. Women
(%)

general lyceum (men)
structural engineering
mechanical engineering
IT
physical sciences
mathematics & statistics

a. Men
(%)

b. Women
(%)

rates of unemployment in the first few years after graduation, while rates of female unemployment among graduates of Agricultural & Food Technology and, to a lesser extent, Economics & Management begin with and remain at very high levels, even many years after graduation.

Because of the classification of AEI graduates (except for postgraduates) into a large number

of categories, the relevant results have been grouped and are presented in three sets of charts. Charts 4.4a and 4.4b show the estimated rates of unemployment of science graduates. More specifically, estimates are presented for two groups of technical schools graduates, i.e. (a) Structural Engineering and (b) Mechanical Engineering, as well as for (c) graduates of IT, (d) graduates of Physical Sciences and (e)

graduates of Mathematics & Statistics. The group of IT graduates is numerically small and includes relatively few individuals several years after their graduation; consequently, the corresponding results should be interpreted with caution. The main reason we decided to group IT graduates in a separate category is the frequency with which this particular group is mentioned in public discourse as an example of excessive demand in the labour market. Under Structural Engineering we have included graduates from schools such as Civil Engineering, Architecture, Topography, etc. Mechanical Engineering also includes graduates from Naval Architecture, Electrical Engineering, Chemical Engineering, Mineralogy, etc. Under Physical Sciences graduates from Physics, Chemistry, Biology (apart from Medical Biology) and Geology are included.

Among both men and women, the best performers are IT graduates (which confirms the references in public discourse), followed by — at least for the first years after graduation — Polytechnic School graduates (from Structural Engineering and Mechanical Engineering). On the other hand, male — and, to a much larger degree, female — graduates of Physical Sciences or Mathematics and Statistics start with extremely high estimated rates of unemployment. In the case of men, these rates drop dramatically after 5-10 years, while in the case of women, the rates remain very high even 10 years after graduation.

Charts 4.5a and 4.5b illustrate the estimated rates of unemployment for five groups of AEI graduates: (a) Medicine, (b) Horticulture & Forestry, (c) Law, (d) Economics & Management and (e) Social Sciences. Apart from Medical School graduates, the Medicine group also includes dentistry, pharmaceutical and veterinary graduates, while Social Sciences include Sociology, Psychology, Anthropology, etc.

Both male and female graduates of Law Schools have low rates of unemployment (in the case of men the rates are extremely low), even during the first years after graduation.

Chart 4.5 Estimated rates of unemployment of AEI graduates II
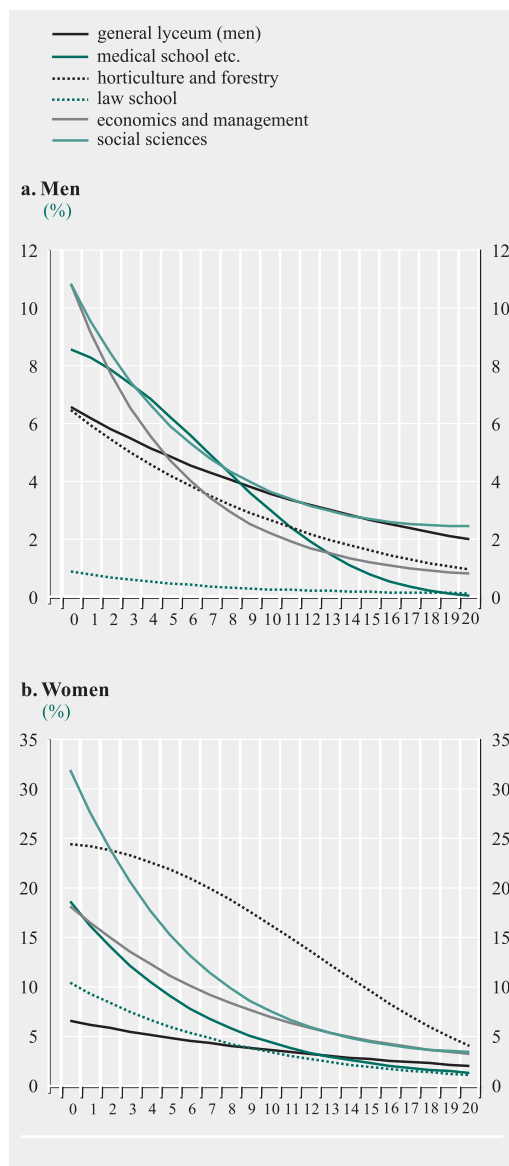
For Medical School graduates, the rates tend to get close to zero only many years after graduation. To illustrate this better, the estimated rates of unemployment of men in this group 8 years after graduation are higher than the respective rates of men who have graduated from a general lyceum. Female graduates of Horticulture & Forestry or Social Sciences also have high estimated rates of unemployment for many years after graduation.

a. Men
(%)

b. Women
(%)
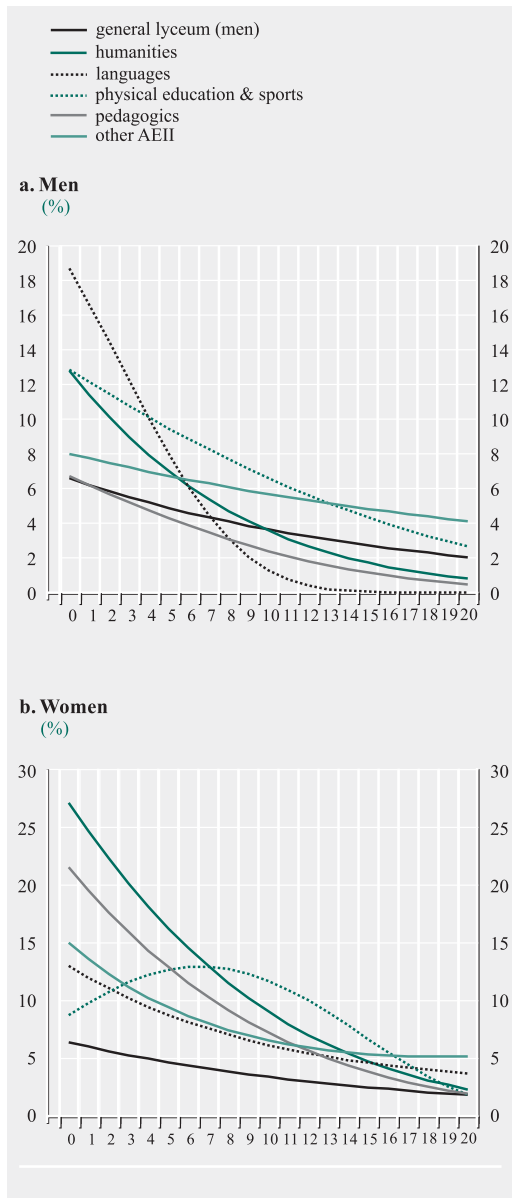
Finally, the estimated rates of unemployment of Economics & Management graduates lie in the middle of the range.

The third category of AEI graduates is that of "Instructors". Charts 4.6a and 4.6b show the estimated rates of unemployment for five groups of schools, namely Humanities, Languages, Physical Education & Sports, Pedagogics and other AEI. The latter includes Fine Arts, Medical Biology, Nursing, Dietetics, Journalism, Librarianship, Home Economics, etc. As in the case of TEI, the high degree of heterogeneity among the members of the group may render the interpretation of the corresponding results almost meaningless. The same applies to men who have graduated from Language Schools, since very few of them are included in the LFS sample. The Humanitarian Studies group includes graduates of Greek Literature, Philosophy, History, Archaeology, Theology, Music, Theatre, etc.

Among men, those with the best prospects appear to be the graduates of Pedagogics and among women the graduates of Languages. By contrast, male graduates of Physical Education seem to face high unemployment for many years after graduation. Among women, high rates of unemployment are observed for graduates of Humanitarian Studies and Pedagogics, especially during the first years after graduation. The shape of the curve for female graduates from Physical Education & Sports is rather surprising, as it implies a rise in the estimated unemployment rate in the first 7 years after graduation and a gradual decline thereafter.

Finally, Charts 4.7a and 4.7b show the results for individuals with postgraduate studies, separately for Master's degree holders (MA, MSc, MBA) and doctorate (PhD) holders. In the case of men, the estimated rates of unemployment of postgraduate degree holders start from unexpectedly high levels (7%-9% for the first year after graduation), but then drop rapidly. In the case of doctorate holders, their rates of unemployment come close to zero in less than 10 years after graduation, while in the case of Master's degree holders they drop below 5% about 5 years after graduation. As for women, differences between the two groups are very difficult to ascertain. Although compared to most groups of female tertiary education graduates their estimated rates of unemployment are lower, they seem to be quite high during the first years after graduation (for the first year, their estimated rate of unemploy-

ment is more than 17%), while even 20 years after graduation, their estimated rate of unemployment remains higher than that of male lyceum graduates, in the corresponding phase of their career.

Table 4 tackles the question "what is the estimated rate of unemployment 1, 3, 5 and 10 years after graduation, after isolating the impact of all other factors?" Many interesting conclusions can be drawn from the results reported there and we have already mentioned some of them. Let us start from the groupings according to education level. Both men and women with basic or lower education have the lowest estimated rates of unemployment one year after the completion of their studies. This is not surprising, as most drop-outs leave school because they have already found a job. Coming to 3, 5 and 10 years after graduation, the lowest rates of unemployment are registered for the group with very high educational qualifications (postgraduate degree holders). As years go by, the relative position of tertiary education graduates improves and AEI graduates are (in general) in a better position than TEI graduates.

At this point we should make two more remarks. First, even if the impact of all other factors is eliminated, the relative position of women in general —and of female higher education graduates in particular— is much worse than that of men. For instance, even 10 years after graduation, when the estimated rate of male unemployment drops to 2.6% for both AEI and TEI graduates, the rates for women are 7.0% for AEI graduates and 9.9% for TEI graduates. Similar differences are also evident among graduates of other education levels. Second, there exist very large differences across groups within specific education levels. Referring to tertiary education alone, one can see the differences in the estimated rates of unemployment in all three time periods (immediately after graduation, after 3 years and after 5 years) for both male and female graduates of Physical Sciences and Mathematics & Statistics on the one hand and Law

Chart 4.7 Estimated rates of unemployment of individuals with postgraduate studies
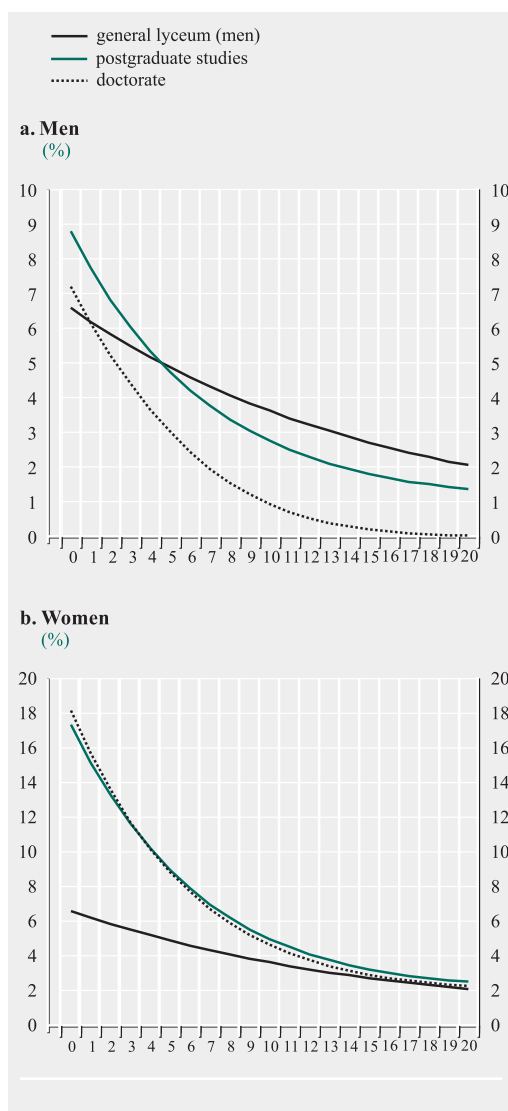
and IT on the other. However, even if a higher education degree shields against unemployment in the long run, Table 4 shows that this does not apply to all graduates. For instance, even 10 years after graduation, the estimated rates of unemployment for women who have graduated from Horticulture & Forestry or Physical Sciences (AEI) as well as from Agricultural & Food Technology or Economics & Management (TEI) are considerably higher than 10%.
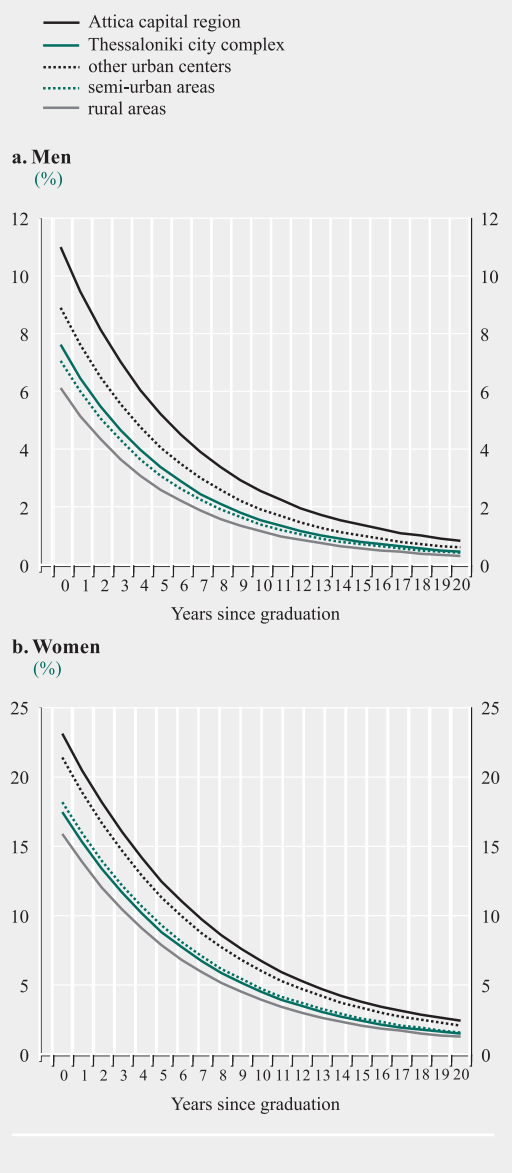
Table 4 Estimated rate of unemployment as a function of years since graduation

	Men				Women			
	Years since graduation				Years since graduation			
Education level	<1	3	5	10	<1	3	5	10
Pre-lyceum education	**7.1**	**6.4**	**6.0**	**5.2**	**17.0**	**17.4**	**17.4**	**17.0**
Primary	9.6	8.7	8.1	6.8	9.9	11.6	12.6	14.3
Lower secondary	4.9	4.8	4.6	4.3	8.6	9.2	9.5	9.8
Lyceum	**8.1**	**6.4**	**5.5**	**3.8**	**27.0**	**22.5**	**19.8**	**14.5**
General lyceum	6.6	5.5	4.9	3.6	12.2	11.5	11.0	9.7
Technical lyceum	7.3	5.7	4.9	3.5	19.2	17.5	16.3	13.6
Post-gymnasium technical school	5.6	4.9	4.4	3.5	14.6	13.9	13.4	12.0
Post-lyceum non-tertiary education	**10.3**	**7.6**	**6.3**	**4.0**	**24.9**	**20.6**	**18.3**	**13.7**
IEK	9.7	7.2	5.9	3.8	20.5	17.9	16.4	13.2
Other post-lyceum education	6.1	5.6	5.3	4.8	14.0	13.0	12.4	11.3
TEI	**12.4**	**7.6**	**5.5**	**2.6**	**27.2**	**19.7**	**16.0**	**9.9**
Structural Engineering	6.9	4.4	3.3	1.6	15.3	11.4	9.5	6.5
Mechanical & Computer Engineering	10.3	6.4	4.7	2.3	27.3	16.4	11.7	5.6
Agricultural & Food Technology	12.4	8.4	6.6	3.7	27.1	22.2	19.6	15.1
Economics & Management	11.1	7.2	5.5	2.8	20.9	18.2	16.7	13.9
Medical Sciences	20.7	10.9	6.8	1.9	24.6	17.4	13.7	7.5
Other TEI	11.7	6.7	4.7	2.1	29.7	19.1	14.3	7.5
AEI	**10.9**	**7.0**	**5.2**	**2.6**	**24.8**	**17.1**	**13.2**	**7.0**
Structural Engineering	6.4	4.2	3.2	1.7	19.6	12.0	8.6	4.1
Mechanical Engineering	5.8	4.6	3.9	2.8	11.5	7.0	5.1	2.7
IT	0.7	2.1	2.5	0.6	10.1	9.1	5.5	0.1
Physical Sciences	16.3	10.5	7.7	3.3	40.1	27.4	20.6	9.2
Mathematics & Statistics	24.5	11.3	6.5	1.6	44.1	25.9	17.2	5.9
Medical School etc.	8.6	7.5	6.3	3.0	18.7	12.2	9.1	4.4
Horticulture & Forestry	6.5	5.1	4.3	2.7	24.5	23.4	21.9	16.4
Law School	1.0	0.7	0.5	0.3	10.4	7.6	6.1	3.4
Economics & Management	10.9	6.6	4.8	2.3	18.3	13.6	11.2	7.0
Social Sciences	10.9	7.5	6.0	3.7	32.0	20.7	15.4	7.6
Humanities	12.9	9.0	7.0	3.6	27.3	20.3	16.5	9.3
Languages	18.7	12.3	8.0	1.3	13.2	10.4	9.0	6.4
Physical Education & Sports	12.9	10.8	9.5	6.6	9.0	11.8	12.9	11.9
Pedagogics	6.7	5.2	4.3	2.4	21.7	16.1	13.1	7.5
Other AEI	8.0	7.2	6.8	5.7	15.2	11.4	9.6	6.8
Postgraduate studies	**9.2**	**5.9**	**4.3**	**2.2**	**18.4**	**11.9**	**9.0**	**4.8**
Postgraduate degree	8.8	6.1	4.8	2.8	17.4	11.7	9.0	5.0
Doctorate	7.2	4.4	3.0	0.9	18.2	11.8	8.9	4.7

Table 5 attempts to answer the question "after how many years would the estimated rate of unemployment drop to 2%, 4% and 6%?". Undoubtedly, 2% can be considered to fall within frictional unemployment, many economists would consider 4% to fall within the natural rate of unemployment and, given the current conditions prevailing in the Greek economy, 6% can be considered a relatively satisfactory rate of unemployment. In Table 5 it is assumed that 40 years after graduation is the maximum time period that an individual remains in the labour market. The sample of the LFS used in our analysis includes a few persons who were less than 65 years old and reported that they had reached their highest education achievement 40 years earlier. In any case, the vast majority exits the labour market in less than 40 years after the completion of studies.

Women reach the 6% threshold after 18, 12 and 9 years from the completion of their TEI, AEI and postgraduate studies respectively. The estimated rates of 4% are reached only by female graduates of AEI and postgraduate studies, while 2% is reached only by AEI graduates (23 years after graduation) and not by female postgraduates. Men reach the estimated rates of unemployment much sooner than women and, in general, the higher the education level, the fewer the years required for the attainment of these levels. Again, the differences across education groups within the same level are very large. At the tertiary education level, men are close to 2% already from the first year after graduation from IT and Law Schools, but never after obtaining a degree in Social Sciences. Additionally, while the rate of unemployment is less than 6% already from the first year since graduation from IT, Law, Structural Engineering (both AEI and TEI) and Mechanical Engineering, or again already from the second year since graduation from Horticulture & Forestry and Languages, it usually takes graduates of Physical Education & Sports 12 whole years to reach the same levels. As regards women, the rate of unemployment drops to 2% in 10 years after graduation from IT Schools. According to our estimates, female

Chart 5.1 Estimated rates of unemployment of AEI graduates by degree of urbanisation

— Attica capital region
— Thessaloniki city complex
······ other urban centers
······ semi-urban areas
— rural areas

a. Men
(%)

Years since graduation

b. Women
(%)

Years since graduation

graduates of Economics & Management, Social Sciences and Languages (AEI), graduates of any TEI (excluding Medical Sciences) and holders of Master's degrees and doctorates do not fall below these unemployment rates within the period of 40 years after graduation.

The last part of our empirical results is presented through charts and deals with the

Table 5 Years until the estimated rate of unemployment drops to 2%, 4% and 6%

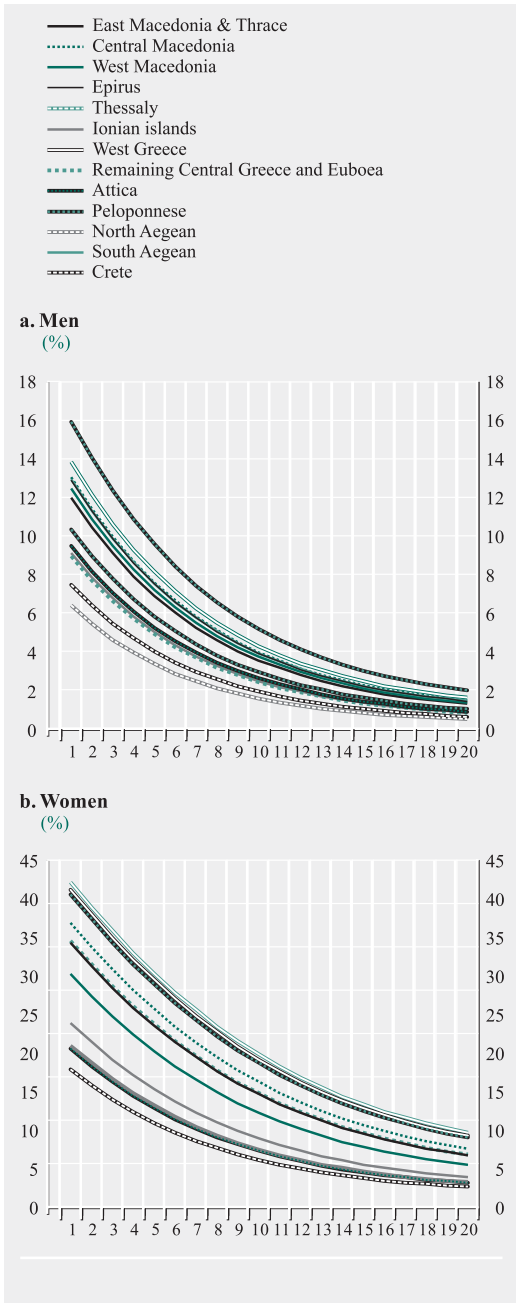|	Men			Women		
	Years until the estimated rate of unemployment drops to			Years until the estimated rate of unemployment drops to		
Education groups	**2%**	**4%**	**6%**	**2%**	**4%**	**6%**
Before lyceum	**38**	**18**	**6**	**40+**	**40+**	**38**
Primary school	39	24	14	40+	39	35
Gymnasium	32	13	1	40+	36	29
Lyceum	**21**	**10**	**4**	**40+**	**40**	**27**
General lyceum	21	9	2	40+	32	24
Technical lyceum	23	8	3	40+	35	28
Post-gymnasium technical school	25	8	1	40+	33	27
Post-lyceum non-tertiary education	**21**	**11**	**6**	**40+**	**40+**	**40+**
IEK (post-lyceum vocational training institute)	19	10	5	40+	40+	33
Other post-lyceum education	40+	21	1	40+	40+	40+
TEI (Technological Educational Institutes)	**12**	**8**	**5**	**40+**	**40+**	**18**
Structural Engineering	9	4	1	40+	40+	12
Mechanical & Computer Engineering	11	7	4	40+	14	10
Agricultural & Food Technology	18	10	6	40+	40+	40+
Economics & Management	14	8	5	40+	40+	40+
Medical Sciences	10	8	6	23	16	12
Other TEI	11	6	4	40+	40+	13
AEI (Universities)	**13**	**7**	**5**	**23**	**15**	**12**
Structural Engineering	9	4	1	18	11	8
Mechanical Engineering	18	5	1	15	7	4
IT	1	1	1	8	6	5
Physical Sciences	13	9	7	19	15	13
Mathematics & Statistics	10	7	6	16	12	10
Medical School etc.	12	9	6	17	11	8
Horticulture & Forestry	14	6	2	23	21	19
Law School	1	1	1	15	9	6
Economics & Management	11	7	4	40+	17	12
Social Sciences	40+	10	5	40+	17	13
Humanities	15	10	7	22	17	14
Languages	10	8	7	40+	20	12
Physical Education & Sports	23	16	12	21	18	16
Pedagogics	12	6	2	21	16	12
Other AEI	40+	21	9	40+	40+	13
Postgraduate studies	**11**	**6**	**3**	**40+**	**12**	**9**
Postgraduate degree	14	7	4	40+	13	9
Doctorate	7	4	2	40+	12	8

impact of three factors on the probability of unemployment. These factors are: nationality, region and urbanisation level of the place of residence. The results are set forth in Charts 5.1a through to 5.3b, separately for men and women, and involve all AEI graduates. As the terms of the equation are introduced as dummy variables, the respective curves do not intersect.

Charts 5.1a and 5.1b depict the estimated unemployment rates for male and female graduates of AEI, in relation to the degree of urbanisation of their place of residence, holding constant the impact of other factors. Both men and women residing in Athens or another urban center (apart from Thessaloniki) face considerably higher rates of unemployment, especially during the first years after graduation. On the other hand, residence in rural areas is associated with lower rates of unemployment. It is quite possible — but cannot be ascertained by our results — that the negative (positive) impact of living in a rural area (large urban centre) on the rate of unemployment can be attributed to the excess demand (supply) of labour in those areas. This finding may also be related to the high level of underemployment in rural areas.

Charts 5.2a and 5.2b repeat the same procedure for the 13 regions of the country. The results are quite similar for men and women. Residents in Thessaly, Western Greece and Central Macedonia (men) or the Peloponnese (women) face higher rates of unemployment. By contrast, residing in Crete, the islands of the North Aegean, the remaining Central Greece and Euboea (men) or Attica (women) is associated with lower rates of unemployment. It should be noted that differences in the estimated regional rates of unemployment are considerably high, especially in the first years after graduation.

Finally, Charts 5.3a and 5.3b show the estimated rates of unemployment for AEI graduates according to the years after graduation, separately for men and women, on the basis of

Chart 5.2 Estimated rates of unemployment of AEI graduates by region

- East Macedonia & Thrace
- Central Macedonia
- West Macedonia
- Epirus
- Thessaly
- Ionian islands
- West Greece
- Remaining Central Greece and Euboea
- Attica
- Peloponnese
- North Aegean
- South Aegean
- Crete

a. Men
(%)

b. Women
(%)

their nationality. The LFS sample is divided into three categories: Greek nationals, other EU countries' nationals and non-EU nationals. The estimated rate of unemployment of Greek men is considerably higher than the rates of the other two groups. By contrast, Greek women

Greek nationals
other EU countries' nationals
non-EU nationals

a. Men
(%)

Years since graduation

b. Women
(%)

Years since graduation
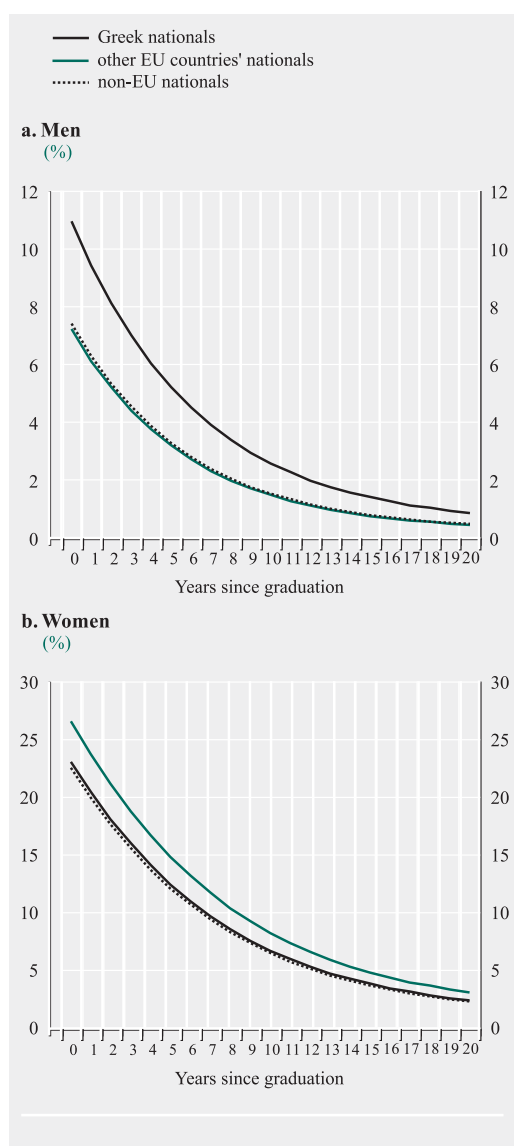
and non-EU women face the same unemploy-
ment rates, while the estimated unemployment
rate of women from EU countries other than
Greece is slightly higher.

5 CONCLUSIONS

According to Georganta, Kandilorou and
Livada (2008), 58% of second-year students of

the Athens University of Economics and Busi-
ness and the University of Macedonia
reported that they decided to pursue tertiary
education in order to find a better-paid job
more easily (the "better-paid" part will be the
subject of another study). Can our findings jus-
tify the "more easily" part? In other words, can
tertiary education shield against unemploy-
ment? The results of our analysis show that
these students took a very rational decision, as
better educational qualifications seem to be
quite effective in shielding against unemploy-
ment, even if it is only in the long run. It should
also be noted that Schools whose graduates
experience the lowest unemployment rates are
the most popular ones among tertiary educa-
tion applicants.

This study has yielded other findings as well.
Some of these findings are consistent with the
results of previous studies. However, as it
becomes clear from the review of the second
section, empirical studies on youth unemploy-
ment in Greece show divergent results. The
first finding of the present paper is that the dis-
course on youth unemployment is rather mis-
placed. The problem is not quite a problem of
youth unemployment, but a problem of tran-
sition from education to the labour market,
irrespective of age. It also involves graduates
of all education levels, not only tertiary edu-
cation. The difference between tertiary edu-
cation graduates and graduates of lower edu-
cation levels is that the unemployment rates of
the first drop to acceptable levels a few years
after graduation, while for the latter the pace
of this decline is substantially slower and unem-
ployment rates converge to higher levels. This
is the second significant finding of our paper.
In general, the higher the education level (TEI,
AEI, postgraduate studies) the lower the rate
of unemployment in the long run.

The third finding relates to the very significant
differences within education levels. Some
groups of graduates face no real problems after
graduating (from IT and Law Schools – at least
the male graduates), others run a serious risk
of unemployment for a relatively small number

of years after graduation (Physical Sciences, Mathematics & Statistics), while others face a serious problem of unemployment for several years after graduation (Physical Education & Sports, Social Sciences and several TEI Schools). The last finding of the study is that, *ceteris paribus*, women in general, and female tertiary education graduates in particular, face a significantly higher risk of unemployment compared to male graduates with similar educational qualifications. For certain categories of female tertiary education graduates, the estimated unemployment rates are exceptionally high, even several years after graduation (AEI: Horticulture & Forestry, Physical Education & Sports; TEI: Agricultural & Food Technology, Economics & Management).

Would it be possible to generalise the above results and extrapolate them to the future? Possibly yes, but that would be too risky because of ever-changing circumstances. Tertiary education in Greece —like in most OECD countries— has expanded rapidly in the past 15 years. A recent OECD report concludes that demand for tertiary education will increase in the years to come. The recent economic crisis and the recession could possibly push more young people to remain in education as, in most countries, the pay gap between tertiary education graduates and people with lower education keeps widening (OECD, 2009).

In Greece, the number of places available in AEI and TEI for students accounts for more than 80% of the corresponding (annual) demographic cohort. Of course, many places remain vacant and some students never graduate. But even if these two factors are taken into consideration, the share of tertiary education graduates in recent cohorts is substantially higher than in previous ones. Would this imply that the increased supply of graduates —which is expected to continue in the next years— will lead to a more permanent increase in the graduate unemployment rate, or that graduate unemployment is not just a temporary phenomenon, as described in this study? The answer to this depends on a number of factors,

as for example whether enterprises in Greece will increase their demand in high-skilled human capital or whether they will be willing to recruit graduate labour to fill positions where higher education qualifications are not required (Kikilias, 2008). If these prospects do not materialise, and if there is no significant brain drain, then we may witness higher rates of graduate unemployment and the phenomenon of graduate unemployment may turn out to be more permanent (Karamessini, 2003).

Finally, there are a number of policy implications stemming from our results. It is obvious that all curricula, especially in tertiary education, have to be upgraded and linked to the knowledge society and the labour market. They should provide young people with the necessary skills to creatively address the great challenges of modern world. Their content must focus on the development of cutting-edge and high-demand skills that respond to the needs of the Greek labour market, thus contributing in effectively shielding from unemployment. Mechanisms linking education to the labour market could also contribute to the achievement of this goal since, as confirmed by our analysis, the main problem is not youth unemployment but the transition from education to the labour market, irrespective of age. The effective operation and upgrading of such mechanisms, e.g. the National System for Linking Vocational Education and Training to Employment, the Career Offices of AEI and TEI and the services of the Greek Manpower Employment Organisation (OAED), could help curb the problem of youth and graduate unemployment. Private human resources management firms may also play an important role. However, contrary to what happens in other countries, the small number of such enterprises in Greece focuses on recruiting high-skilled executives primarily on behalf of multinational corporations. This is probably due to the structure of the Greek economy, with its large number of small and medium-sized enterprises, which do not turn to specialised (especially private) entities to cover their needs in human resources.

ANNEX

Table A1 MALE – Estimated probability of unemployment

Dependent variable: unemployed=1

Independent variables	Coefficient	
Single parent with children – male	0.2322	
Single parent with children and other members – male	0.6288	***
Couple with children – male	0.0029	
Couple with children and other members – male	0.3106	***
Single male	0.1746	***
Couple without children – male	Reference group	
Other type of household, single parent (without children) – male	0.5408	***
Other type of household, couple (without children) – male	0.4359	***
Primary or lower education	0.2393	**
Lower secondary education	-0.1521	*
General Lyceum	Reference group	
Technical Lyceum	0.0475	
Post-gymnasium technical school	-0.0827	
IEK	0.2024	**
Other post-lyceum education	-0.0453	
Structural Engineering (TEI)	0.0228	
Mechanical & Computer Engineering (TEI)	0.2402	
Agricultural & Food Technology (TEI)	0.3476	
Economics & Management (TEI)	0.2827	*
Other TEI	0.3133	
Medical Sciences (TEI)	0.6851	**
Structural Engineering	-0.0210	
Mechanical Engineering	-0.0659	
Other AEI	0.1017	
IT	-0.9305	
Horticulture & Forestry	-0.0078	
Medical School etc.	0.1395	
Physical Sciences	0.5213	*
Mathematics & Statistics	0.8121	**
Law School	-0.8395	*
Economics & Management	0.2698	**
Social Sciences	0.2705	
Humanities	0.3698	
Languages	0.6157	
Physical Education & Sports	0.3725	
Pedagogics	0.0076	
Postgraduate degree	0.1547	
Doctorate	0.0456	

*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table A1 MALE – Estimated probability of unemployment (continued)

Dependent variable: unemployed=1

Independent variables	Coefficient	
Years since graduation x Primary or lower education	0.0100	
Years since graduation x Lower secondary education	0.0275	***
Years since graduation x General Lyceum	Reference group	
Years since graduation x Technical Lyceum	-0.0115	
Years since graduation x Post-gymnasium technical school	0.0065	
Years since graduation x IEK	-0.0243	*
Years since graduation x Other post-lyceum education	0.0174	
Years since graduation x Structural Engineering (TEI)	-0.0454	
Years since graduation x Mechanical & Computer Engineering (TEI)	-0.0589	**
Years since graduation x Agricultural & Food Technology (TEI)	-0.0468	
Years since graduation x Economics & Management (TEI)	-0.0524	*
Years since graduation x Other TEI	-0.0783	
Years since graduation x Medical Sciences (TEI)	-0.1116	*
Years since graduation x Structural Engineering	-0.0418	
Years since graduation x Mechanical Engineering	-0.0104	
Years since graduation x Other AEI	0.0122	
Years since graduation x IT	0.2280	
Years since graduation x Horticulture & Forestry	-0.0111	
Years since graduation x Medical School etc.	0.0153	
Years since graduation x Physical Sciences	-0.0603	
Years since graduation x Mathematics & Statistics	-0.1527	**
Years since graduation x Law School	-0.0152	
Years since graduation x Economics & Management	-0.0655	***
Years since graduation x Social Sciences	-0.0431	
Years since graduation x Humanities	-0.0385	
Years since graduation x Languages	-0.0410	
Years since graduation x Physical Education & Sports	-0.0033	
Years since graduation x Pedagogics	-0.0093	
Years since graduation x Postgraduate degree	-0.0396	
Years since graduation x Doctorate	-0.0469	

*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table A1 MALE – Estimated probability of unemployment (continued)

Dependent variable: unemployed=1

Independent variables	Coefficient	
Years since graduation sqrd./100 x Primary or lower education	-0.0209	
Years since graduation sqrd./100 x Lower secondary education	-0.0498	**
Years since graduation sqrd./100 x General Lyceum	Reference group	
Years since graduation sqrd./100 x Technical Lyceum	0.0504	
Years since graduation sqrd./100 x Post-gymnasium technical school	0.0008	
Years since graduation sqrd./100 x IEK	0.0561	
Years since graduation sqrd./100 x Other post-lyceum education	-0.0026	
Years since graduation sqrd./100 x Structural Engineering (TEI)	0.0763	
Years since graduation sqrd./100 x Mechanical & Computer Engineering (TEI)	0.1438	**
Years since graduation sqrd./100 x Agricultural & Food Technology (TEI)	0.1290	
Years since graduation sqrd./100 x Economics & Management (TEI)	0.1311	
Years since graduation sqrd./100 x Other TEI	0.2277	
Years since graduation sqrd./100 x Medical Sciences (TEI)	0.1535	
Years since graduation sqrd./100 x Structural Engineering	0.1053	
Years since graduation sqrd./100 x Mechanical Engineering	0.0577	
Years since graduation sqrd./100 x Other AEI	-0.0102	
Years since graduation sqrd./100 x IT	-2.0429	
Years since graduation sqrd./100 x Horticulture & Forestry	-0.0133	
Years since graduation sqrd./100 x Medical School etc.	-0.3710	
Years since graduation sqrd./100 x Physical Sciences	0.0319	
Years since graduation sqrd./100 x Mathematics & Statistics	0.3621	**
Years since graduation sqrd./100 x Law School	0.0713	
Years since graduation sqrd./100 x Economics & Management	0.1761	***
Years since graduation sqrd./100 x Social Sciences	0.1690	
Years since graduation sqrd./100 x Humanities	0.0074	
Years since graduation sqrd./100 x Languages	-0.6442	
Years since graduation sqrd./100 x Physical Education & Sports	-0.0494	
Years since graduation sqrd./100 x Pedagogics	-0.0969	
Years since graduation sqrd./100 x Postgraduate degree	0.1188	
Years since graduation sqrd./100 x Doctorate	-0.1342	
Years since graduation	-0.0311	***
Years since graduation sqrd./100	0.0213	

*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table A1 MALE – Estimated probability of unemployment (continued)

Dependent variable: unemployed=1

Independent variables	Coefficient	
Greek national	Reference group	
Other EU national	-0.2253	
Third country national	-0.2265	***
East Macedonia–Thrace	0.1591	***
Central Macedonia	0.1442	***
West Macedonia	0.1558	**
Epirus	0.1578	***
Thessaly	0.1090	**
Ionian Islands	0.2150	***
West Greece	0.0682	
Central Greece and Euboea	0.0949	**
Attica	Reference group	
Peloponnese	0.1173	***
North Aegean	0.0375	
South Aegean	0.2027	***
Crete	0.1552	***
Capital region – Attica	Reference group	
City complex – Thessaloniki	-0.1974	***
Other urban areas	-0.1154	***
Semi-urban areas	-0.2366	***
Rural areas	-0.3146	***
First year of survey (2004)	-0.0644	**
Second year of survey (2005)	-0.0190	
Third year of survey (2006)	-0.0154	
Fourth year of survey (2007)	Reference group	
1st quarter	0.0260	
2nd quarter	-0.0206	
3rd quarter	Reference group	
4th quarter	0.0343	
Regional rate of unemployment	5.2382	***
Constant term	-1.8455	***

*** Statistically important coefficient at importance level 1%
**   Statistically important coefficient at importance level 5%
*   Statistically important coefficient at importance level 10%

Table B1 MALE – Estimated probability of participation in labour force

Dependent variable: labour force participant=1

Independent variables	Coefficient	
Single parent with children (0 aged up to 5, 1+ aged 6-17) – male	-0.8720	***
Single parent with children (1+ aged up to 5, 0+ aged 6-17) – male	-0.4188	
Single parent with children (0 aged up to 5, 1 aged 6-17) and other members – male	-0.1822	**
Single parent with children (0 aged up to 5, 2 aged 6-17) and other members and Single parent with children (0+ aged up to 5, other aged 6-17) and other members – male	0.2099	
Couple with children (0 aged up to 5, 1 aged 6-17) – male	-0.2698	***
Couple with children (0 aged up to 5, 2 aged 6-17) – male	-0.3715	***
Couple with children (0 aged up to 5, 3+ aged 6-17) – male	-0.5677	***
Couple with children (1 aged up to 5, 0 aged 6-17) – male	0.9621	***
Couple with children (1 aged up to 5, 1 aged 6-17) – male	0.4873	***
Couple with children (1 aged up to 5, 2 aged 6-17) – male	-0.1258	
Couple with children (1 aged up to 5, 3+ aged 6-17) – male	-0.4203	***
Couple with children (2 aged up to 5, 0 aged 6-17) – male	0.6096	***
Couple with children (2 aged up to 5, 1 aged 6-17) and Couple with children (2 aged up to 5, 2 aged 6-17) and Couple with children (2 aged up to 5, 3+ aged 6-17) – male	0.4779	***
Couple with children (3+ aged up to 5, 0+ aged 6-17) – male	0.3124	
Couple with children (0 aged up to 5, 1 aged 6-17) and other members – male	-0.1442	***
Couple with children (0 aged up to 5, 2 aged 6-17) and other members – male	-0.2168	***
Couple with children (0 aged up to 5, 3+ aged 6-17) and other members – male	-0.4081	***
Couple with children (1 aged up to 5, 0 aged 6-17) and other members – male	0.3859	***
Couple with children (1 aged up to 5, 1 aged 6-17) and other members – male	-0.0453	
Couple with children (1 aged up to 5, 2 aged 6-17) and other members – male	-0.3340	
Couple with children (1 aged up to 5, 3+ aged 6-17) and other members and Couple with children (2+ aged up to 5, 0+ aged 6-17) and other members – male	0.1775	
Single male	-0.2780	***
Couple without children – male	Reference group	
Other type of household, single parent (without children) – male	0.0752	**
Other type of household, couple (without children) – male	0.0989	***
Primary or lower education	0.9370	***
Lower secondary education	-0.1058	***
General Lyceum	Reference group	
Technical Lyceum	0.5414	***
TEI	0.9062	***
AEI	0.5051	***
Postgraduate degree	1.2741	***
Years since graduation	0.2280	***
Years since graduation sqrd./100	-0.4791	***

Note: Wald test (rho = 0): $x^2(1) = 21.80$ Prob $> x^2 = 0.0000$.
*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table B1 MALE – Estimated probability of participation in labour force (continued)

Dependent variable: labour force participant=1

Independent variables	Coefficient	
Eastern Macedonia–Thrace	-0.0539	
Central Macedonia	-0.0167	
Western Macedonia	-0.2810	***
Epirus	-0.1581	***
Thessaly	0.0655	*
Ionian Islands	-0.1276	**
Western Greece	-0.1348	***
Central Greece and Euboea	-0.0373	
Attica	Reference group	
Peloponnese	0.0196	
North Aegean	-0.1632	***
South Aegean	0.0359	
Crete	-0.0572	*
Attica capital region	Reference group	
Thessaloniki city complex	-0.0090	
Other urban areas	0.0581	**
Semi-urban areas	0.2506	***
Rural areas	0.3917	***
First year of survey (2004)	-0.0118	
Second year of survey (2005)	-0.0037	
Third year of survey (2006)	-0.0063	
Fourth year of survey (2007)	Reference group	
1st quarter	-0.0257	
2nd quarter	-0.0220	
3rd quarter	Reference group	
4th quarter	0.0133	
Constant term	-0.7881	***
/athrho	0.5143	***
rho	0.4733	

Note: Wald test (rho = 0): $x^2(1) = 21.80$ Prob > $x^2 = 0.0000$.
*** Statistically important coefficient at importance level 1%
**   Statistically important coefficient at importance level 5%
*   Statistically important coefficient at importance level 10%

Table A2 FEMALE – Estimated probability of unemployment

Dependent variable: unemployed=1

Independent variables	Coefficient	
Single parent with children – female	0.2290	***
Single parent with children and other members – female	0.3122	***
Couple with children – female	0.0425	
Couple with children and other members – female	0.1301	***
Single female	-0.0417	
Couple without children – female	Reference group	
Other type of household, single parent (without children) – female	0.2758	***
Other type of household, couple (without children) – female	0.2364	***
Primary or lower education	-0.1336	
Lower secondary education	-0.1995	**
General Lyceum	Reference group	
Technical Lyceum	0.2934	***
Post-gymnasium technical school	0.1110	
IEK	0.3416	***
Other post-lyceum education	0.0879	
Structural Engineering (TEI)	0.1420	
Mechanical & Computer Engineering (TEI)	0.5612	***
Agricultural & Food Technology (TEI)	0.5574	***
Economics & Management (TEI)	0.3562	***
Other TEI	0.6333	**
Medical Sciences (TEI)	0.4790	***
Structural Engineering	0.3091	
Mechanical Engineering	-0.0333	
Other AEI	0.1390	
IT	-0.1075	
Horticulture & Forestry	0.4771	
Medical School etc.	0.2780	
Physical Sciences	0.9142	***
Mathematics & Statistics	1.0191	***
Law School	-0.0904	
Economics & Management	0.2610	**
Social Sciences	0.6999	***
Humanities	0.5627	***
Languages	0.0490	
Physical Education & Sports	-0.1760	
Pedagogics	0.3841	**
Postgraduate degree	0.2291	
Doctorate	0.2596	

*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table A2 FEMALE – Estimated probability of unemployment (continued)

Dependent variable: unemployed=1

Independent variables	Coefficient	
Years since graduation x Primary or lower education	0.0446	***
Years since graduation x Lower secondary education	0.0246	***
Years since graduation x General Lyceum	Reference group	
Years since graduation x Technical Lyceum	-0.0104	
Years since graduation x Post-gymnasium technical school	0.0023	
Years since graduation x IEK	-0.0219	**
Years since graduation x Other post-lyceum education	-0.0075	
Years since graduation x Structural Engineering (TEI)	-0.0549	
Years since graduation x Mechanical & Computer Engineering (TEI)	-0.1250	***
Years since graduation x Agricultural & Food Technology (TEI)	-0.0459	
Years since graduation x Economics & Management (TEI)	-0.0247	
Years since graduation x Other TEI	-0.1123	**
Years since graduation x Medical Sciences (TEI)	-0.0763	***
Years since graduation x Structural Engineering	-0.1036	***
Years since graduation x Mechanical Engineering	-0.0910	*
Years since graduation x Other AEI	-0.0534	
Years since graduation x IT	0.0570	
Years since graduation x Horticulture & Forestry	0.0055	
Years since graduation x Medical School etc.	-0.0860	***
Years since graduation x Physical Sciences	-0.1088	**
Years since graduation x Mathematics & Statistics	-0.1669	***
Years since graduation x Law School	-0.0504	
Years since graduation x Economics & Management	-0.0560	***
Years since graduation x Social Sciences	-0.1145	***
Years since graduation x Humanities	-0.0661	***
Years since graduation x Languages	-0.0385	
Years since graduation x Physical Education & Sports	0.0785	
Years since graduation x Pedagogics	-0.0593	
Years since graduation x Postgraduate degree	-0.0801	**
Years since graduation x Doctorate	-0.0890	*

*** Statistically important coefficient at importance level 1%
**   Statistically important coefficient at importance level 5%
*   Statistically important coefficient at importance level 10%

Table A2 FEMALE – Estimated probability of unemployment (continued)

Dependent variable: unemployed=1

Independent variables	Coefficient	
Years since graduation sqrd./100 x Primary or lower education	-0.0943	***
Years since graduation sqrd./100 x Lower secondary education	-0.0453	**
Years since graduation sqrd./100 x General Lyceum	Reference group	
Years since graduation sqrd./100 x Technical Lyceum	0.0116	
Years since graduation sqrd./100 x Post-gymnasium technical school	-0.0136	
Years since graduation sqrd./100 x IEK	0.0564	**
Years since graduation sqrd./100 x Other post-lyceum education	0.0721	
Years since graduation sqrd./100 x Structural Engineering (TEI)	0.1944	
Years since graduation sqrd./100 x Mechanical & Computer Engineering (TEI)	0.3986	***
Years since graduation sqrd./100 x Agricultural & Food Technology (TEI)	0.1653	
Years since graduation sqrd./100 x Economics & Management (TEI)	0.1020	*
Years since graduation sqrd./100 x Other TEI	0.3469	**
Years since graduation sqrd./100 x Medical Sciences (TEI)	0.1429	*
Years since graduation sqrd./100 x Structural Engineering	0.2845	**
Years since graduation sqrd./100 x Mechanical Engineering	0.3187	**
Years since graduation sqrd./100 x Other AEI	0.2010	
Years since graduation sqrd./100 x IT	-2.1860	
Years since graduation sqrd./100 x Horticulture & Forestry	-0.2124	
Years since graduation sqrd./100 x Medical School etc.	0.1787	**
Years since graduation sqrd./100 x Physical Sciences	0.1397	
Years since graduation sqrd./100 x Mathematics & Statistics	0.3821	**
Years since graduation sqrd./100 x Law School	0.0733	
Years since graduation sqrd./100 x Economics & Management	0.1242	**
Years since graduation sqrd./100 x Social Sciences	0.3136	***
Years since graduation sqrd./100 x Humanities	0.0725	
Years since graduation sqrd./100 x Languages	0.1115	
Years since graduation sqrd./100 x Physical Education & Sports	-0.4890	*
Years since graduation sqrd./100 x Pedagogics	0.0650	
Years since graduation sqrd./100 x Postgraduate degree	0.2242	*
Years since graduation sqrd./100 x Doctorate	0.2503	*
Years since graduation	-0.0106	**
Years since graduation sqrd./100	-0.0257	**

*** Statistically important coefficient at importance level 1%
**   Statistically important coefficient at importance level 5%
*   Statistically important coefficient at importance level 10%

Table A2 FEMALE – Estimated probability of unemployment (continued)

Dependent variable: unemployed=1

Independent variables	Coefficient	
Greek national	Reference group	
Other EU national	0.0886	
Third country national	-0.0209	
East Macedonia–Thrace	0.2138	***
Central Macedonia	0.2224	***
West Macedonia	0.1497	**
Epirus	0.2442	***
Thessaly	0.2709	***
Ionian Islands	0.1629	***
West Greece	0.1769	***
Central Greece and Euboea	0.2305	***
Attica	Reference group	
Peloponnese	0.2947	***
North Aegean	0.2930	***
South Aegean	0.1607	***
Crete	0.2483	***
Capital region – Attica	Reference group	
City complex – Thessaloniki	-0.2156	***
Other urban areas	-0.0822	***
Semi-urban areas	-0.1664	***
Rural areas	-0.2119	***
First year of survey (2004)	-0.0201	
Second year of survey (2005)	-0.0133	
Third year of survey (2006)	0.0129	
Fourth year of survey (2007)	Reference group	
1st quarter	0.0068	
2nd quarter	-0.0161	
3rd quarter	Reference group	
4th quarter	-0.0021	
Regional rate of unemployment	5.6842	***
Constant term	-1.7809	***

*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table B2 FEMALE – Estimated probability of participation in labour force

Dependent variable: labour force participant=1

Independent variables	Coefficient	
Single parent with children (0 aged up to 5, 1 aged 6-17) – female	0.2829	***
Single parent with children (0 aged up to 5, 2 aged 6-17) – female	0.1740	**
Single parent with children (0 aged up to 5, 3+ aged 6-17) – female	-0.0355	
Single parent with children (1 aged up to 5, 0 aged 6-17) – female	0.6509	***
Single parent with children (1 aged up to 5, 1 aged 6-17) – female	-0.1298	
Single parent with children (1 aged up to 5, 2+ aged 6-17) – female	-0.0771	
Single parent with children (2+ aged up to 5, 0+ aged 6-17) – female	-0.3168	
Single parent with children (0 aged up to 5, 1 aged 6-17) and other members – female	0.2237	***
Single parent with children (0 aged up to 5, 2+ aged 6-17) and other members – female	0.1241	
Single parent with children (1+ aged up to 5, 0+ aged 6-17) and other members – female	0.1153	
Couple with children (0 aged up to 5, 1 aged 6-17) – female	-0.2394	***
Couple with children (0 aged up to 5, 2 aged 6-17) – female	-0.2951	***
Couple with children (0 aged up to 5, 3+ aged 6-17) – female	-0.3850	***
Couple with children (1 aged up to 5, 0 aged 6-17) – female	-0.2161	***
Couple with children (1 aged up to 5, 1 aged 6-17) – female	-0.3661	***
Couple with children (1 aged up to 5, 2 aged 6-17) – female	-0.4686	***
Couple with children (1 aged up to 5, 3+ aged 6-17) – female	-0.4620	***
Couple with children (2 aged up to 5, 0 aged 6-17) – female	-0.3920	***
Couple with children (2 aged up to 5, 1 aged 6-17) – female	-0.6709	***
Couple with children (2 aged up to 5, 2 aged 6-17) – female	-0.9113	***
Couple with children (2 aged up to 5, 3+ aged 6-17) – female	-1.2648	***
Couple with children (3+ aged up to 5, 0+ aged 6-17) – female	-0.7267	***
Couple with children (0 aged up to 5, 1 aged 6-17) and other members – female	-0.2126	***
Couple with children (0 aged up to 5, 2 aged 6-17) and other members – female	-0.2168	***
Couple with children (0 aged up to 5, 3+ aged 6-17) and other members – female	-0.3372	***
Couple with children (1 aged up to 5, 0 aged 6-17) and other members – female	-0.0799	
Couple with children (1 aged up to 5, 1 aged 6-17) and other members – female	-0.0237	
Couple with children (1 aged up to 5, 2 aged 6-17) and other members – female	-0.5561	***
Couple with children (1 aged up to 5, 3+ aged 6-17) and other members and	-0.4717	***
Couple with children (2+ aged up to 5, 0+ aged 6-17) and other members – female	-0.3842	***
Single female	-0.0037	
Couple without children – female	Reference group	
Other type of household, single parent (without children) – female	0.2677	***
Other type of household, couple (without children) – female	0.0292	*

Note: Wald test (rho = 0): $x^2(1) = 53.40$ Prob > x^2 = 0.0000
*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

Table B2 FEMALE – Estimated probability of participation in labour force *(continued)*

Dependent variable: labour force participant=1

Independent variables	Coefficient	
Primary or lower education	0.0901	***
Lower secondary education	-0.3163	***
General Lyceum	Reference group	
Technical Lyceum	0.8168	***
TEI	1.0967	***
AEI	0.9779	***
Postgraduate degree	1.5844	***
Years since graduation	0.0906	***
Years since graduation sqrd./100	-0.2136	***
East Macedonia–Thrace	0.2354	***
Central Macedonia	0.1183	***
West Macedonia	0.0554	*
Epirus	0.0815	***
Thessaly	0.1502	***
Ionian Islands	0.0931	**
West Greece	-0.0107	
Central Greece and Euboea	0.0750	***
Attica	Reference group	
Peloponnese	0.2317	***
North Aegean	-0.1056	***
South Aegean	-0.0672	**
Crete	0.2336	***
Attica capital region	Reference group	
Thessaloniki city complex	-0.1756	***
Other urban areas	-0.0980	***
Semi-urban areas	0.0261	
Rural areas	0.2388	***
First year of survey (2004)	-0.0047	
Second year of survey (2005)	0.0048	
Third year of survey (2006)	0.0031	
Fourth year of survey (2007)	Reference group	
1st quarter	-0.0009	
2nd quarter	0.0175	
3rd quarter	Reference group	
4th quarter	-0.0319	*
Constant term	-0.5449	***
/athrho	*1.0758*	***
rho	*0.7916*	

Note: Wald test (rho = 0): $x^2(1)$ =53.40 Prob > x^2 = 0.0000
*** Statistically important coefficient at importance level 1%
** Statistically important coefficient at importance level 5%
* Statistically important coefficient at importance level 10%

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INFLATION AND NOMINAL UNCERTAINTY: THE CASE OF GREECE

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The goal of monetary policy in most advanced economies is that of price stability, usually defined as some low rate of inflation. This is seen as crucial to providing a predictable environment, where expectations of future inflation are anchored. The rationale for such a policy goal is founded on the idea that inflation brings both direct and indirect costs.

Understanding the nature of these costs has proved to be a fundamental task for theoretical economists. A consensus that has emerged views moderate anticipated inflation as being associated with small welfare costs. Rather, it is unexpected inflation that is the source of the costs of inflation. Uncertainty about future inflation is generally thought to distort the relative-price mechanism, leading to a misallocation of resources and thus harming growth.

Within the context of the literature on the costs of inflation,[1] the aspect that has often been the subject of academic debate is the relationship between inflation and inflation uncertainty. Some have argued that higher inflation directly causes inflation uncertainty, thus generating real indirect costs from inflation for any economy (Friedman, 1977, Ball, 1992); others hold the view that the direction of causality is reversed, with higher inflation uncertainty causing higher average inflation (Cukierman and Meltzer, 1986; Cukierman, 1992).

The purpose of this paper is to examine the relationship between inflation and inflation uncertainty for Greece covering the period from 1981 to 2008. This relationship has not been studied for Greece before. Yet Greece, as a country which has experienced both periods of high and variable inflation and, more recently, low inflation, could well prove an interesting testing ground for the competing theories. Univariate GARCH models are used to generate alternative measures of inflation uncertainty, using both seasonally unadjusted and seasonally adjusted data. Subsequently, Granger causality tests are employed to investigate causality between inflation and inflation uncertainty and, where present, to detect its direction and sign.

The paper proceeds as follows: in Section 1 we consider the extensive theoretical and empirical academic literature on both the costs of inflation and the possible relationship between inflation and inflation uncertainty; Section 2 describes our data and Section 3 outlines and discusses our empirical approach; Section 4 presents our findings, and Section 5 provides some concluding remarks.

I THE COSTS OF INFLATION: A SELECTED REVIEW OF THE LITERATURE

Fully anticipated inflation can generate costs for an economy from two main sources. First there are search costs (often referred to as "shoe-leather" costs). As inflation rises, holding money becomes more costly because it loses its value over time (that is, a given amount can purchase a smaller basket of goods as time progresses). Individuals will thus spend their money closer to the time when they receive their income and shops will hold smaller stocks, which implies more queuing or searching. At the same time, to economise on holding cash, more will be held in banks, which implies the need for more trips to the bank (hence the "shoe-leather" costs). All these consequences of effectively taxing the holdings of money balances generate costly and unproductive activities in any economy.

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1 For a good early survey of the literature, see Driffill et al. (1990).

The second main cost of anticipated inflation arises from the fact that tax systems are often not indexed to inflation. Consider a tax system with various tax bands, where the tax rates are unchanged. In an economy with positive inflation, effective tax rates (the actual rate paid) will usually rise with inflation. This leads to distortions with respect to both private savings and labour supply decisions.

It is often argued that the costs associated with anticipated inflation are likely to be small. This is particularly true in a world where tax systems are indexed and where cash transactions are limited because of new electronic means of payment. However, it is unlikely that inflation can ever be fully anticipated. This leads economists to focus on the costs from unanticipated inflation. Unanticipated inflation can generate welfare costs because of its impact on the price mechanism's ability to allocate resources efficiently (that is, to where they will do the most good).

An early attempt at explaining this was provided by Lucas (1973). In his model, unanticipated inflation causes economic agents to confuse absolute and relative price changes. Assume producers, for example, know the price of the goods they produce or trade, at any point in time; the absolute price level in the economy as a whole is, however, known only in the next period. Assume there is an unexpected rise in the money supply. The demand for all goods will rise and, for given output levels, prices will rise. Each individual producer experiences a rise in the price of the good they produce. Thinking this to be a rise only in the price of their good and not a general rise in prices, they increase output. Of course in the next period they realise that the increase in prices was a general one and not specific to the good they produce; their response of increasing output was inappropriate, since there was no increase in relative demand.

In short, inflation causes agents to confuse real shocks, which warrant a change in quantities (output, labour supply, investment, etc.), with

nominal shocks (or monetary shocks), which do not. If economic agents realise that both kinds of shocks are possible, but neither is predictable, then they will tend to overreact to monetary shocks and underreact to real shocks. It is this kind of story that leads economists to argue that inflation can be costly when it is unpredictable – it distorts the price mechanism in a way that changes in prices (either of goods, services or assets) no longer reflect underlying real changes in the economy which may warrant a change in the allocation of resources to certain activities and hence investment in one sector rather than another.

However, if it is inflation unpredictability or uncertainty that generates costs, the interesting question arises as to whether inflation uncertainty is connected in some way to the actual level of inflation. Several, often contradictory theoretical arguments can be found in the academic literature regarding the possible direction of a causal relationship between inflation and inflation uncertainty. Okun (1971) was perhaps the first to suggest that countries with high rates of inflation were also likely to experience high inflation variability. The underlying theoretical insight for this argument was provided by Friedman (1977) in his Nobel lecture. He reasoned that, while high inflation generates political pressure to reduce it, policy makers are usually reluctant to do so, for fear of the possible recessionary effects of such an effort. This lack of strong commitment on behalf of the monetary policy authority creates nominal uncertainty and higher inflation volatility, which in turn results in instability in consumption, production and investment decisions, and hence growth and welfare losses. All these consequences justify the public's underlying aversion to inflation.

Friedman's well-known insight was first formalised by Ball (1992) in the context of a game of asymmetric information between the monetary authority and the public, in which higher inflation leads to increasing uncertainty over the monetary policy stance. Economic agents know there are two types of policy makers, only

one of which is willing to bear the economic costs of reducing inflation. When inflation is low, both types of policy makers strive to keep it so, giving rise to low inflation uncertainty as perceived by economic agents. At higher levels of inflation, however, only one type is willing to disinflate, the other being reluctant to do so for fear of causing a recession. Given that the policy makers stochastically alternate in office, an increase in inflation creates uncertainty about future monetary policy, future inflation and thus the general prospects of the real economy. This line of argument is often referred to in the literature as the Friedman-Ball hypothesis. Its conclusion is that inflation very clearly causes inflation uncertainty and the higher the rate of inflation, the greater that uncertainty will be. Thus inflation is costly not only because of its direct costs, but also because of its indirect costs arising from its impact on inflation uncertainty.

Another strand of the academic literature pursues the idea that causality may run in the opposite direction, i.e. that in fact it is greater inflation uncertainty which causes higher average inflation. This possibility has been formalised as a feature of models based on the Barro-Gordon framework. Seminal among this body of work is that of Cukierman and Meltzer (1986) and Cukierman (1992), in whose model the low policy credibility, the ambiguity of objectives and the poor quality of monetary control that characterise policy makers increase the average rate of inflation. The monetary policy authority has a dual mandate, containing inflation and promoting economic growth, which is reflected in its stochastic objective function, as is the trade-off between the two objectives. However there is no commitment mechanism. The monetary policy authority has an incentive to create monetary surprises —i.e. to generate inflation uncertainty— in an effort to stimulate economic growth; this in turn leads to increases in the level of inflation. The money supply process is also assumed to have a random component, due to the monetary authority's inability to discern the most appropriate monetary policy

instrument and to precisely control it. Therefore, not only are economic agents uncertain about the level of future inflation but, moreover, they have no way of inferring whether an increase in the observed level of inflation is due to a random money supply disturbance or to a shift in the government's emphasis on unemployment. In this context, higher inflation uncertainty generates higher inflation and is evidence of an "opportunistic" or "myopic" central bank.[2]

It is not only the direction of causality that is questioned – that is, whether it is inflation that causes inflation uncertainty or vice-versa. It is also the sign. In both Friedman-Ball and Cukierman-Meltzer, higher inflation is associated with higher inflation uncertainty. Following a different thread, Holland (1995) proposes that, if the Friedman-Ball hypothesis is valid, there may also be a secondary feedback effect from inflation uncertainty back to inflation, as a result of the policy makers' stabilisation efforts. As inflation uncertainty rises due to increasing inflation, there is an increased incentive for policy makers to respond by contracting money supply growth and contain inflation in order to reduce inflation uncertainty and the associated negative real output and welfare effects. Thus, a negative causal effect of inflation uncertainty on inflation is evidence of what is known as the "stabilisation motive" of the monetary policy authority, which views inflation uncertainty as a welfare cost. It generates the result that higher inflation uncertainty lowers inflation because of the monetary authorities' response.

The final case argues that it is inflation that causes inflation uncertainty but that, in con-

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[2] In a comparable theoretical setup, Devereux (1989) justifies the causal link from inflation uncertainty to the level of inflation, by modelling discretionary monetary policy as incorporating not only inflation but also real disturbances and the degree of endogenous wage indexation. He argues that a rise in the variance of real disturbances in the economy lowers the optimal degree of wage indexation in the labour market and provides a stronger incentive for policy makers to create surprise inflation, thereby increasing the average rate of inflation in a "discretionary equilibrium". Lower indexation provides a stronger incentive for policy makers to create surprise inflation, and thereby inflation uncertainty, which can be argued to precede the higher average rate of inflation.

trast to the Friedman-Ball theory, higher inflation reduces inflation uncertainty. Pourgerami and Maskus (1987) and Ungar and Zilberfarb (1993) argue that, as inflation increases, so agents invest more resources in forecasting inflation thus, in theory at least, reducing inflation uncertainty.

The different hypotheses on the link between inflation and inflation uncertainty have given rise to a large empirical literature. Using US data, Ball and Cecchetti (1990) investigate the effects of inflation on inflation uncertainty at different horizons and find that they are much stronger at long horizons. This finding implies increased inflation risks for individual agents who commit to nominal contracts, as well as large monetary policy swings and output fluctuations. Evidence in support of the Friedman-Ball hypothesis for US data is also presented in Holland (1995) and Caporale and McKiernan (1997). Grier and Perry (2000), using post-war US data, fail to find any evidence that it is inflation uncertainty which causes inflation. Indeed, their estimation results indicate that, in line with Friedman's argument, higher inflation uncertainty does significantly lower output growth. Moreover, Hwang (2001) considers US data for the sample periods 1926-1992 and 1947-1992 and finds that, while it is inflation that causes inflation uncertainty, the effect is negative – in line with Pourgerami and Maskus (1987) and Ungar and Zilberfarb (1993).

Grier and Perry (1998) undertake a similar investigation for the G7 countries using data for the period 1948-1993. They report that higher inflation significantly raises inflation uncertainty in all countries. Mixed evidence is obtained for the reverse causal relationship, as increased inflation uncertainty appears to lower inflation in the US, the UK and Germany, in line with Holland's concept of a "stabilisation motive" for the monetary policy authority, and to raise it in Japan and France, as predicted by the Cukierman-Meltzer model of "opportunistic" central bank behaviour. The authors note that these differential responses to inflation uncertainty are corre-lated with Cukierman's (1992) ratings of central bank independence, with Japan and France ranking less independent than the rest.[3] The results of Hwang (2001) and Apergis (2004) for the G7 economies are in the same direction – higher inflation causes inflation uncertainty but the reverse is not necessarily true. More recently, in the tests in Henry, Olekalns and Suardi (2007) on the G7, Friedman-Ball effects are reported for the US, the UK and Canada.

Fountas, Ioannidis and Karanasos (2004) consider 6 major EU countries and report Friedman-Ball effects in all of them. They also find that in Germany and the Netherlands increased inflation uncertainty lowers inflation, while in Italy, Spain and, to a lesser extent, France increased inflation uncertainty raises inflation. Caporale and Kontonikas (2006) empirically investigate the presence of structural breaks in the relationship between inflation and inflation uncertainty in 12 EMU countries and find that, with the introduction of the euro, any relationship that existed appears to have broken down in many countries.

For the UK in particular, Fountas (2001), using a century of data, provides strong evidence in favour of the hypothesis that inflationary periods are associated with high inflation uncertainty. Likewise, Kontonikas (2004), whose sample period spans from 1972 to 2002, estimates a positive relationship between past inflation and uncertainty about future inflation in the UK. Moreover, by controlling for the indirect effects of lower average inflation —which have historically coincided with inflation targeting periods— he concludes that the adoption of an explicit inflation target eliminates inflation persistence and reduces long-run uncertainty.

Finally, turning to recent multi-country research, the results of Thornton (2007) for 12 emerging market economies provide strong

Chart 1 CPI inflation
(1981-2008)

(percentage points)

seasonally unadjusted CPI inflation
seasonally adjusted CPI inflation
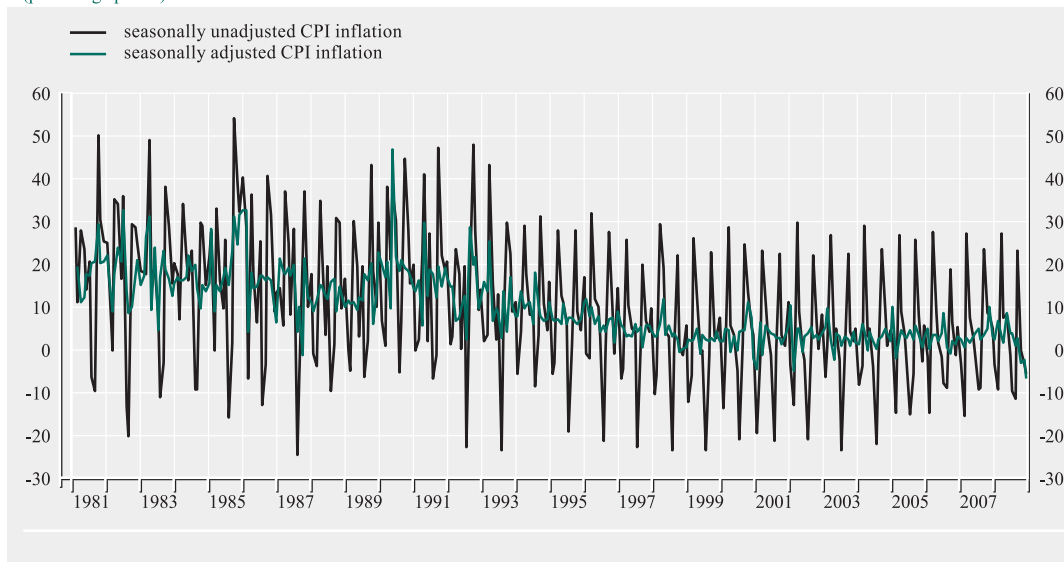
support for the Friedman-Ball hypothesis. Daal, Naka and Sanchez (2005) consider a large panel comprising 22 developed and emerging economies and find that, for most countries, inflation causes inflation uncertainty, while evidence for causality in the opposite direction is mixed. Their results also indicate that positive inflationary shocks have a differential impact on inflation uncertainty across countries – it is mainly Latin American countries, with their history of many episodes of high inflation, which have the strongest impact.

In summary, the majority of the available empirical evidence appears to indicate that it is inflation that causes inflation uncertainty for most countries and that the effect is positive. This provides support for the Friedman-Ball hypothesis. In contrast, the evidence for an effect running from inflation uncertainty to inflation appears to be mixed, if not inconclusive.

2 DATA

Our data is the monthly consumer price index (CPI) for Greece, spanning the period 1981-

2008, as provided by the National Statistical Service of Greece. This series, which is not seasonally adjusted, is used to calculate CPI inflation in month-on-month annualised percentages.

As an alternative measure, we also calculate and use a seasonally adjusted time series for CPI inflation, by applying the Census X12 technique provided by the US Bureau of the Census (http://www.bls.gov/cpi/cpisapage.htm) and used by the US Bureau of Labor Statistics for the estimation of seasonally adjusted US CPI-U. The resulting constructed data series allows us to explore causality once seasonal variation has been accounted for. Both time series are plotted in Chart 1.

3 EMPIRICAL METHODOLOGY

In order to test the theories outlined in Section 2 one requires an adequate measure of inflation uncertainty; therein lies the first empirical issue to be addressed in this literature. Several alternative empirical approaches to proxying uncertainty can be found in the literature. Early cross-country work in this area

used simple differences in the sample standard deviation of inflation across countries as a measure of differences in inflation uncertainty.[4] More recent work relies either on rolling statistical measures of variability or on the dispersion of survey-based individual forecasts as proxies for inflation uncertainty.[5] However, neither can be said to adequately capture uncertainty as understood in the present context. Statistical measures of variability, such as the moving average of a variable's standard deviation, incorporate both predictable and unpredictable variability; however, only the variance of the stochastic, or unpredictable, component of a variable reflects true economic uncertainty. In the case of inflation in particular, predictable inflation variability can be addressed by economic agents, e.g. through indexation; unpredictable inflation variability, which cannot, is more in line with the notion of inflation uncertainty. Survey-based measures suffer from the same shortcoming. Moreover, while they do summarise the range of disagreement among individual forecasters at a given point in time, they hold no information on the individual forecasters' level of uncertainty regarding their point respective forecasts, and hence may potentially be misleading.[6]

Current research largely relies on model-derived measures of inflation uncertainty, primarily on GARCH-type estimations.[7] In contrast to the above measures, GARCH specifications provide a tool to formally model and estimate the time-varying variance of the dependent variable's unpredictable innovations, i.e. a measure that corresponds well to the notion of uncertainty used in the theoretical literature underlying our work and reflects its time variation. Hence, this is our methodology of choice.

A second empirical issue to be addressed relates to deciding upon a way of testing for causality. Virtually all of the aforementioned academic literature uses Granger causality tests to detect the presence of a causal relationship between inflation and inflation uncer-

tainty. These tests, just as any other statistical approach, actually explore temporal precedence rather than causation, a point to be borne in mind when results are interpreted. An exception to this norm are Berument and Dincer (2005) who, in a multi-country setup, test for causality between inflation and inflation uncertainty by using the Full Information Maximum Likelihood Method with extended lags, in addition to Granger causality tests. In principle, in multi-country VAR-type estimations, impulse responses could also be used to draw relevant conclusions. However, neither approach is applicable in our single-country setting, nor indeed do they indicate anything more than temporal precedence themselves. Hence we perform Granger causality tests on our variables and try to reinforce our results by using many different horizons and alternative proxies for uncertainty.

Three sequentially nested GARCH models of inflation are used to obtain the corresponding estimated time-varying conditional variances which are subsequently used as alternative measures of inflation uncertainty. These are presented in equations (1) to (5).

A standard general GARCH (1,1) model of inflation is presented in equations (1) and (2).

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4 See, for example, Okun (1971) and Logue and Willett (1976).
5 For example, Cukierman and Wachtel (1979) analyse this relationship using the moving variances of the observed rates of change, as well as the variance of inflation expectations as published in the Livingston and Michigan Survey Research Center surveys. Other research using statistical measures of inflation variability include that by Pagan, Hall and Trivedi (1983) and Silver (1988). Davis and Kanago (1998) use ex-ante inflation forecasts produced and published by Business International while Davis and Kanago (2000) use ex-ante forecasts made by the OECD and published in *Economic Outlook*. It is noted that the findings reported by research employing survey data to capture inflation uncertainty are less unanimous.
6 We note that, in any case, such measures are not available for Greece over a sufficiently long sample period.
7 There have been a number of single country studies utilising the ARCH class of models to proxy inflation uncertainty, seminal among which are those by Engle (1983), Bollerslev (1986), Evans (1991), and Brunner and Hess (1993). Others include Caporale and McKiernan (1997), Balcombe (1999), Caporale and Caporale (2002) and Hwang (2001) for the USA, Fountas (2001) and Kontonikas (2004) for the UK, and Bohara and Sauer (1994) for Germany. Multi-country studies include Grier and Perry (1998), Apergis (2004), Berument and Dincer (2005) and Henry, Olekalns and Suardi (2007) for the G7 countries, Fountas, Ioannidis and Karanasos (2004) for six European Union countries, Daal, Naka and Sanchez (2005) for twenty-two developed and less developed economies, and Thornton (2007) for twelve emerging markets.

$$i_t = \alpha + \sum_{\kappa=1}^{12} b_k i_{t\text{-}k} + e_t \qquad (1)$$

$$\sigma_t^2 = \alpha + \beta e_{t\text{-}1}^2 + \gamma \sigma_{t\text{-}1}^2 \qquad (2)$$

The conditional mean of inflation is specified in equation (1) as an autoregressive process of order 12, so as to reflect the monthly nature of our data. i_t denotes inflation at time t and e_t is the error term which is assumed to follow a conditional normal distribution. The GARCH (1,1) representation of the conditional variance is presented in equation (2) where σ_t^2 denotes the conditional variance of inflation at time t. The model assumes the conditional variance of inflation follows an ARMA (1,1) process, i.e. that the conditional variance at time t depends on past innovations and variances. The implication is that, in predicting the variance of this period's inflation, economic agents form a weighted average of the long-term average variance α, the variance observed in the previous period $\sigma_{t\text{-}1}^2$, and the size of last period's forecast error as captured by $e_{t\text{-}1}^2$. If last period's forecast error and/or variance were unexpectedly large, economic agents will increase their estimates of the variance for the next period.

Equation (3) presents the alternative specification of the conditional variance implied by a Threshold-GARCH model (see Zakoian, 1994, and Glosten, Jagannathan and Runkle, 1993).

$$\sigma_t^2 = \alpha + \beta e_{t\text{-}1}^2 + \beta^n r_{t\text{-}1} e_{t\text{-}1}^2 + \gamma \sigma_{t\text{-}1}^2 \qquad (3)$$

where $r_t = 1$ if $e_t < 0$, and $r_t = 0$ otherwise. In this specification, past innovations are allowed to have a different impact on the conditional variance depending on their sign, i.e. positive news may have a smaller impact on the variance of inflation than negative news. In equation (3) positive news has an impact of β, while negative news has an impact of $\beta + \beta_n$.

Equations (4) and (5) present the conditional variance specification of a Component Threshold-GARCH (1,1) model. This formulation extends the previous ones by addition-

ally allowing the conditional variance to mean revert to a time-varying level.

$$\sigma_t^2 - m_t = \beta(e_{t\text{-}1}^2 - m_{t\text{-}1}) + \beta^n r_{t\text{-}1}(e_{t\text{-}1}^2 - m_{t\text{-}1}) \\ + \gamma(\sigma_{t\text{-}1}^2 - m_{t\text{-}1}) \qquad (4)$$

$$m_t = \alpha + \varrho(m_{t\text{-}1} - \omega) \, \varphi(e_{t\text{-}1}^2 - \sigma_{t\text{-}1}^2) \qquad (5)$$

where m_t is the now time-varying long-run volatility. The first equation describes the transitory component $\sigma_t^2 - m_t$ which converges to zero, while the second equation describes the long-run component m_t which converges to ∞, at rates defined by the coefficients of their respective equations. The variables in the transitory equation will have an impact on the short-run movements in volatility, while the variables in the permanent equation will affect the long-run levels of volatility.

Having estimated these three alternative univariate GARCH specifications for the error term, we examine their relative goodness of fit to each data series and proceed to use the estimated conditional volatilities as proxies for inflation uncertainty. We perform pairwise bidirectional Granger causality tests between each of the three estimated conditional variance series and CPI inflation, seasonally-adjusted and unadjusted for different lag lengths (i.e. different causality horizons) up to 12 months and examine the sign of the sum of the auxiliary (Granger causality) equations' relevant coefficients, in order to establish the direction of the effect where Granger causality is found. Subsequently, we separate our sample at two different dates of possible structural breaks and repeat the process in order to consider whether there has been a shift in the relationships detected using the full sample.

4 EMPIRICAL RESULTS

4.1 ANALYSIS OF THE FULL SAMPLE PERIOD

A diagnostic Lagrange Multiplier (LM) test on our data indicates the presence of strong ARCH effects, that is, that volatility is time-

Table 1 Information criteria

	Akaike	Schwarz	Adj. R²
Seasonally unadjusted CPI inflation			
GARCH	6.64	6.83	0.78
T-GARCH	6.58	6.78	0.78
C-GARCH	6.60	6.82	0.78
Seasonally adjusted CPI inflation			
GARCH	5.87	6.06	0.55
T-GARCH	5.87	6.07	0.55
C-GARCH	5.80	6.02	0.56

Note: Smaller values of the Akaike and Schwarz criteria are preferred.

varying and periods of high or low volatility tend to cluster together. Indeed, all three GARCH specifications appear to provide a good fit to the data, as indicated by the adjusted R-squared measures reported in Table 1. The T-GARCH model appears to provide a superior fit to the unadjusted data on the basis of the Schwartz and Akaike information criteria; i.e. threshold effects appear to be significant in the variance of the inflation process, while allowing for a time-varying mean variance by using the C-GARCH specification not so much so. Conversely, using seasonally adjusted data, it is the C-GARCH which appears to provide a marginally superior fit – i.e. threshold effects in combination with a time-varying mean variance appear to provide the closest fit to the data. One may speculate that the seasonal component of inflation renders the transitory and permanent components

Chart 2 The conditional volatility of CPI inflation (1981-2008)

— estimates GARCH
— estimates T-GARCH
— estimates C-GARCH
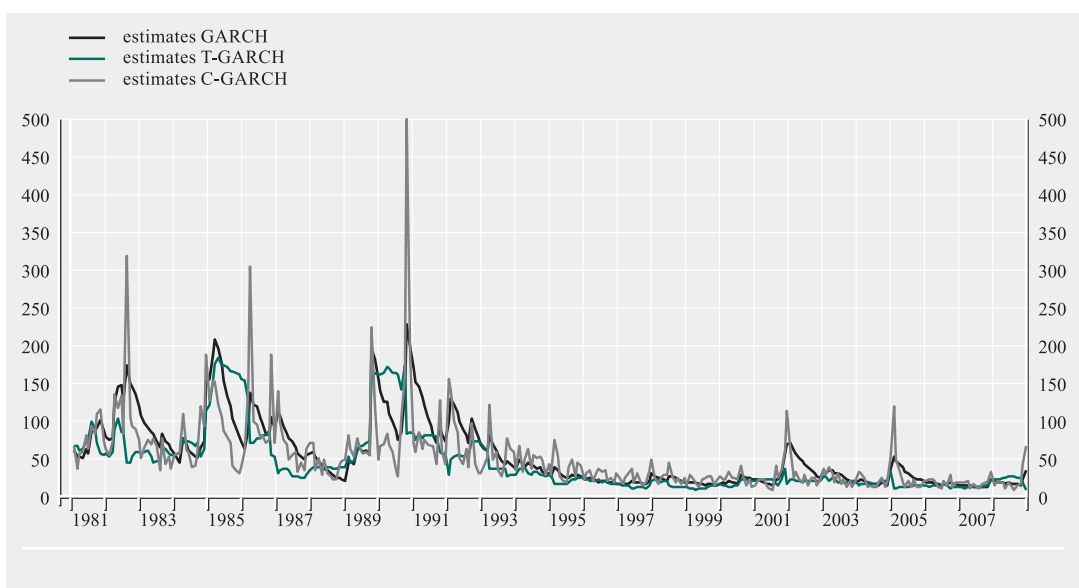
Table 2 Granger causality tests - full sample

Causality horizon (in months):	2	3	4	6	8	12
Seasonally unadjusted CPI inflation - full sample						
Null Hypothesis:	*Probability (p-values)*					
Inflation does not Granger cause GARCH cond. variance	0.003 +	0.003 +	0.002 +	0.000 +	0.002 +	0.000 +
GARCH cond. variance does not Granger cause inflation	0.000 +	0.000 +	0.000 +	**0.087 +**	**0.088 +**	0.000 −
Inflation does not Granger cause T-GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
T-GARCH cond. variance does not Granger cause inflation	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 −
Inflation does not Granger cause C-GARCH cond. variance	0.003 +	0.004 +	0.001 +	0.000 +	0.001 +	0.000 +
C-GARCH cond. variance does not Granger cause inflation	0.000 +	0.000 +	0.000 +	*0.039 +*	**0.050 +**	0.051 −
Seasonally adjusted CPI inflation - full sample						
Null Hypothesis:	*Probability (p-values)*					
Inflation does not Granger cause GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
GARCH cond. variance does not Granger cause inflation	*__0.155__* −	*__0.175__* −	*__0.379__* −	*__0.705__* −	*__0.626__* −	0.060 −
Inflation does not Granger cause T-GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
T-GARCH cond. variance does not Granger cause inflation	*__0.129__* −	*__0.162__* −	*__0.365__* −	*__0.704__* −	*__0.615__* −	0.062 −
Inflation does not Granger cause C-GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
C-GARCH cond. variance does not Granger cause inflation	*0.312* +	*0.314* +	*0.509* +	*0.803* −	*0.845* −	*0.035* −

Note: Figures in normal fonts denote that the null can be rejected at the 1% significance level.
Figures in italics denote that the null can be rejected at the 5% significance level.
Figures in bold italics denote that the null can be rejected at the 10% significance level.
Figures in bold underlined italics denote that the null cannot be rejected at the 10% significance level.
Plus and minus symbols indicate the sign of the sum of the relevant estimated coefficients in the corresponding auxiliary equation.

of conditional inflation variance harder to disentangle.

The conditional variances derived from the various GARCH specifications are plotted against time in Chart 2. The volatility indicated by the conditional variances is in line with developments in the Greek economy over the sample period. In the early part of the sample, volatility was high, with peaks after the 1983 and 1985 drachma devaluations, as would be expected. Volatility also rose in the early 1990s, linked to oil price rises and large fiscal deficits which caused inflation to rise. Inflation was then propagated by the wage indexation mechanism. From around 1994 onwards, volatility fell gradually and has, largely, remained low thereafter. This coincides with important policy choices made by Greek governments. The Maastricht treaty entered into force on 1 November 1993. It set out the path to mone-

tary union in Europe and the Greek government publicly stated its aim to become a member. 1994 was to be a crucial year towards that goal. Controls on capital movements were fully liberalised and monetary financing of the government's budget deficit was prohibited. The first convergence programme of the Greek government was adopted by ECOFIN and focused on fiscal consolidation to meet the Maastricht Treaty criteria. From 1995, the hard drachma policy was adopted to foster nominal convergence.[8] Thus, it is not surprising that the behaviour of inflation volatility changes rather strikingly from the mid-1990s onwards. We return to this below.

Table 2 presents all Granger causality tests performed on the full sample data. Test results for seasonally unadjusted data are pre-

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[8] See Garganas and Tavlas (2001) for a discussion of this period.

sented in the top panel while those for the seasonally adjusted series are in the bottom one. For each set of data (seasonally unadjusted and seasonally adjusted), there are 3 sets of results depending on the particular GARCH specification used. Finally, for each specification two hypotheses are tested. First, we test the hypothesis that inflation does not Granger-cause inflation uncertainty. Rejection of this hypothesis at conventional levels of significance provides support for the view that causality runs from inflation to inflation uncertainty. Second, we test the hypothesis that inflation uncertainty does not cause inflation and rejection in this case provides support for the view that causality runs from inflation uncertainty to inflation. Using all three conditional variance estimates on seasonally unadjusted data, one can reject the null hypothesis of no Granger causality for almost all causality horizons up to 1 year, in both directions. Thus, inflation Granger-causes inflation uncertainty and vice versa, at conventional significance levels. Since the sign of the causal relationship is positive in both cases, these full-sample results on the seasonally unadjusted data provide support for both the Friedman-Ball hypothesis and for the presence of a secondary feedback effect resulting from Holland's (1995) "stabilisation motive".

In the context of this application, however, using non-seasonally adjusted data may have a marked impact on our results. Indeed, inflation is known to exhibit strong seasonality. The component of inflation variability which reflects seasonal patterns in consumption behaviour is of no interest to us here, but may nonetheless strongly affect our measure of inflation uncertainty, as it is likely to filter through to our estimates of the conditional variance of inflation. This concern is the theoretical motivation for repeating this exercise on seasonally adjusted data of our own construction.

The findings presented in the second panel of Table 2 are strikingly different to those above. While, using any of the three alternative

GARCH-specifications, one can yet again reject the null hypothesis that inflation does not Granger-cause its own estimated conditional variance for all causality horizons up to 1 year, the reverse is no longer true, i.e. we cannot reject the null hypothesis that the estimated conditional variance of inflation does not Granger-cause inflation for almost all causality horizons. In other words, based on the seasonally adjusted data Granger causality seems to run from inflation to inflation uncertainty and not vice versa. Correcting for seasonality appears to have completely eliminated the causal effect from inflation uncertainty to inflation which had previously been detected. The sign of the cumulative effect in the causal relationship remains positive and the Friedman-Ball effect appears even stronger.

4.2 ANALYSIS OF SAMPLE SUB-PERIODS DEFINED ON THE BASIS OF POSSIBLE STRUCTURAL BREAKS

Given the substantial changes the Greek economy has undergone in the nearly three decades covered by our sample, it seems reasonable to consider the possibility of structural breaks in our data. We consider two different structural breaks: the end of 1993, when the Maastricht Treaty entered into force, and January 2001, when Greece joined the euro area. As we noted above when describing Chart 2, a structural break around 1994 is not surprising. Similarly, the joining of the euro area in 2001 radically altered the framework of monetary policy formulation and, more generally, economic policy making. Chow tests indeed support the existence of structural breaks at both these times.

The Granger causality tests on seasonally adjusted data for the sub-periods suggested by these structural breaks are presented in Tables 3 and 4, respectively.[9] The top panels now present Granger causality tests for the first subsample, while those for the second subsample are presented in the bottom panel.

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9 The corresponding tests on seasonally unadjusted data are available upon request.

Table 3 Granger causality tests - structural break in 2001

Causality horizon (in months):	2	3	4	6	8	12
Seasonally adjusted CPI inflation - Sample: 1981M01 2000M12						
Null Hypothesis:	Probability (p-values)					
Inflation does not Granger cause GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
GARCH cond. variance does not Granger cause inflation	*0.262* −	*0.326* −	*0.529* +	*0.791* −	*0.689* −	*0.129* −
Inflation does not Granger cause T-GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
T-GARCH cond. variance does not Granger cause inflation	*0.234* −	*0.313* −	*0.514* +	*0.789* −	*0.674* −	*0.130* −
Inflation does not Granger cause C-GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +
C-GARCH cond. variance does not Granger cause inflation	*0.452* +	*0.495* +	*0.689* +	*0.891* −	*0.901* −	*0.114* −
Seasonally adjusted CPI inflation - Sample: 2001M01 2008M12						
Null Hypothesis:	Probability (p-values)					
Inflation does not Granger cause GARCH cond. variance	*0.100* +	0.010 +	*0.011* +	*0.046* +	**0.052** +	*0.131* +
GARCH cond. variance does not Granger cause inflation	*0.258* −	*0.323* −	*0.496* −	*0.683* −	*0.828* −	*0.519* +
Inflation does not Granger cause T-GARCH cond. variance	*0.157* +	0.016 +	*0.020* +	**0.075** +	**0.083** +	*0.182* +
T-GARCH cond. variance does not Granger cause inflation	*0.265* −	*0.324* −	*0.498* −	*0.683* −	*0.828* −	*0.507* +
Inflation does not Granger cause C-GARCH cond. variance	0.001 −	0.000 +	0.000 +	0.002 +	0.003 +	0.005 +
C-GARCH cond. variance does not Granger cause inflation	*0.196* −	*0.245* −	*0.394* −	*0.548* −	*0.684* −	*0.354* +

Note: Figures in normal fonts denote that the null can be rejected at the 1% significance level.
Figures in italics denote that the null can be rejected at the 5% significance level.
Figures in bold italics denote that the null can be rejected at the 10% significance level.
Figures in bold underlined italics denote that the null cannot be rejected at the 10% significance level.
Plus and minus symbols indicate the sign of the sum of the relevant estimated coefficients in the corresponding auxiliary equation.

Both sample splits appear to significantly affect our results. In both cases our earlier findings for seasonally adjusted data are confirmed for the first subsample, i.e. inflation appears to Granger-cause inflation uncertainty but not vice versa. Moreover, the sign of the cumulative effect in the detected causal relationships is almost exclusively positive, in line with the Friedman-Ball hypothesis. However, in the bottom panels representing either the period 1994-2008 (Table 3) or 2001-2008 (Table 4), the presence of Granger causality now appears to be rejected in both directions and at most horizons.

When cast against developments in the Greek economy over the sample period, these findings appear to be intuitive. We seem to find support for the Friedman-Ball hypothesis during the first sample sub-period (whether that

be 1981-1993 or 1981-2000) which corresponds to a period of high and volatile inflation rates coupled with substantial real and nominal uncertainty. This appears to be evidence of the Cukierman-Meltzer hypothesis regarding central bank behaviour, that is, of a monetary authority which is tempted to use inflation in order to stimulate growth.

The second subsamples correspond to Greece's efforts to curb inflation, reduce interest rates and meet the Maastricht criteria with a view to becoming accepted as a member of the EMU (1994-2008) and/or to the EMU era itself (2001-2008). Our findings, which appear to be particularly clear for estimates on the periods before and after the end-1993 break, imply, in line with economic intuition, that the preparation for and creation of the EMU and, later the presence of

Table 4 Granger causality tests - structural break in 1994

Causality horizon (in months):	2	3	4	6	8	12
Seasonally adjusted CPI inflation - Sample: 1981M01 1993M12						
Null Hypothesis:	*Probability (p-values)*					
Inflation does not Granger cause GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.001 +
GARCH cond. variance does not Granger cause inflation	*0.765* −	*0.760* +	*0.785* +	*0.958* +	*0.952* −	*0.615* −
Inflation does not Granger cause T-GARCH cond. variance	0.000 +	0.000 +	0.000 +	0.000 +	0.000 +	0.001 +
T-GARCH cond. variance does not Granger cause inflation	*0.756* −	*0.759* +	*0.775* +	*0.958* +	*0.952* −	*0.619* −
Inflation does not Granger cause C-GARCH cond. variance	*0.012* +	*0.024* +	*0.017* +	*0.031* +	*0.047* +	*0.175* +
C-GARCH cond. variance does not Granger cause inflation	*0.879* −	*0.893* +	*0.952* +	*0.992* −	*0.980* −	*0.514* −
Seasonally adjusted CPI inflation - Sample: 1994M01 2008M12						
Null Hypothesis:	*Probability (p-values)*					
Inflation does not Granger cause GARCH cond. variance	*0.463* +	*0.323* +	*0.474* +	*0.610* +	*0.112* +	*0.372* +
GARCH cond. variance does not Granger cause inflation	*0.350* −	*0.131* −	*0.125* −	*0.236* −	*0.482* −	*0.124* −
Inflation does not Granger cause T-GARCH cond. variance	*0.289* +	*0.262* +	*0.392* +	*0.538* +	0.091 +	*0.354* +
T-GARCH cond. variance does not Granger cause inflation	*0.299* −	*0.109* −	*0.112* −	*0.232* −	*0.463* −	*0.127* −
Inflation does not Granger cause C-GARCH cond. variance	0.099 +	*0.028* +	*0.037* +	0.084 +	*0.047* +	0.242 +
C-GARCH cond. variance does not Granger cause inflation	0.876 −	0.108 −	0.090 +	0.199 −	0.490 −	*0.044* −

Note: Figures in normal fonts denote that the null can be rejected at the 1% significance level.
Figures in italics denote that the null can be rejected at the 5% significance level.
Figures in bold italics denote that the null can be rejected at the 10% significance level.
Figures in bold underlined italics denote that the null cannot be rejected at the 10% significance level.
Plus and minus symbols indicate the sign of the sum of the relevant estimated coefficients in the corresponding auxiliary equation.

the ECB as a monetary policy authority, have created a strong anchor for inflation expectations which appears to have diluted if not disrupted the causal relationship between inflation and inflation uncertainty that had existed in the case of Greece. It must be noted that there is no evidence of a "stabilisation motive" as such on behalf of the monetary authorities, i.e. we detect no Granger causality from inflation uncertainty to inflation. This of course is not surprising, since monetary policy is set not on the basis of Greek inflation but inflation in the euro area as a whole. Neither is there evidence of inflation Granger-causing inflation uncertainty, something which might result from the relatively low level of inflation during this period.

These findings are in line with those of Grier and Perry (1998) and Fountas, Ioannidis and Karanasos (2004), who report a relation between the presence and direction of Granger causality with the degree of central bank independence, as well as with those of Kontonikas (2004), who finds that, when the effects of lower average inflation are controlled for, the adoption of an explicit inflation target eliminates inflation persistence and reduces long-run inflation uncertainty.

5 CONCLUSION

This paper has examined the relationship between inflation and inflation uncertainty for Greece for the period 1981-2008. The rationale for conducting such an exercise stems from the theoretical observation that a significant cost of inflation arises because of its impact on inflation uncertainty.

The results suggest that the direction of causality in the Greek case does indeed run from inflation to inflation uncertainty, and not vice versa. Moreover, the sign of this causal effect is positive, i.e. higher inflation causes higher uncertainty. This is supportive of the Friedman-Ball hypothesis. Interestingly, these results break down in the post-1993 and post-2000 periods. In neither period (either 1994-2008 or 2001-2008) is there much evidence of causality in any direction. This is arguably a consequence of the inflation-targeting monetary policy adopted during these sub-periods, which resulted in far lower levels of inflation as compared to the earlier period and contributed to reducing uncertainty and anchoring expectations.

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DETERMINANTS OF THE GREEK STOCK-BOND CORRELATION

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I INTRODUCTION

A central query in financial economics is the extraction of information on investors' perception of the uncertainty of future market conditions; given its direct implications for capital allocation and risk aversion, this general topic has become critical recently. In this context, the empirical finance literature has focused on measures stemming from financial markets, in order to exploit potential information contained in them in order to be used as 'forward-looking' variables for market conditions.

A growing strand of the empirical finance literature focuses on the correlation between bond and stock returns (hereafter 'stock-bond correlation', for brevity)[1] as a tool for detecting asset price imbalances, thus motivating its use for financial stability purposes. The rationale behind the use of the correlations among stock and bond returns as a proxy for market conditions and the underlying risk can be found in the perception of the existence of common pricing factors and different risk characteristics.

Against this backdrop, if the notion of factors affecting the pricing of both stocks and bonds, establishes, theoretically, the relation between the information contained in the stock-bond correlations, their time-varying characteristics allow for empirical examination. In this respect, the stock-bond correlation has been found to take negative values, under stressed market conditions. Among the reasons for this phenomenon, 'flight-to-quality' effects are the most prominent answer and are related to the market's perception of bonds as safer than equities (see d'Addona and Kind, 2006, and Ehrmann et al., 2005, among others). Flight-to-quality effects refer to increases in holdings of safer assets and sales of assets which are perceived as more uncertain; within this context,

negative correlations between returns in stock and bond markets are explained in the empirical literature as reflecting interrelated opposite transactions in the two markets (see e.g. Hakkio and Keeton, 2009, and Baur and Lucey, 2009).

Furthermore, the stock-bond correlation has been found to be negatively related to high volatility regimes in equity markets (Connolly et al., 2007). Thus, the 'decoupling' phenomenon between stocks and bonds appears to be related to conditions of high uncertainty. A reasonable explanation is given by Baur and Lucey (2009); investors' tendency to "chase the yield(s)" or find shelters in turbulent periods is revealed in the time variation and reversals in the stock-bond correlation.

On the other hand, numerous papers have dealt with interactions among markets and financial segments (e.g. Baele et al., 2004, Davies, 2006, and Yang et al., 2004). Furthermore, in the event that the examination focuses on the transmission of the negative effects from one market to another, during turbulent periods, this phenomenon is referred to as 'contagion'. From this perspective, there is broad consensus in the empirical finance literature that contagion refers to unforeseeable negative returns in a market, which are caused by shocks initiated in another market and transmitted through portfolio rebalancing and risk aversion effects (see Beirne et al., 2009).[2] As a result, previous studies relate stock-bond correlation to market uncertainty, while contagion effects arise in turbulent periods as well.

However, little emphasis has been given to explaining the dynamics of the stock-bond correlation for Greece. Although investigations of

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1 For definitions and terminology we refer to Connolly et al. (2005), Yang et al. (2009) and Baur and Lucey (2009), among others.
2 Contagion presumes a high degree of integration in order for diversification effects to be inactive.

"flight-to-quality" effects have occasionally included Greece in their samples (see Beber et al., 2006), there has not been a specific investigation of the determinants of the Greek stock-bond correlation. In this context, we assess the extent to which the information contained in the stock-bond correlation is explained by several risk proxies related to (i) stock market uncertainty, (ii) credit risk and (iii) liquidity conditions in the banking sector. Additionally, we examine whether the Greek stock-bond correlation is subject to spillover effects from the dynamics of the relevant correlations of the United States, Germany and Italy.[3]

The present empirical analysis unfolds in the following way. Section 2 continues the discussion of the literature, focusing on properties of the stock-bond correlation and financial interactions. Section 3 describes the empirical investigation framework and Section 4 presents the empirical findings and discusses policy implications. Finally, Section 5 concludes.

2 LITERATURE REVIEW

2.1 PROPERTIES OF THE STOCK-BOND CORRELATION

Early on, several works dealt with the common deterministic process underlying the pricing of stocks and bonds. Fama and French (1993) investigated the sources of the common pricing patterns between stocks and bonds; they have found that several risk factors generate variations in the returns on both equities and bonds. Their assessment motivates further exploration of the relation between risk and the correlation of stock and bond returns.

Campbell and Ammer (1993) show that several common factors, including expected excess stock returns, the real interest rate and inflation, exercise causal effects on both equities and bonds. Interestingly, they find that shocks to expected stock returns produce variations in stock and bond returns of the same direction,

while increasing expected inflation results in opposite effects on bond and stock returns. Their results highlight the fact that stocks are a good inflation hedge, whereas bond yields[4] are known to carry the inflation risk premium. As a result, expected inflation stands as a potential source of 'decoupling' effects, that is, periods in which stock returns decreases (increases) and bond returns increases (decreases) may be related to higher (lower) expected inflation.

Laloux et al. (2000) investigate the statistical properties of correlation coefficients stemming from financial time series. The authors investigate the S&P500; their findings indicate that choosing an asset allocation that minimises the risk of the portfolio is similar to choosing a portfolio with large weights on the smallest eigenvalues of the correlation matrix eigenvector. In plain terms, this finding leads to a need to examine the extent to which deterministic factors in the form of financial variables can explain the correlations; the more variability of the correlation can be explained by economically meaningful variables, the less risky is the underlying portfolio. This finding motivates the examination of the stationarity properties of the stock-bond correlation; according to the aforementioned argument, in the event that there exist significant diversification effects between stocks and bonds, as expected, their correlation should be stationary.

Overall, the stock-bond correlation measure has been found to have small but positive values whereas it is positively related to short-term rates and inflation (Yang et al., 2009). Additionally, Cappiello et al. (2003) argued for the time-varying characteristics of the stock-bond correlation measure. This time

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[3] The United States and Germany were chosen for obvious reasons related to market *size* and their respective international and European benchmark status. Italy is also included for two main reasons; it is the 'high-yielders' benchmark, according to Lane (2006), while it could be conceived as a regional leader, in the globalisation concept of Krugman (1991).

[4] It is clear that variable yield bonds are excluded from this reference.

variation has been attributed to stock market uncertainty by Connoly et al. (2005); 'flight-to-quality' effects are found to be reflected in the stock-bond correlation, according to Baur and Lucey (2009). Specifically, it is argued that, in periods of turbulence in financial markets, investors have strong motives to change their portfolio distribution towards lowering the weight of risky assets in the portfolio; as a result, bonds' and equities' returns would diverge. This would produce a 'decoupling effect' that would be reflected in negative stock-bond correlations. Adopting this point of view on the information contained in stock-bond correlations, Hakkio and Keeton (2009) have included the measure under examination as a component to the financial stress index they have compiled for the Fed.

Connoly et al. (2005) also relate decoupling effects between stocks and bonds, as reflected in the stock-bond correlation, with increases in the volatility of stock markets. Their analysis argues that the probability for a negative stock-bond correlation increases in a high-volatility regime.

Summarising the aforementioned findings leads to several useful remarks. First, the stock-bond correlation is found to be related to the degree of uncertainty present in financial markets at any time; the usually positive correlation declines, or even turns negative under financial markets' turbulence. These effects are in line with the explanation given by the literature investigating the co-variates of stock and bond returns; shocks produced by expected stock returns move these assets in the same direction, whereas real interest rates, expected inflation and market volatility contribute to 'decoupling' effects.

2.2 ESTIMATING MARKETS INTERACTIONS

The notion of interactions between two markets refers to whether movements in one market are, at least partially, caused by movements in another. Ultimately, under the Law of One Price, assets with the same characteristics should be priced equally even across different markets. This aspect, while proving to be particularly useful for investigating financial integration effects, also gives a proxy for estimating whether the dynamics in the stock-bond correlation of one country are influenced by similar dynamics in other countries.

The methodological frameworks employed for the examination of interactions between markets or segments are set to capture either causal patterns or spillover effects. In the first case, VARs and VECMs are used for this purpose and Granger causality tests are applied in order to examine the significance and direction of the effects exercised in the pricing processes.[5] Second, several GARCH (Generalised Autoregressive Conditional Heteroskedasticity) models have been used in order to detect variance spillover effects. In this context, correlations, estimated through DCC-GARCH, (Dynamic Conditional Correlation-GARCH) have been used in order to assess spillover and contagion effects in financial markets (e.g. Chiang et al., 2007).

3 THE EMPIRICAL FRAMEWORK

3.1 DESCRIPTION OF DATA

Our analysis is based on data from three European markets with different characteristics (Germany, Italy and Greece) and the United States, for the period after EMU, i.e. January 1999 to December 2009. Both stock and bond returns are included at weekly frequency; we deemed that data of daily frequency would contain noise, valuable for arbitrageurs but not for our purposes, while data with a frequency lower than weekly could result in the loss of information contained in infrequent events. All data were collected from Thomson Financial (Datastream).

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5 Interested readers can refer to Yang *et al.* (2004), Sarno and Valente (2006), Vo (2009), among others.

Stock market returns are estimated as weekly differences of logged, euro-denominated MSCI indices for the aforementioned markets and period.[6] Similarly, weekly bond returns are estimated by taking differences in yields-to-maturity of the relevant 10-year government bonds. Specifically,

$$r_t^s = \log\left(MSCI_t \Big/ MSCI_{t-1} \right) \text{ for stocks}$$

and

$$r_t^b = y_t - y_{t-1} \text{, for bonds.}$$

Variables used for the explanation of risks reflected in the stock-bond correlation are (i) the spread between interbank rates of weekly maturity, denominated in euro (Euribor) and US dollars ($Libor), (ii) the spread between the AAA corporate bond yield[7] and the 10-year benchmark Bunds, and (iii) a volatility proxy for the Greek stock market, estimated as the intraday range of the general index of the Athens Exchange (Athex).

The difference between the weekly Euribor and $Libor rates ($(E-L)_t$), is intended to capture changes in the relative banking sector liquidity positions between Europe and the United States.[8] As a result, liquidity constraints in the European banking sector would be reflected in variations in the relative spread. In this context, as EMU money markets are reported to be fully integrated (see Centeno and Mello, 1999) we believe that this variable is a reliable proxy for the Greek banking sector as well.

The credit spread (CS_t) is intended to approximate credit risk conditions. However, due to a lack of activity in the Greek secondary market for corporate bonds, relevant reliable quotations could not be found. As a result, we rely on overall European corporate bond rates. Even though they are not set to capture idiosyncratic credit risk conditions for the Greek market, they can be used as proxies for credit conditions in the European bond market.

Finally, the intraday price range for the Greek stock market is intended to capture Greek stock market volatility. The intraday range is estimated as the difference between the highest intraday value of the general stock market index (S^H) and its lowest (intraday) value (S^L). After all that has been reported in relevant empirical finance literature, this aggregate is considered suitable for capturing market participants' uncertainty about the "fair-price".[9] Briefly, it should be noted that the argument for using the range as an indicator of investors' uncertainty is that in case the highest and the lowest bids are very divergent, this may reflect large differences in market's participants' perspectives about fair prices for stocks. Even in the event that it is an effect of thin trading activity, it still captures a significant component of market risk, i.e. liquidity risk.

Finally, we use stock-bond correlations from other markets (namely, the US, Germany and Italy) as proxies for interactions across countries. In the event that these variables exercise significant effects on the Greek stock-bond correlation, there will exist cross-country contagion effects, especially when the significant effects are evident in periods of 'decoupling' effects.

3.2 METHODOLOGY

In order to estimate the correlation coefficients between stock and bond returns, we use the dynamic conditional correlation framework established by Engle (2002). Consider the correlation between stock and bond returns in time t, conditional on information available up to time $t-1$, illustrated in equation (1) below:

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6 For the estimation of stock returns under this formulation, see Cappiello et al. (2003).
7 Extracted from the iBoxx AAA index compiled of highly liquid corporate bonds, with a term to maturity 10+ years, denominated in euro.
8 Alexopoulou et al. (2009) provide a more formal discussion on the information expected to be reflected by the spread between short-term rates.
9 For empirical applications using the "intraday range" as a measure for stock market volatility, we refer to Christensen and Podolskij (2006) and Joshy (2008). It should be reminded that so far there is no implied volatility index for the Greek stock exchange, as the one traded in the Chicago Board of Exchange (ticker: VIX) or the German equities' implied volatility index (VDAX).

$$\rho_t^i = \frac{E_{t-1}(r_t^s \quad , \quad r_t^b)}{\sqrt{E_{t-1}[(r_t^s)^2] \cdot E_{t-1}[(r_t^b)^2]}} \tag{1}$$

where, i stands for the countries included in the present analysis, $E_{t-1}(r_t^s, r_t^b)$ denotes the conventional covariance of stock and bond returns, and $E_{t-1}[(r_t^s)^2]$, $E_{t-1}[(r_t^b)^2]$, are the respective variances, conditioned on information available until time t-1.

Afterwards, Bollerslev (1990) proposes the estimation of the conditional constant correlation (CCC) model specified in matrix form, as $H_t = D_t R D_t$, in which R stands for the sample correlation matrix and D is the kxk diagonal matrix of time-varying standard deviations from GARCH(1,1) models with $\sqrt{h_{j,t}}$ on the jth diagonal; that is the square root of the estimated variance.

Then, following Engle, one can relax the constancy assumption of the correlation matrix, thus permitting its assessment as time-varying. That is,

$$H_t = D_t R_t D_t \tag{2}$$

where,

$$R_t = diag\{Q_t\}^{-\frac{1}{2}} Q_t \, diag\{Q_t\}^{-\frac{1}{2}}$$

and then,

$$Q_t = \begin{bmatrix} q_{11,t} & q_{21,t} \\ q_{12,t} & q_{22,t} \end{bmatrix} = (1-a-b)\begin{bmatrix} 1 & q_{21,t} \\ q_{12,t} & 1 \end{bmatrix} +$$

$$+ a\begin{bmatrix} (r_{t-1}^s)^2 & (r_{t-1}^s) \cdot (r_{t-1}^b) \\ (r_{t-1}^s) \cdot (r_{t-1}^b) & (r_{t-1}^b)^2 \end{bmatrix}$$

$$+ b\begin{bmatrix} q_{11,t-1} & q_{21,t-1} \\ q_{12,t-1} & q_{22,t-1} \end{bmatrix}$$

with $\bar{q}_{12} = E(r_t^s, r_t^b)$.

Having estimated p_t^i, we then examine its statistical properties. Emphasis is given to unit root tests, in order to specify the proper econometric treatment of the correlation as a dependent variable. We test the null hypoth-

esis of a unit root in the data both against the alternative of stationarity, by using conventional Dickey-Fuller tests, and against the near-unit-root alternative, set to capture trend stationary series, by applying the test of Elliott et al. (1996).

Then we turn to the examination of our main question: what drives the stock-bond correlation. Conditional upon the appropriate stationarity properties of the variables that enter in the regression, we estimate the relation below:

$$\rho_t^{GR} = \alpha_1 (S^H - S^L)_{t-1} + a_2 CS_{t-1} + a_3 (E-L)_{t-1} +$$

$$+ a_4 \rho_{t-1}^{US} + a_5 \rho_{t-1}^{DE} + a_6 \rho_{t-1}^{IT} + \varepsilon_t \tag{3}$$

Equation 3 is to be estimated with the method of least squares, with heteroskedasticity consistent errors by applying the Newey-West modification. We run several regressions initially for the whole sample and then for four sub-samples, chosen exogenously according to specific market-related conditions. The first is related to the EMU accession period for Greece (1999-2001); additionally, this period is associated with the bursting of the bubble on the domestic stock market. The second period is the post-EMU, pre-crisis period (2001 – August 2007).[10] The third sub-period is related to the global credit crisis (2007-2009), while the fourth sub-period begins with the date of the Lehman Brothers bankruptcy (15 September 2008).

Lastly, we repeat this analysis by regressing only negative values of the Greek stock-bond correlation on the aforementioned explanatory variables. In this way, we intend to take into account switches in the deterministic structure of the system, as the dependent variable moves between positive and negative ground. Again, the periods under examination are the same with those described before.

10 It should be reminded that on 9 August 2007 the Eurosystem's extraordinary liquidity provision to the banking system amounted to €95 billion after the "complete evaporation of liquidity", as BNP Paribas stated to its investors.

4 EMPIRICAL RESULTS

Table 1 presents descriptive statistics for the variable under examination and its determinants. The table contains descriptive statistics, for the whole sample in the upper panel, and conventional (DF) and efficient (DF-GLS) unit root tests in the lower panel. First, the statistics confirm the overall consensus in relevant literature that the stock-bond correlation is positive and low in value. It should be stressed that the figures reported are very similar to those obtained by Conolly et al. (2007), as far as the United States and Germany are concerned. Additionally, we report figures for Greece and Italy; the mean stock-bond correlations for the two countries and the period under examination were 0.105 and 0.19 respectively.

Next, we focus on the unit root test results. Overall, our data are indicated to be stationary, whereas in the case of the interbank rates spread the variable is found to contain a unit root by conventional unit root tests but the

tests of Elliott et al. (1996) confirm trend-stationarity of the series.

In addition, Chart 1 illustrates the dynamic behaviour of the Greek stock-bond correlation. The illustration of the correlation reveals that it has ventured into negative territory at several times in the past; an effect that has been related to flight-to-quality effects in the previous literature. The appearance of negative correlations is mainly concentrated in the period 1999-2001 and late 2007 onwards. We deem that in the first case the reversal captures the bursting of the bubble on the Athens stock market, while in the second period the negative stock-bond correlation is directly related to the credit crisis that erupted in 2007.

Next, we investigate whether the decoupling effects that are reflected in negative stock-bond correlations in Greece are interrelated with similar decoupling effects in the United States, Germany and Italy at time t-1. For the whole sample, the results suggest that about 32.5%,

Table 1 Properties of the data

	Mean	Standard error	Kurtosis	Skewness
ϱ^{GR}	0.105	0.137	-0.388	-0.356
ϱ^{US}	0.253	0.205	-0.115	-0.415
ϱ^{DE}	0.289	0.220	0.213	-0.365
ϱ^{IT}	0.190	0.185	0.232	-0.223
CS	0.627	1.011	12.069	-2.799
E-L	-0.304	1.36	-1.485	-0.097
$S^H - S^L$	0.007	0.005	9.657	2.597

Unit root tests				
	DF (lags=1)	DF (lags=5)	DF-GLS (lags=1)	DF-GLS (lags=5)
ϱ^{GR}	-4.167	-3.812	-3.330	-2.894
ϱ^{US}	-2.613*	-2.532*	-2.607	-2.526
ϱ^{DE}	-3.481	-3.357	-3.381	-3.273
ϱ^{IT}	-5.295	-4.902	-5.299	-4.907
CS	-4.502	-4.982	-3.993	-4.273
E-L	-1.342**	-1.257**	-2.544*	-2.654
$S^H - S^L$	-10.165	-5.443	-2.919	2.340
Critical values	1%= -3.444 5%= -2.867	10%= -2.570	1%=-2.58 5%=-1.95	10%=-1.62

Chart 1 Greek stock-bond correlation

GR
ρ_i

Source: Estimates based on Datastream data.
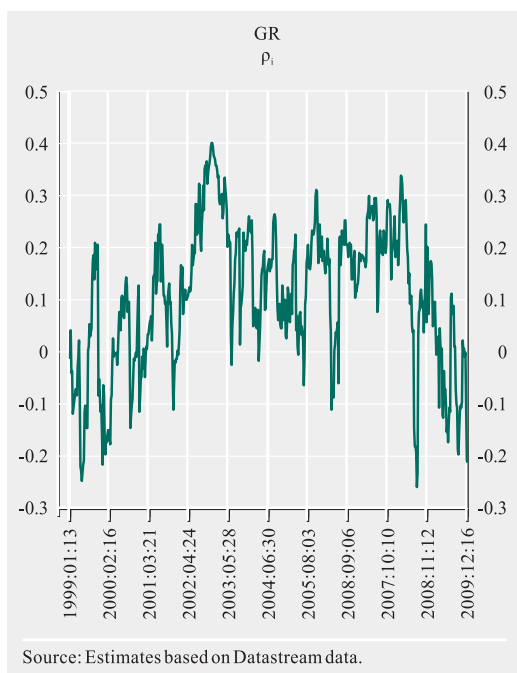
30% and 44.2% of the negative values of the Greek correlation occur when negative correlations have also registered for the United States, Germany and Italy, respectively. However, when we restrict the period to the 2007-2009 crisis, these figures are considerably different; in the cases of the US and Germany, negative stock-bond correlations are found with negative Greek stock-bond correlations only 29.4% and to 5.8% of the time, respectively; by contrast, 70.6% of negative values of the stock-bond correlation in Greece coincide with negative Italian stock-bond correlations. Finally, when the period is further restricted to the post-Lehman-collapse period, the respective figures are 35.7%, 0% and 67.8%, respectively.

From these figures one gains an insight into the interlinkages between the decoupling effects for Greek stock and bond markets with the respective markets from the United States, Germany and Italy. The results suggest that, as far as the United States and Germany are concerned, there exist only weak (if any) evidence for linkages between these effects. On the other hand, these findings initiate the need to further explore the links between the Italian and the Greek stock-bond correlations. Of course, these figures are not adequate in order to argue for the existence of spillover effects, but they provide strong motivation for the following investigation of contagion effects in the Greek stock-bond correlation.

As a result, we turn to the findings of the determinants of the stock-bond correlation dynamics for Greece, according to the formulation of equation 3. Table 2 presents the relevant results. For the whole sample (1999-2009), the Greek stock-bond correlation is found to be explained by previous observations of the interbank rates spread $(E\text{-}L)_{t-1}$ and the previous week's stock-bond correlations for Italy (ϱ_{t-1}^{IT}) and Germany (ϱ_{t-1}^{DE}). The first variable is found to be negatively related to the correlation, while the coefficients of the last two variables are positive. These effects indicate that an increase in the spread between the interbank offer rates of the euro area and the United States explains, to a great extent, a subsequent decrease in the stock-bond correlation in Greece, while there exist spillover effects from the stock-bond correlations of Italy and Germany.

However, these findings differ considerably when we examine several sub-periods of our sample. Overall, the diagnostics, contained in the lower panel of the table, indicate that the formulation under examination explains efficiently and to a great extent (except for the 1999-2001 period) the dynamics of the Greek stock-bond correlation. Nevertheless, a more thorough inspection of the findings reveals several interesting points. Specifically, it is indicated that in the period after the launch of the EMU and before the official accession of Greece, only the dynamics of German stock-bond correlation are found to significantly affect movements in the Greek stock-bond correlation. This effect has outlived the accession of Greece in the euro area, while it is associated with the emergence of significant effects

	1/1/1999-9/12/2009	1/1/1999-4/12/2000	1/1/2001-9/8/2007	9/8/2007-9/12/2009	15/9/2008-9/12/2009
$(S^H\text{-}S^L)_{t\text{-}1}$	-1.859 (1.194)	-2.191 (1.794)	-0.717 (1.387)	-2.235 (1.551)	-0.958 (2.060)
$CS_{t\text{-}1}$	-0.022 (0.012)	0.087 (0.129)	0.007 (0.022)	-0.032 (0.021)	0.019 (0.037)
$(E\text{-}L)_{t\text{-}1}$	-0.012** (0.005)	0.017 (0.034)	-0.016** (0.006)	0.014 (0.013)	0.041* (0.023)
$\varrho^{US}_{t\text{-}1}$	0.076 (0.049)	-0.159 (0.138)	0.028 (0.071)	-0.027 (0.055)	-0.041 (0.187)
$\varrho^{IT}_{t\text{-}1}$	0.290** (0.068)	-0.121 (0.156)	0.086 (0.091)	0.515** (0.057)	0.304** (0.089)
$\varrho^{DE}_{t\text{-}1}$	0.205** (0.076)	0.321** (0.156)	0.379** (0.109)	0.132 (0.099)	-0.189 (0.248)
$\widetilde{R}^2$	0.472	0.033	0.405	0.653	0.358
D-W	0.475	0.378	0.506	0.907	0.801

Note: Each cell presents the value (standard error) of the coefficient of the respective explanatory variable, as in equation 3, with the dependent variable being the Greek stock-bond correlation estimated by DCC-GARCH, as in equation 2. The estimation has been performed with consistent heteroskedasticity errors, estimated with the Newey-West formula. Asterisks (**, *) denote (5%, 10%) significance.

stemming from the spread between interbank rates; a finding that we deem is quite reasonable since the liquidity conditions in the euro area banking sector, assumed to be reflected in the respective variable, have a direct impact on the Greek banking sector. On the other hand, since the onset of the credit crisis in 2007, only the Italian stock-bond correlation is found to significantly explain movements in the Greek correlation. Additionally, the effects stemming from the Italian variable are positive, indicating the existence of significant spillover effects, during the credit crisis period.

This last finding can be further clarified by the examination of the decoupling effects, reflected by negative values of the stock-bond correlation. The respective findings are reported in Table 3.

For the whole sample the intraday stock market's range, assumed to capture underlying uncertainty in the stock market, is found to significantly explain movements in the stock-bond correlation when it is negative. Specifically, the results suggest that an increase[11] in the stock market's intraday range causes the negative

stock-bond correlation to become even more negative in the subsequent week. Additionally, we find that the spread between the two interbank rates leads to positive effects on the stock-bond correlation. However, the significance of this variable might reflect mostly effects from the 2007-2009 period, when the US banking system, initially, experienced strong deterioration in its liquidity conditions. Finally, the significant relation of the Greek and Italian stock-bond correlations is confirmed in periods of decoupling effects in the Greek stock and bond markets as well.

However, the examination of the relation during the selected sub-periods reveals that the explanatory variables under review do not provide a meaningful explanation concerning the negative values of the correlation, over the period 1999-2007. The variables explain the dynamics of the Greek stock-bond correlation only for the period which followed the onset of the credit crisis. In this context, Greek stock market uncertainty (as measured

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[11] An increase in the range has been reported to reflect an increase in investors' uncertainty. Interested readers should refer to empirical literature mentioned in Section 3 (footnote 8).

Table 3 Determinants of negative values of the Greek stock-bond correlation

	1/1/1999-9/12/2009	1/1/1999-4/12/2001	1/1/2001-9/8/2007	9/8/2007-9/12/2009	15/9/2008-9/12/2009
$(S^H-S^L)_{t-1}$	-2.020** (0.578)	-1.125 (1.167)	-0.537 (0.289)	-2.150** (0.867)	-1.931* (1.067)
CS_{t-1}	-0.007 (0.004)	0.042 (0.076)	-0.003 (0.025)	-0.016 (0.015)	0.013 (0.023)
$(E-L)_{t-1}$	0.006** (0.002)	0.030 (0.022)	0.000 (0.001)	0.015** (0.007)	0.007 (0.012)
ϱ^{US}_{t-1}	-0.034 (0.024)	-0.101 (0.063)	-0.002 (0.005)	-0.136** (0.045)	-0.058 (0.087)
ϱ^{IT}_{t-1}	0.128** (0.029)	0.026 (0.075)	0.006 (0.009)	0.261** (0.035)	0.246** (0.054)
ϱ^{DE}_{t-1}	-0.028 (-0.028)	0.161* (0.088)	0.005 (0.008)	0.001 (0.074)	-0.149 (0.128)
$\widetilde{R}^2$	0.241	0.137	0.035	0.436	0.191
D-W	0.583	0.519	1.038	0.920	0.742

Note: Each cell presents the value (standard error) of the coefficient of the respective explanatory variable, as in equation 3, with the dependent variable being the negative values of the Greek stock-bond correlation. The estimation has been performed with consistent heteroskedasticity errors, estimated with the Newey-West formula. Asterisks (**, *) denote (5%, 10%) significance.

by the intraday range) is found to have significant explanatory power for the decoupling effects reflected in the negative values of the stock-bond correlation in the period 2007-2009, while there exist significant contagion effects stemming from the Italian correlation over the Greek correlation for the whole crisis period. Furthermore, the interbank spread and the US stock-bond correlation have a decisive impact on the dynamics of the Greek correlation, but this does not apply for the period after the collapse of Lehman Brothers. Finally, an important finding is that an increase in the US stock-bond correlation leads to a decrease in the Greek stock-bond correlation, which is highly likely to reflect diversification effects.

In sum, it is assumed that monitoring the dynamics of stock and bond yields over time provides valuable insight into the underlying conditions prevailing in the Greek financial sector. Conversely, it would be useful to define the objectives of such an exercise beforehand, in order to ensure the efficient use of the measure.

Notably, we find that the Greek stock-bond correlation is affected by liquidity conditions in the banking system and by interactions stemming from stock-bond correlations in other markets, particularly the Italian market. In turbulent periods only the latter effects are significant. Overall, decoupling effects reflected in negative correlations are found to be significantly related to increased market uncertainty, liquidity conditions in the banking system and contagion effects mainly stemming from Italy. These results are also confirmed as regards the turbulent period after 2007. By contrast, the AAA credit spread has not been found to significantly affect the Greek stock-bond correlation; this suggests that the decoupling effects are not to be interpreted as reflecting deteriorating credit risk conditions. This finding indicates that the decoupling effects reflected in the negative stock-bond correlations cannot be explained as flight-to-quality against credit risk.

5 CONCLUDING REMARKS

This paper has assessed the dynamic correlation between Greek stocks and bonds. Our main objective was to examine the determinants of the dynamics of the Greek stock-bond

correlation. In this context, we included variables reflecting stock market uncertainty, credit risk, liquidity conditions in the banking system and interactions from similar correlation dynamics in the US, Germany and Italy. Our findings indicate that the correlation is influenced by the degree of uncertainty, while negative correlations have been explained as indicating flight-to-quality effects.

The results presented confirm the findings reported in empirical literature concerning other markets, namely that the stock-bond correlation is negatively related to uncertainty and subject to contagion effects. In particular, the examination of the determinants of negative values of the stock-bond correlation suggests flight-to-quality effects, indicating that the correlation is a good proxy for market uncertainty. However, our findings suggest that flight-to-quality reflected in the correlation between Greek stocks and bonds may not be a result of heightened credit risk.

In this context, our analysis has assessed the driving factors of the stock-bond correlation. We deem that our findings may serve as a basis for using stock-bond correlation as a tool for market analysis and policy decisions, for Greece. However, the dynamic nature of this measure and the changing nature of market conditions disallow optimism that the answer provided herein is conclusive; the main technical finding is that the dependent variable is subject to shifts related to different states of volatility. Additionally, apart from the specified determinants related to a variety of risk perceptions, several other explanatory variables may exist, probably explaining the residual variations. In this respect, we deem that macroeconomic reflections in the Greek stock-bond correlation would be an interesting topic for future research.

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WORKING PAPERS
(FEBRUARY 2009 – FEBRUARY 2010)

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CONTENTS

Monetary Time Series of Southeastern Europe from the 1870s to 1914

Working Paper No. 94
Members of the SEEMHN Data Collection Task Force

The SEEMHN Data Collection Task Force is a cross-national collaboration of economists and statisticians from six Southeastern European (SEE) countries that put together for the first time a comprehensive collection of monetary data for the pre-WWI period. The countries covered include: Albania, Austria-Hungary, Bulgaria, Greece, Romania and Serbia. For each country, historical aggregates are preceded by an introduction which provides an institutional and historical narrative on the SEE region and its monetary institutions and standards. The dataset refers to four key variables: banknotes in circulation, total reserves, exchange rates and central bank discount rates. The frequency is monthly and the time span covers the period from 1870 or earlier to 1914. Each country uses standardised definitions for each series to facilitate cross-country comparison. A foreword by Michael Bordo on the paramount importance of historical data series is supplemented by a detailed introduction by Matthias Morys placing an emphasis on a cross-country historical comparison of the countries' monetary institutional structures and the policy-making process.

Modelling distortionary taxation

Working Paper No. 95
Panagiotis Chronis

The main aim of this work is to provide a methodology for analysing the distortionary character of the tax system. It offers a formal proof of a general functional form which can be used for this purpose.

In public economics, distortionary taxation is related, on the one hand, to the distortions income tax brings to the labour market – by affecting the behaviour of tax payers via income and substitution effects (Stiglitz, 1988; Atkinson and Stiglitz, 1980; Cowel, 1981) or by affecting labour mobility (Goodspeed, 2002) – and on the other hand, to "tax compliance" (Andreony et al., 1998) and "tax evasion" (Allingham and Sandmo, 1972; Clotfelter, 1983; Feinstain, 1991), as the higher the tax burden, the higher the probability of tax evasion. In the presence of tax evasion, unreported income escapes taxation and, as a result, the higher the required taxes, or equivalently the tax rates, the greater the distortionary effect of income taxation. This is also related to tax incidence, since for those burdened by taxation it is easier to evade and pay fewer taxes. Hence, the tax rate has a substitution effect encouraging tax evasion and an income effect discouraging it (Yitzaki, 1974; Clotfelter, 1983).

Therefore, the choice of tax rate has a decisive role to play in the framework of distortionary taxation, and its relation to the notions of tax compliance, tax evasion and tax collection. It is also clear that the tax rate is related to the behaviour of tax payers; it determines their behaviour regarding methods of tax burden avoidance. As a result, within a distortionary taxation system, tax revenues are lower compared to a non-distortionary system (e.g. lump-sum taxation).

Turning now to the majority of macroeconomic models that use taxation in their analysis, we can distinguish two main ways taxation is intro-

duced. The first treats the tax instrument as exogenous, by assuming lump-sum taxation. Consequently, it ignores the relation between taxes and income, as well as its growth rate, since, under this assumption, no distortions exist. The second way taxation is treated in the literature is the proportional taxation scheme, where tax revenue is written as a fraction of income. This is often called a distortionary taxation system (in the sense that changes in the level of income, caused by the fiscal authority's tax policy, affect tax revenues).

Furthermore, the proportional taxation scheme is consistent with Ramsey's approach, usually used in macroeconomics in order to study optimal policy problems in a dynamic setting, where the deviation from lump-sum taxation allows the benevolent government to avoid the first best solution, and hence a distortionary framework ensues. However, this approach is subject to criticism. Golosov et al. (2006) argue that, under the Ramsey setting, the main goal for the government is to mimic lump-sum taxes, while it is not clear why the tax instrument takes a particular form. As a result, the Ramsey approach does not provide a theoretical foundation for distortionary taxation. Distortions are simply assumed and their overall level is determined exogenously by the need of the benevolent government to finance its spending.

A closer look at the above taxation schemes makes clear that the notion of a distortionary taxation system, in the sense described previ-

ously (including tax compliance, tax evasion and tax collection), is depicted neither in the lump-sum nor the proportional taxation scheme. In fact, including it would complicate the analysis, since it will introduce a non-linear dynamic relation that relates the behaviour of tax payers to the path of tax revenue, the tax rate and its relation to income. This dynamic relation results in a loss of tax revenue for the fiscal authority, with a deterministic role in equilibrium (if equilibrium occurs at all) of economic models that investigate the relation between distortionary taxation and the path of debt, and/or its relation to inflation and the path of income (Woodford, 2001, 2003; Leeper, 1991, 2005; Chari and Kehoe, 2007).

To the best of our knowledge, the approach just described is not treated in the relevant literature. Hence, if one wants to include into the analysis the consequences of a distortionary taxation system on the economy, it is vital to deal with the above mentioned problem of non-linearity.

The purpose of this paper is to provide a methodology for dealing with this problem by using formal analysis. For this we build and suggest a general functional form which relates the behaviour of tax payers to the tax rate and the path of tax revenue, and we then study its properties as well as its economic rationale. We finally use an example, in order to show the way this functional form can be applied to economic models.

Fertility determinants and economic uncertainty: an assessment using European panel data

George Hondroyiannis

This paper examines the determinants of fertility, using panel data for 27 European countries. We employ panel cointegration to estimate fertility as a function of demographic and economic variables. The analysis suggests that fertility variations in Europe are explained by changes in infant mortality, female employ-

ment, nuptiality, old age dependency ratio, real income per capita, real wage and output volatility. Two measures, production volatility and the unemployment rate, are used as proxies to measure uncertainty and insecurities in modern economies.

The empirical results for the panel data indicate that a downward shock to infant mortality, due to e.g. medical advances, leads to lower fertility. An upward shock in real GDP per capita, due to e.g. improved terms of trade, leads to an increase in fertility. This implies a positive income effect on the demand for children. However, an increase in the real wage, which is a proxy for the opportunity cost of children, will decrease fertility. This implies a negative substitution effect, which is reinforced by the increase in female employment. Hence the opportunity cost of time devoted to childcare has increased as a result of increasing real wage and female labour force participation, and consequently fertility has declined. At the same time, an increase in nuptiality leads to higher fertility, since children constitute one of the most important gains of marriage.

Finally, the empirical results support the proposition that economic uncertainty might be an important determinant of the fertility decision, explaining the decline in fertility in Europe. The empirical findings suggest that in economies with high per capita income, an increase in output volatility associated with low economic performance leads to lower fertility. Contrary to that, in economies with low income per capita, an increase in output volatility associated with a downturn in economic activity, or an increase in real economic activity associated

with reduction in volatility, will result in a decline of fertility. Likewise, high unemployment increases labour market insecurities. Since children are long-term commitments, labour market uncertainties might dominate adults' decisions for partnership and parenthood, since responsible couples will decide to have children when they are able to secure their present and future income.

The empirical results have important implications for the sample of European countries, with declining fertility and aging population. Fertility is found to be related to demographic and economic factors, such as infant mortality, nuptiality rate, female employment, real per capita output, real wage and uncertainty, so that the movements in fertility rates observed over the last three decades can be accounted for by changes in these economic variables. Therefore, the declining fertility rates in the European countries can be explained by the positive effect of a lower infant mortality rate, the negative effect of a higher price of having children, due to increasing female employment, outperforming the positive effect of a higher income on the demand for children. Finally, the declining fertility rates may be attributed to the growing uncertainties related to labour market insecurities, which are a major feature of modern European societies, characterised by internationalisation and globalisation.

Macroeconomic implications of alternative tax regimes: the case of Greece

Working Paper No. 97
Dimitris Papageorgiou

This paper examines how changes in the tax mix (defined as distribution of revenue by type of tax) influence economic activity and welfare in the Greek economy. Conducting tax policy analysis using a Dynamic General Equilibrium model which incorporates a detailed fiscal (tax-spending) policy structure, this is the first study that analyses the implications of changes in the tax policy mix for the Greek economy within a Dynamic General Equilibrium framework.

The results suggest that tax reforms reducing the capital income tax rate and increasing the labour or the consumption tax rates lead to higher levels of output, consumption and investment. A reduction in the labour income tax rate met by an increase in the consumption tax rate increases output, consumption, investment and hours worked. The opposite results are observed when the capital tax rate increases in order to meet the loss in labour tax revenue.

Cuts in the consumption tax rate compensated by increases in labour or capital income tax rates have a negative impact on output and investment both in the short and the long run.

The results also suggest that if the goal of tax policy is to promote growth by replacing one distortionary tax rate with another, then it should reduce the tax rate on capital income and increase the tax rate on consumption. On the other hand, if the goal of tax policy is to promote lifetime welfare, then it should decrease the labour income tax rate and increase the consumption tax rate.

The Greek current account deficit: is it sustainable after all?

Working Paper No. 98
George A. Zombanakis, Constantinos Stylianou and Andreas S. Andreou

The aim of the present paper is to shed some additional light on the issue of the sustainability of the Greek current account deficit. The variety of techniques employed and conclusions reached in the literature regarding the specific issue points to the use of Artificial Neural Networks as the appropriate analysis tool, given a number of advantages over traditional methods of analysis. The paper demonstrates that, despite its size, the current account deficit of Greece can be considered sustainable. The conclusion takes into consideration that the current account has been burdened during the past few years by a number of exogenous disturbances (in particular, oil price increases as well as import payments for ships to cover the high demand for global sea transport services), the effect of which is expected to be either temporary or linked to investment activity. In addition, the reduction in the effect brought about by some of these exogenous variables, to a large extent as a consequence of the recent international crisis, is expected to help by bringing the current account as a share to GDP down to possibly one-digit levels.

The endogenous structural weaknesses of the economy, however, appearing in the form of import price inelasticity and lack of import substitution, together with high income elasticity of imports on one hand and the well-known competitiveness problems on the other, are expected to continue imposing a number of binding constraints on the function of the Greek external sector, and consequently sustaining the pressures exercised on the current account deficit even in the absence of any financing requirements. This means that unless such imbalances are taken care of, the threat of an unsustainable current account deficit will persist, despite the absence of any financing requirements, especially in an environment of recovery from the recent global crisis, with all the adverse repercussions that such a deficit figure might entail for vital economic aggregates like growth and employment.

Optimum currency areas, structural changes and the endogeneity of the OCA criteria: evidence from six new EU Member States

Working Paper No. 99
Dimitrios Sideris

The present study has two aims. The first is to analyse the degree of convergence of six new member states (NMS) of the European Union with the euro area, in an attempt to evaluate their readiness to adopt the euro. The six countries are Bulgaria, the Czech Republic, Hungary,

Poland and Romania, which have not adopted the euro yet but plan to do so at some future date, and the Slovak Republic which adopted the euro in January 2009. The work examines whether these countries form an OCA with the euro area by using the Generalised Purchasing Power Parity (GPPP) theory. The GPPP theory proposes testing whether the real exchange rates of a group of economies with respect to a base currency converge in the long run.

The second aim is to investigate whether the introduction of the euro and the decision of the six countries to seek to join the euro area have fostered integration of these countries with the euro area. We argue that the decision of the six economies to join the monetary union and the policy steps made towards convergence with it, have already promoted integration. This idea is in line with the endogenous OCA theory, which supports the view that countries joining a currency union may satisfy the criteria of an OCA ex post, even if they do not ex ante.

In the empirical work, cointegration analysis is employed to test the GPPP hypothesis, after an initial assessment of the stationarity of each real exchange rate series. The cointegration analysis examines the joint behaviour of the rates, in three different periods: the full period 1993.1-2007.12, and the periods before and after the introduction of the euro. The results provide evidence in favour of an OCA with the euro area only for the period following the introduction of the euro. The results indicate that the group of the six economies has enjoyed reduced real exchange rate instability in the post-euro period. This could be due to increased trade integration of the six economies with the EU, caused by the introduction of the euro and the switch of the exchange rate policies of most NMSs towards euro-based exchange rate regimes.

For indicative purposes, a similar analysis with respect to the US economy is also performed. It suggests that alignment of the countries with the US is supported by the data for the period before the introduction of the euro, but not for the period following it. These results probably reflect the weakening role of the dollar in the European markets and the policy change in the six countries.

Overall, the findings imply that the convergence process with the euro area has been promoted in recent years probably as a result of the convergence of the policies of the six economies, the structural changes that took place in the economic systems of the countries, their increased trade integration with the European Union and the significant role of the euro in the European markets. Thus, at present, the six economies are quite well aligned with the euro area.

Revisiting the merger and acquisition performance of European banks

Ioannis Asimakopoulos and Panayiotis P. Athanasoglou

The study examines the value creation of Merger and Acquisition (M&A) deals in European banking from 1990 to 2004. This is performed, first, by examining the stock price reaction of banks to the announcement of M&A deals and, second, by analysing the determinants of this reaction. The findings provide evidence of value creation in European banks, as the shareholders of the targets have benefited from positive and (statistically) significant abnormal returns, while those of the acquirers have earned small negative but non-significant abnormal returns. In the case of the shareholders of the acquirers, domestic M&As, and especially those between banks with shares listed on the stock market, seem to be more beneficial compared to cross-border ones, or those when the target is unlisted. Shareholders of the targets earn in all cases positive abnormal returns. Finally, although

the link between abnormal returns and fundamental characteristics of the banks is rather weak, it appears that the acquisition of smaller, less efficient banks generating more diversified income is more value-creating, while acquisition of less efficient, liquid banks characterised by higher credit risk is not a value-creating option.

Bank heterogeneity and monetary policy transmission

Working Paper No. 101
Sophocles N. Brissimis and Manthos D. Delis

Understanding the transmission mechanism is crucial for monetary policy. In this respect, the special role of banking institutions in this mechanism has been studied extensively both at a theoretical and empirical level. The existing evidence shows that banks alter their lending behaviour in specific ways following a change in monetary policy. But does this reaction involve only changes in lending behaviour, as studied in the bulk of the literature? And do all banks in the market respond uniformly to monetary policy changes? This paper tries to answer these questions by analysing empirically the heterogeneous response of US and euro area banks over the period 1994-2007 in terms of their lending and risk-taking decisions following a monetary policy change. The ultimate impact of a monetary policy change on bank performance is also considered. In the empirical strategy, the distributional effects of monetary policy stem from a number of bank characteristics, namely liquidity, capitalisation and market power.

The empirical analysis elucidates the sources of differences in the response of banks to changes in policy interest rates by disaggregating, down to the individual bank level. This is achieved by the use of a Local GMM technique that also enables a quantification of the degree of heterogeneity in the transmission mechanism.

As banks have a special role in the financing of economic activity, their heterogeneous behaviour is of particular importance to researchers and policy makers alike. The results of this paper show that the extensive heterogeneity in banks' response identifies overlooked consequences of bank behaviour and highlights potential monetary sources of the current financial distress.

An Optimum-Currency-Area Odyssey

Working Paper No. 102
Harris Dellas and George S. Tavlas

The theory of optimum currency areas was conceived and developed in three highly influential papers, written by Mundell (1961), McKinnon (1963) and Kenen (1969). Those authors identified characteristics that potential members of a monetary union should ideally possess in order to make it feasible to surrender a nationally-tailored monetary policy and the adjustment of an exchange rate of a national currency. We trace the development of optimum-currency-area theory, which, after a flurry of research into the subject in the 1960s, was relegated to intellectual purgatory for about 20 years. We then discuss factors that led to a renewed interest into the subject, beginning in the early 1990s. Milton Friedman plays a pivotal role in our narrative; Friedman's work on monetary integration in the early 1950s presaged subsequent optimum-currency-area contributions; Mundell's classic

formulation of an optimal currency area was aimed, in part, at refuting Friedman's "strong" case for floating exchange rates; and Friedman's work on the role of monetary policy had the effect of helping to revive interest in optimum-currency-area analysis. The paper concludes with a discussion of recent analytical work, using New Keynesian models, which has the promise of fulfilling the unfinished agenda set-out by the original contributors to the optimum-currency-area literature, that is, providing a consistent framework in which a country's characteristics can be used to determine its optimal exchange-rate regime.

Benchmark bonds interactions under regime shifts

Working Paper No. 103
Petros M. Migiakis and Dimitris A. Georgoutsos

The present paper formulates a multivariate framework that captures the interactions between fixed income markets, by taking into account the time-varying characteristics of financial integration. The main contribution of this paper to the relevant literature is that it relaxes the linearity restriction on the interactions between the markets examined, by allowing the system to shift between regimes according to underlying causal relations. In particular, we suggest that causal relations among financial markets are subject to regime shifts, resulting in changes in the strength and direction of interactions between them.

Our empirical analysis focuses on the interactions of major bond markets of the euro area, namely Germany, France, Italy and the Netherlands, and the US Treasury market, for the period 1992-2007. First, we specify the long-run relations of the system. Specifically, we examine the cointegration properties of the underlying system and find that there exists a single common trend governing the stochastic process of the system, thus satisfying the precondition imposed by previous financial integration literature (Haug et al., 2000). Next, we estimate the long-run equilibrium relations, by imposing restrictions in line with the interest rates parity hypothesis. The tests confirm that the system is characterised by significant parity relations.

In the second part of the empirical analysis, we examine whether the causal relations of the system are subject to regime-switching effects, by applying the Markov Switching Vector Error Correction Model (VECM). Employing the MS-VECM framework proves informative as it reveals the impact of monetary unification in Europe on underlying interactions between markets. Specifically, a regime shift is found to have occurred close to the time of the launch of the common currency, resulting in strengthened interactions among the underlying variables and significantly enhanced causal adjustment effects towards the long-run equilibria.

In the last part of our paper, we assess leader-follower relations by means of a variance decomposition analysis for each of the two regimes (Lütkepohl and Reimers, 1998). The results indicate significant changes in the proportion of the variables' variances explained by the Bund or the Treasury after 1999. Although these two variables are found to explain the largest proportion of the variance in the system prior to the monetary unification, their dominant characteristics are significantly limited after the regime shift and replaced by a three-fold benchmark status. In particular, in the period after monetary unification, movements in European variables are found to be caused, to a large degree, by the Bund but only for the initial period (1-2 months) after the shock. However, in the longer run, the variables with the most important effects are found to be the French OAT (for the period of 5-12 months after the shock) and the Italian bond (in the interim period). These results are in

line with recent empirical findings on benchmark status in European bond markets (Dunne et al., 2002). However, they provide a more complex answer to the question of 'benchmark status' in the European government bond market, allowing for the characterisation of a bond as benchmark to be related to the duration of its causality effects.

Fiscal adjustments and asset price movements

Working Paper No. 104
Athanasios Tagkalakis

In the context of the current macroeconomic and financial market turmoil, and in the presence of asset price swings, expansionary fiscal policy has been at the forefront. As the economic recovery gathers pace, governments around the globe will start withdrawing some of the fiscal stimulus and initiating fiscal consolidation in order to ensure sustainable fiscal positions. These consolidation efforts will be affected by asset price movements as the economy picks up.

As has been discussed by earlier literature (Schuknecht and Eschenbach, 2004), asset prices can affect the budget via a series of channels. Directly, they affect the budget via certain revenue categories, e.g. taxes related to capital gains/losses. Indirectly, higher asset prices raise consumer confidence and consumption, via the wealth effect, and increase the collection of indirect taxes. Finally, in case of asset price busts and ailing financial institutions, the state might be asked to intervene bearing some of the costs.

The objective of this paper is to improve our understanding of the links between asset price movements and fiscal adjustments. Building on previous literature on the determinant of successful fiscal adjustments (Alesina and Perotti, 1995 and 1997; Tavares, 2004; Tagkalakis, 2009), it goes one step further by investigating whether asset price movements have any effect on the probability of initiating and successfully concluding fiscal adjustment. Following earlier studies (Borio and Lowe, 2002), we use a real aggregate asset price index (from the Bank of International Settlements) and its three subcomponents, real residential, real commercial and real equity prices.

Our findings suggest that a pick up in asset prices increases the probability of initiating a fiscal adjustment, but does not necessarily lead to a sustainable correction of fiscal imbalances. This finding is reaffirmed both for residential and commercial property prices. This is in line with the recent experiences of several countries which faced a rapid deterioration of tax revenues following the collapse of residential activity and prices. However, increases in equity prices contribute positively both to the initiation and the successful conclusion of a fiscal adjustment.

Therefore, fiscal policy makers should focus their attention on the sustainable improvement of fiscal balances by adopting measures of a structural nature. In doing so, they should also take on board, on top of the effect of the economic cycle, the effects that asset price movements have on fiscal balances, in order to have a better grasp of the actual fiscal stance and the realised fiscal outcomes.

Money supply and Greek historical monetary statistics: definition, construction, sources and data

Working Paper No. 105
Sophia Lazaretou

This paper attempts to provide, for the first time, a survey of the construction of estimates of the quantity of money in Greece since the establishment of the National Bank of Greece in 1842 until the eve of WWII. Specifically, we describe in detail the methods of construction and the sources of data used in building these aggregates. We discuss the data collection procedure and publication practices. The end product is presented in a data appendix.

The effect of asset price volatility on fiscal policy outcomes

Working Paper No. 106
Athanasios Tagkalakis

The ongoing economic and financial market turmoil has been accompanied by a significant fall in asset prices, following several years of asset price boom. These asset price movements affect the fiscal policy stance through a series of channels (see e.g. Schuknecht and Eschenbach, 2004). Directly, they affect specific revenue categories, e.g. capital gains and losses related to direct taxes on households and businesses. Indirectly, they affect revenue via a feedback loop from higher asset prices to real economic activity (higher asset prices raise consumer confidence and consumption, via the wealth effect) which increases the collection of indirect taxes. Finally, in case asset price busts lead to defaults of financial institutions, the state will be asked to intervene to preserve the stability of the financial system.

This paper, building on the work of Fatas and Mihov (2003), goes beyond the previous literature in examining whether asset price volatility amplifies the volatility of fiscal policy outcomes. Following previous studies such as Jaeger and Schuknecht (2004), we use a real aggregate asset price index (taken from the Bank of International Settlements) and its three subcomponents: real residential, real commercial and real equity prices. According to our findings, there is significant evidence that asset price volatility affects the volatility of discretionary fiscal policy in a positive and significant manner. Higher residential property price volatility leads to more volatile government spending and, thus, to a more volatile discretionary fiscal policy stance. Equity price volatility affects the volatility of the fiscal policy stance primarily via the government revenue channel.

These findings point to the need for adjusting fiscal balances, and in particular government revenues, for both the economic and the asset price cycle, in order for the policy maker to have a clear grasp of developments in the fiscal policy stance.

Given that asset price movements amplify the volatility of the discretionary fiscal policy stance, which in turn amplifies business cycle fluctuations and harms economic growth (Fatas and Mihov, 2003), a word of caution is needed as regards the continuation of fiscal policy interventions undertaken in response to the ongoing economic and financial market turmoil. Such interventions also entail the risk of increasing policy volatility, generating a negative effect on economic growth, thus putting a toll on economic recovery.

An alternative methodological approach to assess the predictive performance of the moving average trading rule in financial markets. Application for the London Stock Exchange

Alexandros E. Milionis and Evangelia Papanagiotou

The hypothesis of efficient markets states that asset prices reflect all available information, hence, future prices are not predictable from past and current information. By contrast, the so-called technical analysis (i.e. the study of market action, primarily through the use of charts, for the purpose of forecasting future price trends) has been a thriving activity for more than a century. Among the trading rules used by researchers to test market efficiency, the one employed most frequently is the so-called moving average (MA) rule. In one of its simplest versions, two non-centred, moving averages with different lengths are created from the time series of stock prices. Buy (sell) signals are then generated when the relatively shorter moving average crosses the relatively longer moving average from below (above).

A usual way of measuring the predictive power of the MA trading rule is to test for the statistical significance of the difference between the mean return of individual trading periods characterised as "buy" (trading periods that according to the MA trading rule the investor's capital should remain invested in the market) and the mean return of the whole investment period, and/or the mean return of individual trading periods characterised as "sell" (trading periods that the investment capital should be liquidated or sold short) and the mean return of "buy" trading periods, and/or the mean return of "sell" periods and either the mean return of the whole investment period or zero. Although on several occasions simple t-tests have been used to test for the statistical significance of such differences, strictly speaking, the application of the t-test which assumes normal, stationary and time-independent distributions is not legitimate since one or more of these assumptions is very often violated in time series of asset returns. To overcome this problem bootstrapping techniques have been sug-

gested and this approach has been recognised as the established one and used by most authors.

This paper suggests an alternative testing procedure for assessing the predictive performance of the MA trading rule and argues that it has some considerable advantages over the existing one. In principle the proposed approach allows for the concurrent estimation of measures of the predictive power of the MA trading rule, such as the ones mentioned above, and at the same time takes into consideration the interdependence in asset returns.

The intended testing procedure is a modification of the so-called impact assessment models, originally developed by Box and Tiao. The term impact assessment means a test of the null hypothesis that an event caused a change in a stochastic process measured by a time series. Events (also called "interventions" in time series literature) may be represented by binary variables. However, the standard parametric or non-parametric statistical tests used to test differences in levels (e.g. the t-test, ANOVA, etc.) cannot be used in serially correlated data, as was explained previously. Moreover, a change in level may not take place instantaneously, but gradually.

The Box and Tiao method of impact assessment takes into account serial correlation, as well as gradual level shifts, and allows for simultaneous maximum likelihood estimation of the parameters related to the level change and those related to the serial correlation. Hence, it can be considered as a generalisation of the t-test. Thus far, the method has been used to study the effect of events which occur on continuous lags. In this work a modification of the Box and Tiao methodology is suggested

and applied in cases where the events occur discontinuously. This can be made possible under the assumption that the effect of such events is transient. More specifically, as was previously explained, the role of the MA trading rule is to classify each individual trading period (in this case each individual day) as "buy" or "sell". The "buy" days are considered to be the discontinuous interventions. In that way the modified Box and Tiao approach is used to examine whether or not there is predictive power in the MA trading rule as applied to capital markets.

In particular, the trading rule is applied to daily closing prices of the FT30 Index of the London Stock Exchange for the time period 1935-1994. The total time period that the dataset considered in this work covers, as well as the particular capital market, approximately coincide with that of previous studies by other scholars who examined the predictive performance of the MA trading rule for the same stock exchange index, but using different techniques. This allows for a direct comparison of the results derived following the statistical approach suggested above with those of the previous studies. The total time period is divided into three 20-year subperiods: 1935-1954, 1955-1974 and 1975-1994; and each subperiod is also examined. Moreover, the particular combinations of long and short moving averages for the application of the MA trading rules employed are deliberately taken to coincide with those of previous studies.

For this purpose two different classes of models are tested. The intervention component for both models is the simplest possible (technically, a model with a zero order intervention component is used for both classes) and represents the relative average increase (if any) on returns during the "buy" periods, as compared to the "sell" periods. With the first class of models (simple benchmarks) any linear dependencies among index returns are disregarded. Therefore, results for the statistical significance of the intervention parameter may be directly compared with the results from an

ordinary t-test for the mean difference of "buy-sell" for index returns. The effects of linear dependencies in index returns are taken into account with the second class of models that is used, and the statistical significance of the intervention component may be compared with the results from bootstrapping techniques. The results derived from the application of the proposed methodology as compared with the results of existing methods (such as bootstrapping and the so-called cointegration cumulative profit test) using the same dataset are found to be, by and large, equivalent. More specifically, the results for statistical significance for the intervention component agree completely with the results derived by bootstrapping techniques for all time periods and all trading rules.

Direct comparison regarding the significance of the intervention component is not possible when the cointegration cumulative profit is considered, since the approach followed by the latter is based on a different reasoning. Qualitatively, all methods provide evidence of a pronounced weakening of the predictive power of the MA trading rule for the last sub-period (1975-1994) for the London Stock Exchange, which implies that the market gradually became more efficient.

An advantage of the proposed methodology is that it may be enhanced further, as it is susceptible to several improvements at both a technical and practical level. At first, a possible problem with non-normal distributions in asset returns may be alleviated by considering the more general class of GED distributions for the testing procedure. Further, second-order dependencies in asset returns such as autoregressive conditional heteroscedasticity may also be taken into account by considering a general ARMA-GARCH model for the noise component of the impact assessment model. Moreover, the proposed methodology is suitable to quantitatively test empirical techniques of technical analysis by allowing a higher-order intervention component in the stochastic model. In that way, the time-varying effects of trading sig-

nals may be modelled and tested. It is noted that the proposed methodology is less computationally intensive than bootstrapping, and its application is relatively easy for practitioners in the field. Hence, overall, the proposed methodology seems promising and potentially has some considerable advantages compared to the established and the existing ones.

The margins of labour cost adjustment: survey evidence from European firms

Working Paper No. 108
Jan Babecký, Philip Du Caju, Theodora Kosma, Martina Lawless, Julián Messina and Tairi Rõõm

Apart from a decrease in base wages, firms could use other ways of reducing labour costs when faced by negative external shocks, e.g. cut bonuses and benefits, encourage earlier retirement and hire workers at lower wages than those who have recently quit. The adjustment of non-wage labour costs has gained attention in the policy debate for two main reasons. First, non-wage labour costs represent a substantial part of total compensation. Since firms are primarily concerned with total compensation per employee, an assessment of the flexibility of non-wage labour costs is as important as the evaluation of the degree of wage flexibility. Second, in an environment of sticky prices and nominal wages, non-wage labour costs become an important tool for adjustment to external shocks, allowing a dampening of the effects of negative demand shocks on the firm's employment.

Using a unique survey of firms from 12 countries of the European Union conducted between the second half of 2007 and the first quarter of 2008 within the framework of the Wage Dynamics Network coordinated by the European Central Bank, the paper examines the importance and determinants of alternative strategies firms might use to adjust their labour costs. In the survey, firms' managers were asked directly about their use of these policies in the recent past. Specifically, the incidence of the following six labour-cost saving strategies can be identified: reduce or eliminate bonus payments; reduce non-pay benefits; change shift assignments or shift premia; slow or freeze the rate of promotions; recruit new employees at a lower wage level than those

who left voluntarily; and encourage early retirement to replace high wage employees by entrants with lower wages.

The paper's contribution to the literature is threefold. First, it documents comparable information on labour cost adjustment practices beyond base wages for a large set of EU countries and sectors. This allows the analysis of the relative importance of each individual strategy across countries characterised by different sets of laws and institutions governing their labour markets. The survey shows that to reduce labour costs firms fairly commonly use strategies other than base wage reduction: 63% of the firms' managers said they had used at least one other margin of adjustment in the recent past, and 58% had used at least one of the six margins explicitly identified in the survey. The results show that there is substantial heterogeneity in the use of these strategies across countries and firms, depending on firm characteristics and labour market institutions.

Second, the paper examines the characteristics of firms and the environments in which they operate that determine the relative importance of each type of labour cost adjustment mechanism. The use of each margin is related to several firm characteristics, such as the relative size or skills distribution, as well as several indicators of the economic environment in which they operate. In particular, larger firms show a greater flexibility with respect to using any of these strategies in order to adjust labour costs. Different indicators of competition intensity suggest that firms in more competi-

tive environments are more likely to use some of these strategies more heavily. Furthermore, the results indicate that the presence of unions in wage-setting is associated with a greater use of most of the strategies. A plausible explanation is that unions limit the flexibility of wages, pushing firms towards alternative labour-cost-cutting strategies.

Finally, the paper shows how the use of these adjustment practices can be related to firms' experience regarding nominal wage rigidity, as well as to the extent of wage indexation applied by firms. The impact of unionisation on the use of alternative margins remains even after different indicators of wage rigidity (either nominal wage rigidity or alternative definitions of wage indexation) are controlled for. Interestingly, it is shown that firms subject to nominal wage rigidities are much more likely to use each of the six cost-cutting strategies. This indicates that there is some degree of substitutability between wage flexibility and the flexibility of other labour cost components, and that this substitutability is not limited by the presence of unions in wage setting.

Assessing market dominance: a comment and an extension

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Melnik et al. (2008) propose a measure in order to assess whether the firm with the highest market share in an industry can be characterised as dominant. A positive answer to this question is a prerequisite for further investigating the extent to which market dominance comes together with the abuse of such a dominant position, according to Article 82 of the EC Treaty.

Additionally, Guidelines, Regulations, related statements by the European Commission and European Court Decisions point to the investigation of the degree of monopoly power that creates or strengthens a dominant position, particularly in cases of planned mergers or buyouts.

In this paper we investigate certain mathematical properties of the proposed measure, identifying some of its weak points and relating it to other research papers Melnik et al. had not considered in their study.

Downward nominal and real wage rigidity: survey evidence from European firms

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Jan Babecký, Philip Du Caju, Theodora Kosma, Martina Lawless, Julián Messina and Tairi Rõõm

Based on a unique firm-level survey carried out between late 2007 and early 2008 within the framework of the Wage Dynamics Network, the flexibility of wages across 14 countries of the European Union (EU) is analysed. The objective of the paper is to examine the extent and determinants of downward nominal and real wage rigidity.

Downward nominal wage rigidity (DNWR) is defined on the basis of nominal wage freezes.

Firms freezing nominal base wages at any point during the five-year period prior to the survey are considered to be subject to nominal wage rigidity. Downward real wage rigidity (DRWR) is defined on the basis of wage indexation. Firms that have an automatic link between nominal base wages and past or expected inflation are regarded as being subject to DRWR. The survey-based measures of downward nominal and real wage rigidity used in the paper are closely related to the alternative measures

derived by earlier studies on the basis of the wage change distributions.

The evidence indicates that the incidence of both types of wage rigidity is quite substantial in Europe – approximately 10% of firms experienced wage freezes and 17% of firms applied wage indexation mechanisms. Thus, indexation (DRWR) is much more prevalent in the EU countries than wage freezes (DNWR). This is consistent with other evidence on wage rigidity in most continental European countries, as opposed to the US and the UK. Overall, non-euro area countries of the EU are more likely to experience wage freezes compared to euro area countries, whereas indexation mechanisms are more widely used in the euro area countries included in our sample.

Next, the paper analyses how DNWR and DRWR are related to a number of firm-level and institutional characteristics of labour markets in the countries covered by the sample. The multinomial logit estimation method is employed, which makes it possible to assess these relationships simultaneously for both types of rigidities. The estimations indicate that country-specific factors appear to be significant determinants of downward wage rigidities, and that institutional differences between countries are an important factor behind this finding. For example, high collective bargaining coverage is positively related to real wage rigidity, while the estimated relationship with nominal wage rigidity is insignificant. A possible interpretation of this finding is that unions have the capacity to provide their members with information about inflation expectations and explain the importance of maintaining the real income level of workers. Thus, union coverage reduces the prevalence of money illusion.

Analysis of the union contracts negotiated at different levels (firm-level versus higher-level bargaining contracts) implies that firm-level contracts are a more likely source of real wage rigidity in centralised wage-setting environments. However, there is a substantial degree of heterogeneity across countries regarding the impact of different types of union contracts. The institutional aspects related to the difficulty of the employer to lay off workers are also related to wage rigidity. The paper shows that nominal wage rigidity is positively associated with the extent of permanent contracts. In addition, permanent contracts have a stronger effect on wage rigidity in countries with stricter labour regulations.

Workforce composition also appears to play a significant role in determining wage rigidities. Both types of rigidity are positively correlated with the share of high-skilled white-collar workers; DNWR is positively related to employees' tenure in the firms under study. Both of these significant relationships are consistent with the implications of related theoretical models. In addition, firms employing labour-intensive technologies are more likely to have rigid wages.

Finally, there seems to be a positive relationship between product market competition and DNWR, although the results are dependent on the way competition is measured. A possible cause of this empirical result is that in highly competitive industries rents should be low, and therefore so should wages. This leaves smaller margins to reduce wages, because firms paying low wages that are closer to a collectively agreed or legislative minimum level have less flexibility than firms having a so-called wage cushion between the minimum and the actual wage.

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